RESEARCH ARTICLE

Cause and Effect of Phishing Attack

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ABSTRACT

Cyber-crime has become a serious issue in our day to day lives. One among those issues is "phishing" and is considered as cyber-attack. Phishing is considered as a cyber-crime; by using this attacker will steal one's personal information. This review paper gives awareness to the people about phishing attack and how to overcome those situations.

Keywords: Cyber-Security, online, techniques, attack, awareness.

INTRODUCTION

Cyber-Security

Cyber Security is a field of information technology that will gives security to sensitive data in a system, connected-networks from different types of attacks. It is one of the major topics in present day's competitive world. The goal of cyber security is to give full security to the sensitive data and prevent it from unauthorized access. Users data are not safe when they are shared in an online site there may be a chance of loss of data by these type of attacks. one should face these types of attacks at present and in future too, so in order to resolve this problem cyber security introduces many techniques. Today's Information technical world all the companies activities are maintained in computer itself including confidential data of the company, so it will need more security to protect it from cyber theft. Cyber security plays a major role in giving security to one's sensitive data and protects it from attacker.

Phishing Means?

The term PHISHING is generated in the middle of 1990 by a well-known hacker whose name is Khan C Smith. It is the attempt to obtain one's sensitive data such as credit card details, username, passwords etc. Phishing happens either by email spoofing or by instant messaging. In other way the hacker will directly ask to fill all the personal information of the targeted in a fake website which seems to be a copy of real one. Example: In unknown online shopping website entering the bank account details for purchasing the products without thinking whether that site is genuine or not, it will leads to loss of financial information of an individual. Usually phishing happens when a person give response to the fraud or unknown e-mails, or the person is connecting to unsecured Wi-Fi in public places and in some websites they will ask us to connect through some of our social accounts like, Facebook messengers, or whatsapp asking for update our respective social media account passwords. Here in phishing the attacker will send a mail to victim in the name of some trusted organization, so the victim will go through that link and provides all the asked information. It will help the attacker to easily grab the victim's financial information's or other sensitive information's. One who hacks the data of an individual or a company are known as attacker or hacker and one who affected by this attack are known as victim.

Phishing and Its Examples

Phishing is one major type of cyber-attack in which an e-mail or text messages will be sent to a victims, these messages will seem to be come from some well-known trusted websites, so by going through that link which sent by the attacker, all targeted persons personal information will be in hand of that attacker. As we all know phishing is a web-based application and this is mainly used to steal the data. Every web application is connected to a web server, when one person using the web application some of the data packets or that person's personal ID information are set from working application to web server and vice versa, in this way they establish the communication between the web application and web server. In phishing what happens is, the attacker himself disguise as a web server. Usually the normal person or the user thinks that they are communicating with the actual web server but in reality, they are communicating with the fake web servers those hackers have built. So that hackers steals our credentials or the personal details.

Various Phishings Attacks

Phishing Mails

Consider any bank notifications warning that are "log-in activity" on their accounts: In phishing mail, they will ask the users to enter their Name, number of credit card, contact number, address, and date of birth etc. By collecting those details the attacker will apply for credit card for loans and they will open fraudulent bank accounts too.

Deactivation Scares

Mails which seems to come from some trusted sites and makes the victim to click on the link provided by the mail. For example a person getting a mail from his bank that bank account will be deactivated if they do not follow the link given in the mail but that mail is phishing mail without knowing that the person responds to the mail. This will make one's to update their bank account details.

Look-alike Websites

It's very difficult to tell that whether it is phishing website or real website. The fake websites are accurate copies of real websites and they contain real websites URL as a part of their own URL. But if the person should identify carefully when they get to know that where is phishing points.

Spear Phishing

A cyber-criminal has previously collected data about the victims typically spear phishing which uses some knowing languages of the victim to act immediately. Here they will target the victims who put their personal information in online and they can will to view victims profile and all transactions which victim make through online.

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CEO Fraud

As the name suggest it happens in the name of CEO of some organization. The attacker will urgently ask the victim or employee of that organization to update their employees details. Here they will use the name of the CEO of a company with a small change in their e-mail address and they will send it to a target employee of that company.

Session Hijacking

It is also called as cookie side jacking. Making use of improved phishing technique, cyber criminals have access to a some company's web server and steal information that is stored in the server. When one login to any of their online account the server will give cookie acceptance notification as we can see in all sites for the application to identify and give access to their account. These session hijacking is happens by stealing the session cookie of that user.

Malware

Malware it is malicious software designed by the cyber criminals to steal computer systems data. The attacker will send mail to the victim by attaching some files, when victim just go through that link his system will get attacked by the malware.

Whaling

Whaling attack which always targets a higher position of an organization. The attacker will send a mail in the name of particular organisation CEO or any other senior manager to their employees. When employee respond back to mail without checking the email resource that will results in robbing of sensitive data of that organisation.

Pharming

Pharming is one of the major cyber attack that will done when attacker fixs the malicious things on the targeters computer or in server. That will make one's to unknowingly redirect to some of the fake websites.

Outcomes of Phishing Attack

Financial Loss

Phishing attack causes financial loss for both individuals and business organizations. Financial loss for an individual causes a high risk because the attacker will have access to individuals sensitive bank account information, investments and personal funds etc. For an organization it will results in remediation costs and fines by regulatory bodies.

Cyber Theft on Intellectual Property (IP)

Intellectual property means it is a proprietary that does not have a physical existence but has a value. Intellectual property theft means robbing of copyrights , trade secrets, new ideas, research and patent of a company by using internet and computer. This will results in economic damage, loss of competitive edge and have a large impact on business growth. By frequently updating the IP's list(Intellectual Property) and by checking for cyber activities repeatedly one can avoid the Intellectual property loss.

Reputational Damage

Reputation of an organisation is built on trust. Reputational damage involves financial damage and stealing of customers data. Mainly results in loss of customers trust on company this will affect companies economic growth and loss of company value.

Investor Confidence

Phishing Attack makes Investor to loss their confidence on company or any organisation to invest on them. Once the company loss investors trust it is very difficult to rebuild it. If an organisation does not have any investors then how it will reaches the needs of customers so having investors trust on organisation matters more here.

Business Disruption

Phishing attack causes many impacts on business growth by stealing their confidential information. Disruption means disturbance or a problem that interrupt the business activity or process. When the organisation is in the control of the attacker there will be a drastic change in business activities so it will cause business disruption.

How to Avoid Phishing Attack?

i)   Before knowing anything don't react to the suspecious mail.
ii)   The source of incoming mail should be checked before responding back to it.
iii)   Whenever one should receive a mail from their bank don't go through the link that provided in mail, visit the banks official site and provide the information there only.
iv)   Without confirming whether the website is real one or not don't go for entering personal information
v)   Online accounts maintained by an individual should be periodically checked.
vi)   Educate oneself about how phishing attack happens and how to avoid them.
vii)   Check at the URL of the web application.
viii)   Regularly update personal online accounts
ix)   Avoid connecting to public Wi-Fi
x)   Provide a strong password to online accounts.

Future of Phishing

Today, phishing attacks are targeting individuals, are becoming difficult to detect, wrong and fraudulent people are getting permissions over users' private data. This is extended to online services too. In the olden days phishing attacks were much simpler and more fraudulent emails were being sent to dupe the user but in recent times where there is lot of technological advancement in digital platform the phishing attacks have become very serious and advanced. Malicious content in being churned out and sent to users' desktops in disguised format. Trust being the epicentre of this phishing attacks is notable point. A third-party application believed to be Google-approved service was trusted and users gave permissions to this application resulting in loss of data. This kind of infiltration was disguised successfully by changing some part of application domain. Traditional phishing was very simple in its execution and took advantage of the users' lack of knowledge. Many individuals and fraudsters were posing as Government officials and calling people on their telephone and used to trick the individuals in revealing their entire information.

Traditional phishing was so simple on those days and execute also so simple but human didn't have that much of knowledge to identify that attach and it's really lack of knowledge in olden day. For example, social works done by phone calls or any emails wherein malicious software pretend to act as government working sites. Therefore targets of these attacks are more because people believe that it is a government websites so attacker can easily attack the target person. No age limit people who are using internet and web servers as the working tools they become the targets. So the people who are stuck with this attack are ready to give the personal information, bank account details to enter in that phishing sites. Traditional attacks have become very ineffective in today's times as the user has become very aware of these methods and also detection of these attacks is also advanced. In todays' times many service providers like email service are alerting users about malicious mails and users themselves are very well equipped to deal in detecting these attacks.

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As there is an increase in internet users there is also an increase in the various forms of phishing attacks. It is imperative that the measures must be stringent in tackling this phishing. More applications are need to develop in detecting, alerting and ultimately destroying the attacks.

CONCLUSION

Phishing is techniques to collect confidential information about the victim using unknown links and emails which are sent by the attacker. It is one of the major issues now a days cyber-attack that mainly occur in well-known organizations, bank credentials, etc. It is very difficult to made separation between original e-mails and phishing e-mails. There are several methods that can be used to get solution this attack. Updating of anti-phishing tools and platforms or software to get rib from this attacks. And it can be more powerful. This study provides brief information about phishing, the mechanism of the attack, various forms it can occur in and the possible solutions to overcome them.

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9. https://www.comparitech.com/blog/vpn-privacy/phishing-statistics-facts/
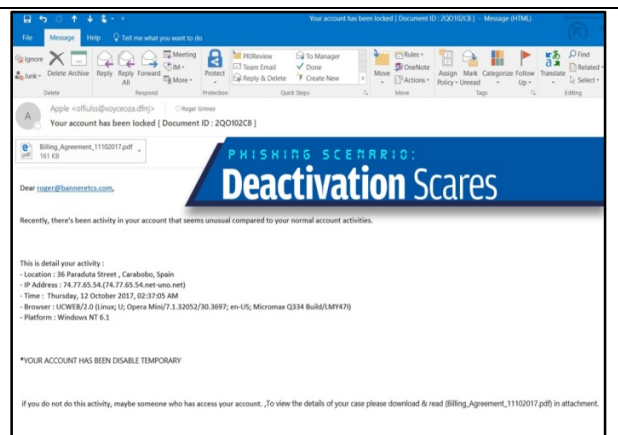
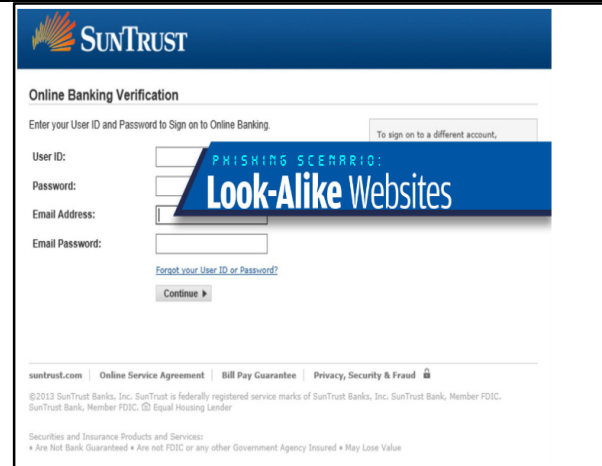| Fig 1: An example for Spear Phishing attack | Fig 2 : An example of deactivation scares. |

Fig 3 : An example of Look alike websites.

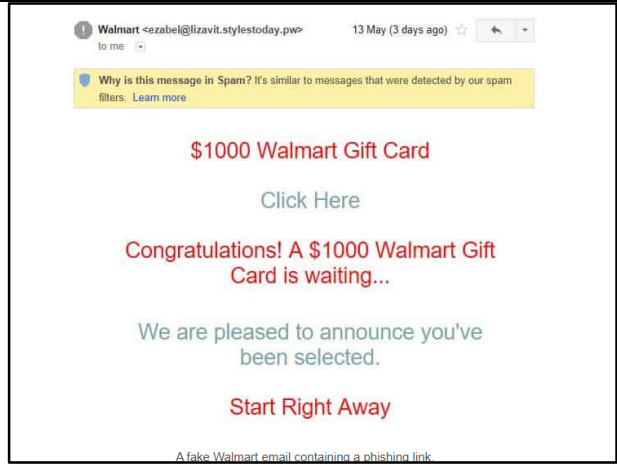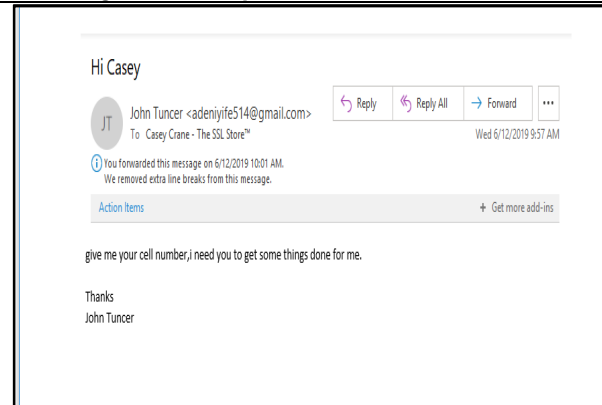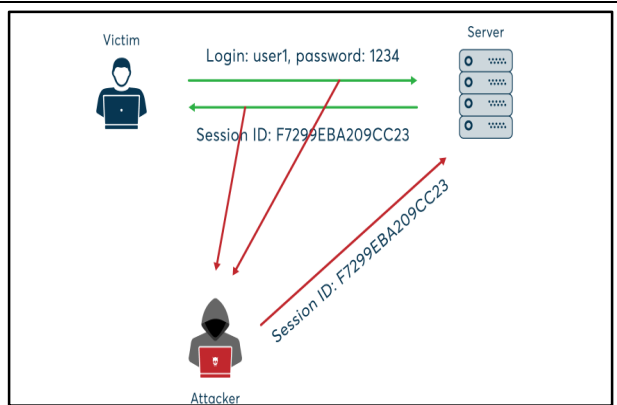**Fig 4 : An instance of Spear Phishing.**

Fig 5 : CEO Fraud

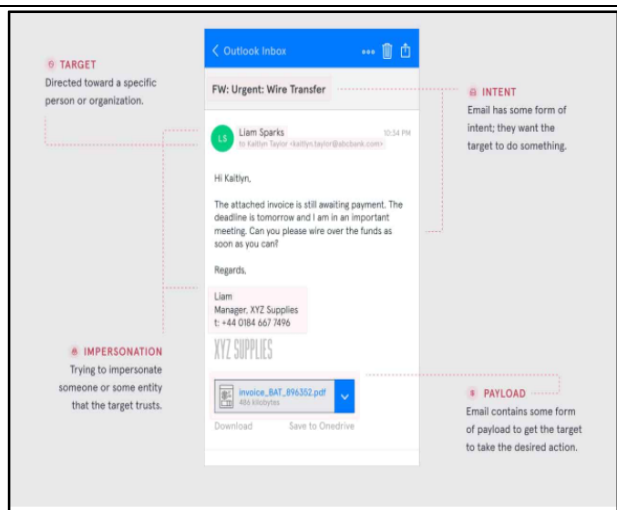**Fig 6 : Hijacking the session**
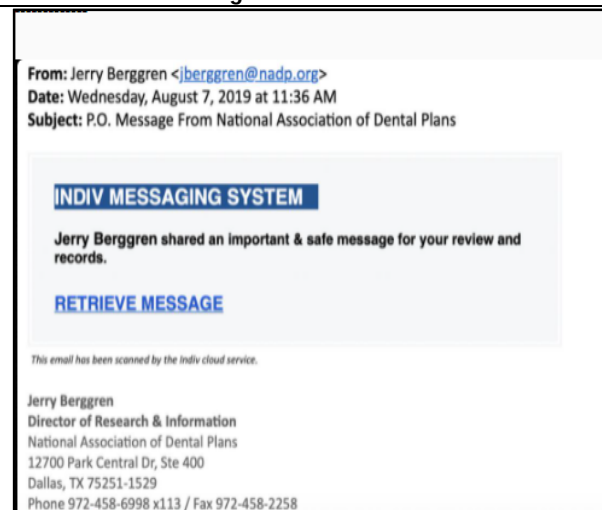
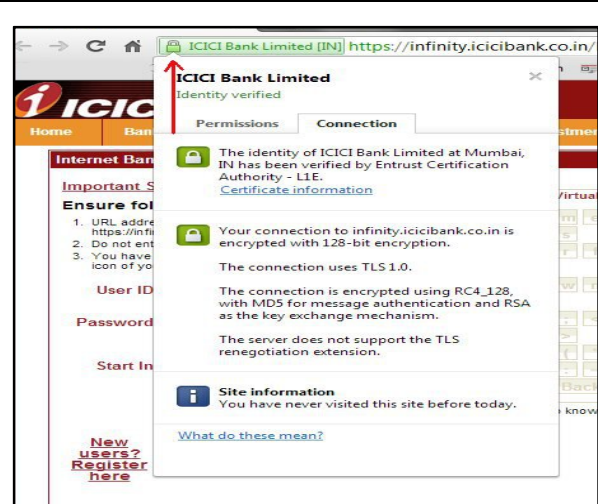**Fig 7 : Malware attacks**

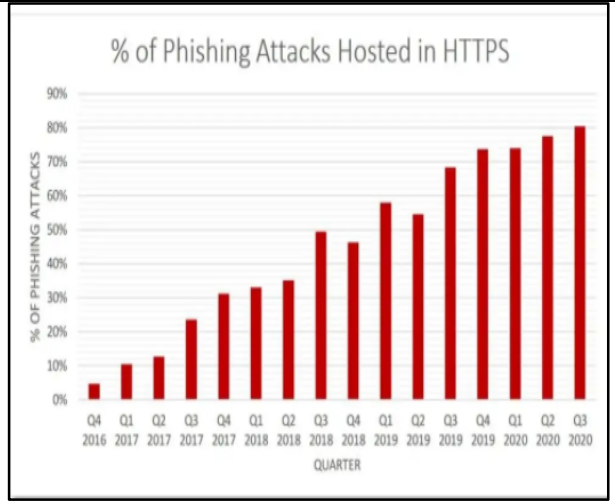**Fig 8 : Whaling attacks**

Fig 9: Pharming attacks

Fig.10 :Graphical Representation Of Phishing Attack Occurred Year Wise: [9]

A Deep Dive into the Challenges Faced in the Faster Delivery of Products by the Small and Medium It Firms In Bengaluru

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ABSTRACT

In a developing nation like ours, where a significant portion of the GDP is contributed by the MSME and SME sectors, it makes sense to analyse the environment that they work upon and identify issues that needs to be addressed. Change is a common concept embraced by the software industry. Paradigms which worked yesterday have lost significance today. Keeping in viewpoint the above points, we directed our focus to identify the challenges faced by the small IT firms towards the delivery of products within deadline and on time. A structured questionnaire was designed to carry out a survey. The recorded opinion helped in understanding the relationship between the variables and also allowed to focus on the contributory factors leading to longer lead times.

Keywords: Challenges for longer delivery time, small IT Firms, MSME.

INTRODUCTION

The working environment of the MSMEs are quite different from the technological giants. With their limited resources, stringent budget and schedule deadlines, the environment demands a different approach to yield success. Due to lack of proper process guidelines [11], these organizations frequently exceed the deadlines, which results in

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huge loss financially for the firms. Henceforth, an attempt is made in this study to chart out the factors leading to delay in such firms. In order to accomplish the same, a structured questionnaire was prepared for data collection so that the factors leading to increased lead times could be identified. Four variables considered in the study include-individual skills, work complexity, NVA and throughput. The organization for the paper is as follows: related works, methodology ised, results and finding and discussion.

Related Works

A survey of literature from a set of papers were handpicked which threw light into the segments of agile software development, techniques helping in the reduction of lead time, VSM and FMEA. Kupiainen [1] focuses on the metrics used in various phases and found that the ones used in the industry and the ones in the literature are not the same. Another work [2] by him directs us to widely used metrics like DTI, velocity, customer-satisfaction, effort. Parreiras's[3] literature review gives an extensive report of agile and highlights the pathway which can be lead for future research. The [4] applicability of lean methods for complex projects are investigated by Francesco *et al.* Gleston [5] in his work came up with the issues faced by SMEs. Officially identifying 4 areas –finance, human-resource, work pressure and less attention to process. Mishra [6] et al emphasizes how SMEs fail to deliver a quality software due to lack of proper planning and resources. Qingqi [7] enables to identify the approacges which could help in identifying and elimination of software wastes inspired from lean production mechanisms. Huang [8] classifies software failure modes through case studies. Dong[9] explains the explanation of FMEA for solving the problem caused due to software failyres. Brian [10] brings about the huge support agile techniques have found in the software industry and the constraints with which it operates upon.

METHODOLOGY

IT SMEs which are an emerging sectors in our country suffer mostly in the timely delivery of quality software. Out of the various issues faced, the predominant areas which pose a major threat to them include limited finances and manpower, inadequate knowledge about the projects undertaken, acute work pressure and lack of know-how of the process being followed. This is study was an attempt to uncover factors leading to increased lead times which in turn were contributing to delay in timely delivery of software. Various research questions were posed, which were fine tuned based on interaction with Industry experts. Four factors namely individual skills, work complexity, NVA and throughput are presented in this paper. The work tries to uncover the variables of these factors, so that we could identify if the these factors pose delay in the timely delivery of software.

Reliability Test

In order to validate the covergence of the questionnaire, we chose cronbach's alpha test to measure the internal consistency. The alpha value is found to be 0.78 which is within the acceptable range and hence we decided to proceed further with the analysis.

RESULTS & ANALYSIS

RQ 1: To examine the effect of individual skills on the fourth principle of Leagile.
H_{01}: There is no effect of individual skills on the fourth principle i.e deliver as fast as possible
H_{11}: There is effect of individual skills on the fourth principle i.e deliver as fast as possible
The table encites the dependent variables for " *individual skills*". Awareness of lean is considered as an independent variable here. The dependent variables are the following- usage of metrics to process SPI, usage of Value Stream Mapping for the process optimization, Hindrance of work due to external informational dependency, effect of over-engineering and provision to contact to customers in order to understand the requirement better. Keeping a confidence level of 95% and the standard error rate of 5%, we can reject the null hypothesis and hence individual abilities has an impact on the fourth principle of LSD.

RQ 2: To understand the impact of work complexity

H_{02}: There is no effect due to work complexity on software projects.

H_{12}: Work complexity effects software projects.

The above table lists the dependent variables identified for work complexity namely running of multiple parallel tasks, shared team effects, time spent on irrelevant features and unnecessary documentation. The response exhibits a lower higher Sig value signifying close relationship. So, keeping a confidence level of 95% and the standard error rate of 5%, we can reject the null hypothesis and hence individual abilities has an impact on the fourth principle of LSD as the Sig is less than 0.05. Alternate hypothesis can be accepted.

RQ 3: To examine the effect of waste(non- value added activities) on the software project.

H_{03}: There is no effect of NVA on the software project.

H_{13}: NVA effects software projects.

The above table represents the various dependent variables in the for waste activities variable. The dependent variables include: extension of the project scope, time wasted on irrelevant documentation, pressure due to impossible deadlines and under allocation of resources. At a confidence level of 95% and an error rate of 5%, we can reject the null hypothesis and emphasize that waste/NVA activities significantly impact the project's schedule and deadline.

Research question 4: To examine the effect of throughput in the timely delivery of software

H_{04}: There is no effect of throughput on the software process.

H_{14}: Throughput effects software process

The table highlights the variables for throughput namely allocation of more user stories than can be handled, excessive time being spent on reviews, sprint cycle time is short, lack of planning and unclear goal for a sprint.

Since the sig<0.05, under 95% confidence level and 5% standard error rate, we can accept the alternate hypothesis and reject the null.

CONCLUSION

Change is only permanent thing in today's world. Organizations must strive hard to cope up with the changing situations and circumstances. Start-ups always suffer due to hiccups in their process life cycle. Agile, lean principles, quality attainment through six sigma have proved their utility and efficiency for the software giants. The current paper discusses four factors posing a hindrance to the faster delivery of software. Hence a study was conducted to identify the variables which can help in better understanding of these factors and which could be utilized for the creation of a tailor-made model. The 4 factors do impact the milestone complettion time and hence the product delivery and hence must be considered for the software process improvement in order to facilitate timely software delivery. Due to limited time, the current paper discusses only 4 factors out of the 8 factors being identified during our study. The future work include the exploration of the remaining 4 factors and identifying the gaps and bridging them if any.

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Table 1.Case Processing Summary

Cases		N	%
	Valid	192	94.58
	Excluded	11	5.42
	Total	203	100.0

Table 2. Reliability Statistics

Cronbach's Alpha	N of Items
.78	45

Table 3. variables for "*individual skills***

Dependent Variable	Level				ANOVA	
	AOL	**N**	**Mean**	**SD**	**F**	**Sig**
Use of metric for process performance measures	Yes	122				
	No	70	**3.28**	**1.281**	10.20	0.00891
	Total	**192**				
Use of VSM for optimization	Yes	122				
	No	70	**3.67**	**0.944**	14.39	0.00843
	Total	**192**				
Blocked un work due to information needed from others	Yes	122				
	No	70	**4**	**0.758**	20.0	0.002
	Total	**192**				
First mover's advantage	Yes	122				
	No	70	**3.36**	**1.223**	14.19	0.00847
	Total	**192**				
Over engineering a user story	Yes	122	**3**	**1.157**	17.002	0.00987

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	No	70				
	Total	**192**				
Access to customers for better requirement understanding	Yes	122		4	0.536	13.126	0.001
	No	70				
	Total	**192**				
	No	103				
	Total	**295**				

Table 4:Anova Table for Hypothesis 2

Dependent Variable	Level				ANOVA	
	AOL	**N**	**Mean**	**SD**	**F**	**Sig**
Multiple tasks in parallel	**Yes**	122				
	No	70	**4.15**	**1.186**	15.002	**0.00767**
	Total	192				
Shared team on multiple projects	**Yes**	122				
	No	70	**2.32**	**0.862**	16.019	**0.09889**
	Total	192				
Time spent on features not requested by customer	**Yes**	122				
	No	70	**3.25**	**0.92**	19.016	**0.0179**
	Total	192				
Unnecessary documentation	**Yes**	122				
	No	70	**2.3**	**0.887**	12.021	**0.00236**
	Total	192				

Table 5:Anova Table for Hypothesis3

Dependent Variable	Level				ANOVA	
	AOL	**N**	**Mean**	**SD**	**F**	**Sig**
Extension of project scope	Yes	122				
	No	70	**3.71**	**0.863**	15.781	0.00589
	Total	192				
Time spent on unnecessary documentation	Yes	122				
	No	70	**3.31**	**1.498**	12.876	0.00488
	Total	192				
Pressure due to unrealistic deadlines	Yes	122				
	No	70	**3.24**	**1.768**	11.876	0.00987
	Total	192				
Under allocation of tasks with resources	Yes	122				
	No	70	**3.4**	**0.883**	16.986	0.0067
	Total	192				

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Table 6:Anova Table for Hypothesis4

Dependent Variable	Level				ANOVA	
	AOL	**N**	**Mean**	**SD**	**F**	**Sig**
More user stories than can be handled	Yes	122	2.84	0.032	12.001	0.012
	No	70				
	Total	192				
Frequent reviews	Yes	122	2.78	1.917	13.001	0.023
	No	70				
	Total	192				
Shorter sprint cycles	Yes	122	3.54	0.244	12.05	0.021
	No	70				
	Total	192				
Skipped planning	Yes	122	2.21	0.139	18.019	0.041
	No	70				
	Total	192				
Unclear goal and vision	Yes	122	2.67	1.944	13.3	0.035
	No	**70**				
	Total	**192**				

RESEARCH ARTICLE

Ricinus communis: Alternative uses in Natural Farming

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ABSTRACT

An experimental study was conducted in hv farm in Karnataka from 2019-2020 on the plant species of Castor (*Ricinus communis*). The prime objective of this study was to find an effective alternative for cattle manure and synthetic fertilizers so as to aggravate plant growth and exterminate pests and bacteria by using castor. In order to extend the utilities of castor to make it an effective manure/fertilizer, the experiment assimilated most of the components in the castor plant such as leaves, castor meal, castor husk and other decomposed materials from the source (castor). Application of castor on various plant species was incorporated in order to derive results that can prove the effectiveness of castor on plants was actualized in the field. The parameters which were considered to observe and differentiate the plants with which castor was used and the plants with which castor was not used were plant height, number of leaves, number of branches, Ph value of soil, trunk thickness etc. Results obtained implied that castor was actually a very effective alternative to the cow manure and synthetic fertilizers as it was observed that there was a rise in growth of plants and increase in leaf number and soil fertility, and decrease in pest population in certain areas where castor was incorporated as a manure/fertilizer for the plants, thus proving that castor can be utilized for common agricultural practices as it promotes plant growth rate, increases soil fertility, and also helps the user combat pest cum bacteria associated problems in a very effective manner. The criterion observed to indicate rise in soil fertility of soil that was under the use of castor was Ph levels of soil. In this case, castor proved very effective in terms of changing soil characteristics from acidic to alkaline.

Keywords: Castor, Bacteria, Pests, Fertilizer, Fertility

INTRODUCTION

Castor is a plant species that commonly grows in the subtropical, tropical and equatorial regions of the planet. The plant is native to Eastern Africa, Mediterranean Basin and India. The plant grows commonly in regions that have temperatures ranging from 20-16^{0}C. The identification of castor can be achieved by observing its abnormally large leaves, long stems that are thick at the bottom and a bunch of spiny spherical seed capsules that are usually present as a cluster in the plant. Plant height can reach up to 12meters to 13 meters, resembling an underdeveloped tree. Castor seed are rich in triglycerides, ricinolein, and other chemicals that are present in the carboxylic and hydroxyl group. Castor leaves are long and broad, ranging from 15-45 cm in length, consisting of lobes that range from 5-11 numbers. The leaves turn red-purple on reaching maturity. Their benefits as a medicine include, anti-inflammation, protection of plants from rodents and pests. An alcoholic extract from the leaf can prove fatal toward the life of rats, therefore making it advantageous for combating the rodent problem as well. The species has a varied number of benefits, one of the most prominent being its oil that can show positive effects on the skin by reducing inflammation and swelling. It is also used as a hair conditioning product, for it consists of highly effective anti-dandruff properties. Castor is also very useful as an industrial chemical. It is also utilized as an alternative to petroleum-derived lubricants as well.

METHODOLOGY

The experiment was conducted at the HV farm,(12°58'53.9"N 76°56'11.6"E) during the period of 2018 to 2020 in all seasons. The annual rainfall ranges from 320mm to 707mm with temperatures ranging from 36 to 40 degree /c. The period of rainy season in the area varies from place to place, but generally lasts about couple of weeks .

The utilities of different components of castor under different circumstances were classified into:
A. Castor as mulching material
B. Castor plants surrounded near main crop
C. Castor seeds crushed with oil extraction
D. Castor crushed without oil extraction

A. The castor leaves were utilized as mulching material and this experiment was observed by utilizing it on plantations of coconut saplings and jasmine plants. The reason for choosing the leaves for the experiment was due to the fact that castor leaves are porous, huge and consist of many toxic components that can be considered hazardous against pests like grubs, moles, field rodents etc. as they consist of chemicals like lesquirolic acid and glycoproteins that can cause transitory muscle tremors and excessive salivation. They also help the soil as a nitrogen fixer, which can increase the plant growth.

B. This process was executed in aspiration of providing the plant(crop) shade, restricting waste of water through evaporation and maintaining soil temperature. Castor roots can restrict growth of nematodes as they are slightly phyto-toxic. Castor roots can protect the main crop roots in terms of parasites attacks as well.

C. The crushed seeds are soaked in water for 7days in a closed container. After seven days essence are collected and sprayed at sites of frequent movement of rodents and moles. The reason for this practice was because of the fact that the odor emitted by the essence was something that was disliked by the rodents and moles.

D. The crushed bean without removing oil in it, are placed along the farm boundaries so as to prevent rodents and other pests from entering the farm through the means of soil.

RESULT

The implementation of castor indicated a significant effect on the plants on which, utilization of castor was implemented. The evidence for the same was procured by measuring the pH values of the soil and also, comparison between the heights of crops before and after utilization of castor on the above mentioned crops was observed.
As seen in Table-1, the use of castor in the plants not only influenced the plants, but even the soil as well. The average level of the pH value of the soil has been observed to be 8.34, a pH level that can be considered above average as it meets the requirements of being above 7.5, a level that is considered the minimum pH level of a soil that is neutral / worthy of being contemplated to be able to show promising results in plant growth. Table-2 helps us deduce the idea that castor can positively influence a plants characteristics by aggravating its growth, primarily in the means of plant height. The observation done to study the heights of plants before and after utilization of castor on them indicated that the prime specimen that was studied to understand its potential as a manure/fertilizer indeed meets the demands of being able to influence the growth of plants when applied on them

Outcome of mulching on soil properties
The sandy loam soil holds a property of being acidic and having low amount of humus in it. The acidic nature of the soil needed to be enriched and neutralized with the available organic matter. Mulching with castor plant inputs and WDC improved the apparent density and its porosity of the soil. Results shown in field after applying mulch material conserved the soil moisture, enhanced soil fertility, enriched the soil and protected the area from weed growth.

Property of the soil
When compared the property of the soil as per table1 proves that drastic improvement of pH value from acidic to alkaline on the given plot.

Leaf growth
After the usage of castor on specimen-based saplings, it was observed that there was an increment in the amount of chlorophyll content in the leaves of the saplings. A steady normal growth was observed in the plant specimens on which we had implied the use of castor for the purpose of experimenting on its (castor's) benefits.

Plant growth
The growth of plants was determined using the method of AGR (Absolute Growth Rate) on the specimens of plants with which castor was utilized versus plants with which castor was not utilized over a period of 12 months. The results indicated that the plants with which castor was used had a positive effect on them as they had a larger trunk size of about 62 mm compared to that of the plants with which castor was not used that had a trunk size of about 43 mm. The height of plants that had castor used on them and the plants that were deprived of castor use on them were in the ratio of 4.5 feet: 3 feet, therefore proving that castor is beneficial toward a plant's growth as a manure/fertilizer.

CONCLUSION

The experiment conducted implied one result, that castor is an effective alternative to manure and fertilizers. Castor seeds are cost effective. Farmers can avail this opportunity to use castor as a substitute to assist the plant and help the soil in terms of nitrogen fixing and protection of plants from fungal infections. Application of castor manure on plants proved significant for the plant's overall growth, through the means of its height, number of fruits grown on it, trunk thickness, and the density of the leaves of the plant. Implementation of castor can also be regarded as a beneficial factor for the soil as it revealed a significant increase in the pH levels of the soil. This proves that castor can

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be utilized as an alternative for the conventional products of farming such as manure/fertilizers when there is no feasibility for the same.

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Table-1: pH value of soil of crops that were supplied with castor

Plants/trees	Before castor usage	After castor usage
Coconut	2.5	8.2
Moringa	4.7	8
Jasmine	8	8
Turmeric	7.5	9
Guava	6	8.5

Table-2: Height of plants influenced by implementation of Castor on plant

year	1st quarter	2nd quarter in cm	3rd quarter in cm	4th quarter in cm
2019	Coconut collected from 90 year old plant (germinated)	6	20.32	45
2020	Replanted	76	116.84	121

RESEARCH ARTICLE

Assessment of Salt Water Intrusion in the Coastal Aquifer of Ponnaiyar River Basin, South India using Geographical Information System

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ABSTRACT

Salt water intrusion in the groundwater of coastal aquifers is the great environmental impact on a Indian coastal areas. The aim of the present research is to assess the salt water intrusion in the coastal aquifer of Ponnaiyar river basin of Tamil Nadu, southern India using Geographical Information System (GIS). In the first step, the water samples were collected and analyzed for major ionic parameters such as Electrical Conductivity (EC), Total Dissolved Solids (TDS), Magnesium (Mg), Sulphate, Sodium (Na) and Chloride (Cl). These parameters input into the GIS platform and generate the thematic maps of factors influencing the sea water intrusion. All the parameters were calculated using the sea water mixing index equation and using the output of index values classified into five categories. The result revealed that the good quality groundwater in the northern part was not affected by the seawater mixing. According to final output most of the region was significantly affected by seawater intrusion due to the use of over-exploitation of groundwater. The deteriorated groundwater resources in this coastal region should raise environmental and health concerns.

Keywords: Groundwater quality, GIS, Seawater mixing index, Coastal aquifer.

INTRODUCTION

Indian coastal aquifers constitute the second richest groundwater reservoirs after the Indo-Gangetic alluvial plain, which is one of the world's largest fresh groundwater reservoirs. The increasing pressure on land and uncontrolled exploitation of groundwater in coastal aquifers have resulted in reversal of hydraulic gradient and as a result the intrusion of saltwater into coastal aquifers (Ghassemi et al., 1995). Seawater intrusion is the migration of seawater into freshwater aquifers under the influence of groundwater development (Freeze and Cherry, 1979). The entire seawater intrusion phenomenon is governed by Ghyben-Herzberg relation (Todd, 1980). Coastal areas are mostly

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overpopulated with productive agricultural lands and expanded irrigated farming actions. Groundwater overexploitation, climate variation, sea level rise, and land use change in coastal aquifers result in intrusion of seawater (Yang et al. 2013). Coastal aquifers serve as a major source for freshwater supply in many countries around the world, especially in arid and semi-arid zones (Bear et al. 1999; Kaliraj et al. 2015). The hydro-geochemistry has used as a tool to interpret water quality for various purposes (Rao, 2006). Coastal zones contain some of the most densely populated areas and have an average population density of about 80 persons per sq. km, which is twice the world's average population density (Kantamaneni et al., 2017).

Kanagaraj et al (2017) carried out to groundwater geochemistry processes and influence of seawater intrusion in the coastal aquifers south of Chennai, Tamil Nadu, India using geophysical, geochemical, and stable isotope techniques. Barath Kumar et al (2018) carried out to characterize the coastal waters along Tamil Nadu during the pre-northeast monsoon period. A significant spatial variation in coastal water characteristics with respect to physico-chemical parameters was observed, indicating the different level of anthropogenic influence at different study sites. Senthil kumar et al (2019) have studied the integrated seawater intrusion of coastal region of Thiruvallur district, Tamil Nadu, South India. Gopinath et al(2019) estimated the characters of groundwater quality and seawater intrusion in coastal aquifers of Ponnaiyar River Basin, South India using groundwater chemistry and modeling techniques.

In coastal areas, groundwater being the primary source of freshwater is exploited indiscriminately to fulfill the increasing water demands for domestic, agricultural as well as industrial usages (Hamed et al., 2018).Gaaloul et al. 2012 identified saline intrusion in coastal aquifers of Tunisia using density-dependent miscible flow and transport modeling approach. Srinivasmoorthy et al.(2011) isolated sources of saline water intrusion in a coastal region of Cuddalore district, Tamil Nadu, India using major ion chemistry. Seawater intrusion not only affects the industrial and agriculture growth in the area but also hampers the living standards of people (Demirel, 2004). The main objective of the present study is the coastal aquifers of Ponnaiyar River Basin to assess the seawater intrusion using geospatial technology.

Study area
The study area Ponnaiyar River basin lies between 11º350 and 12º35′0′′ N latitudes and 77º45′0′′ and 79º55′0′′ E longitudes (Fig. 1). It extended over approximately of 11,595 sq. km. The Ponnaiyar basin is predominantly built up with granite and gneisses rocks of archean period. The chief components of rocks are hornblende and feldspar. The diamond granite is also found in scattered pockets in the area of Chitteri hills in Dharmapuri and Krishnagiri sub-divisions. Alluvium and sand-dunes of quaternary period are also seen at a few places. The 15 years (2000–2014) average annual rainfall in the basin is 969 mm. The climate in general is hot; April and May being the hottest months of the year when the temperature rises to 34ºC.

MATERIALS AND METHODS

The base map is prepared using Indian topographical map in the scale of 1:50,000. The water samples from the different wells are collected and the physical and chemical parameters are analyzed. The statistical analysis of the water samples are given in the Table 1. The variations of the water quality for the study area from the 19 wells are studied using GIS spatial interpolation IDW technique.

Hydro-geochemistry

Chloride: Chloride is most common parameter to assess the salt water intrusion in an area. It varies in the study area ranges from 30-1310 mg/l. The chloride concentration of spatial distribution are shown in (Fig.2). The spatial map further reclassified into five categories for better understand the chloride variation in the study area.

Electrical Conductivity: The salt distribution in any water samples are generally calculated by electrical conductivity. It is varies from 565 to 4523 (µS/cm) in the study area. The spatial distribution map of electrical conductivity are shown in (Fig.3). From the map it has been observed that very small portion of the study area falls below 1000 (µS/cm). The major portion of the study area is having EC within the limit of 1000-2000 (µS/cm) range. The spatial map further reclassified into five categories for better understand the chloride variation in the study area

Magnesium: Magnesium causes hardness in water. The concentration ranges from 5.2-49.6 mg/l in the study area. The most part of the study area has 50-100 (mg/l) of Magnesium and moderate portion is having below 50 (mg/l). The map showing Magnesium concentration is presented in (Fig.4).

Sodium (Na): The sodium is important parameter to assess the salt water intrusion. The spatial distribution map of sodium are shown in Figure 5. Sodium (Na) concentration of water samples ranges from 57-1960 mg/l. The sodium concentration were classified into five categories.

Sulphates: The sulphates are also important concentration for salt water intrusion assessment. Its ranges from 1.6 to 53.1 mg/l in the study area. The spatial distribution of the sulphate are presented in (Fig.6).

Total Dissolved Solids (TDS): The total dissolved solids is one of the important element to estimate the salt water intrusion in the groundwater sample. It is ranges from 230 mg/l to 3020 mg/l in the study area. The spatial distribution of TDS are shown in (Fig.7). from the map it has been observed that major portion of the study area is having very high TDS of (1000-2500 mg/l).

Estimation of Salt water intrusion: As an effective tool for quantitative estimation of the relative degree of seawater mixing in certain water, in this paper we propose a parameter called 'Seawater Mixing Index (SMI)'. This parameter is based on the concentrations of four major ionic constituents in seawater (Na, Cl, Mg, and SO4) as follow.

$$SMI = aX\frac{C_{Na}}{T_{Na}} + b\frac{C_{Mg}}{T_{Mg}} + c\frac{C_{Cl}}{T_{Cl}} + d\frac{C_{SO_4}}{T_{SO_4}} \quad (1)$$

where the constants a, b, c, and d denote the relative concentration proportion of Na, Mg, Cl, and SO4 in seawater, respectively (a=0.31, b=0.04, c=0.57,d=0.08); C is the measured concentration in mg LK1;and T represents the regional threshold values of the considered ions, which can be estimated from the interpretation of cumulative probability curves. If the calculated SMI value is greater than 1, the water may be considered to obviously record the effect of seawater mixing.

RESULTS AND DISCUSSION

The seawater mixing index was calculated using equation 1. The variations of SMI values of study area are 0.31 to 10.61. Fig. 8 shows the spatial distribution of SMI values for coastal groundwater in the study area. We now examine the spatial distribution of SMI values (the degree of seawater mixing) in terms of the distance (from local coastline) and depth of each well. A slight discrepancy was observed in the sample 12, which fell under the seawater–groundwater mixing line of HFE-Diagram and later left out from the seawater dominant wells grouped by hydro-geochemical ionic changes and SMI. The location of this well (far away from the coast) and the permissible TDS value (457 mg/L) supported these argument. Using these T values, calculation of SMI values shows that almost all of the type 1 and type 3 waters have SMI values smaller than 1, while the type 2 and type 4 waters have values larger than 1. About 5% of the analyzed samples, can be considered to be significantly affected by the mixing of seawater components. In order to elucidate the causes of water chemistry change, we attempted an integration of multiple

methods, such as graphical interpretation and geostatistical analysis, for the acquired hydrochemical data (Fig.9). The seawater fraction in individual samples were calculated based on Cl (conservative tracer) concentration and identified that samples (3, 4, 5, 7, 10 & 11) had a positive seawater fraction. Moreover, the negative exchange for Na in these samples indicates the mixing of the seawater in these locations. Higher seawater mixing index values were observed for the same samples; except sample 3, that showed slightly lower value than 1. However, this further confirms the dominance of seawater–groundwater mixing in the samples 4, 5, 7, 10 & 11. The degree of salinization due to seawater mixing in a well or a given area can be indicated by an increase in total dissolved solids and possibly an increase in nearly all major cations and anions. The estimated threshold values can be used to discriminate the samples based on the effects of seawater mixing and/or local anthropogenic pollution.

CONCLUSIONS

Groundwater chemistry in the coastal aquifer shows that southern region to certain extends in the central region, is largely affected by the seawater mixing with the groundwater. The samples having SMI values greater than unity can be considered to record the obvious effect of seawater mixing. Most of the type 1 and type 3 water examined yield SMI values smaller than 1, while the type 2 and type 4 waters have values greater than 1.This study concludes that all the wells located near the coast are affected by seawater intrusion. Groundwater quality has deteriorated seriously in the southern end of the study area and to certain extent, in the central region. Overexploitation must be averted to protect the water quality and also to conserve a sustainable ecosystem. Rain water harvesting and artificial recharge techniques are more useful as a tool in remediation of salt water intrusion. Estimation of surplus run-off is also very important in planning artificial recharge schemes.

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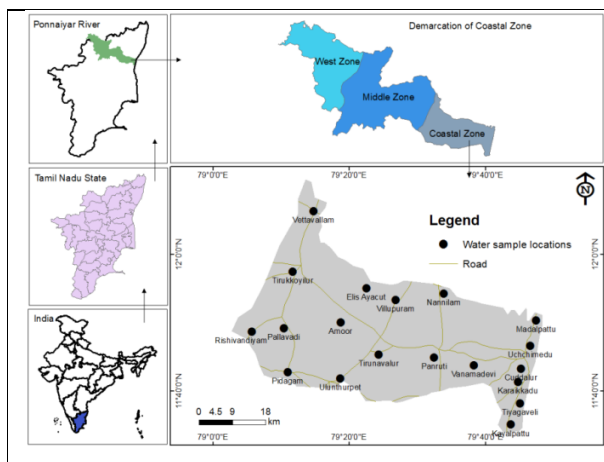
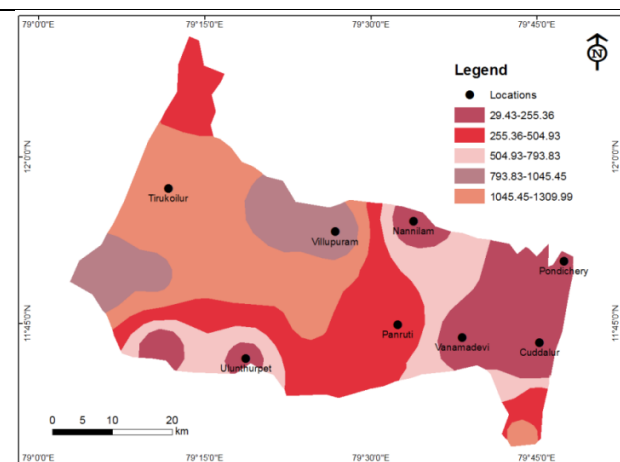**Figure 1 Location of the coastal aquifer of Ponnaiyar River Basin**

Figure 2 Spatial distribution of chloride in the study area
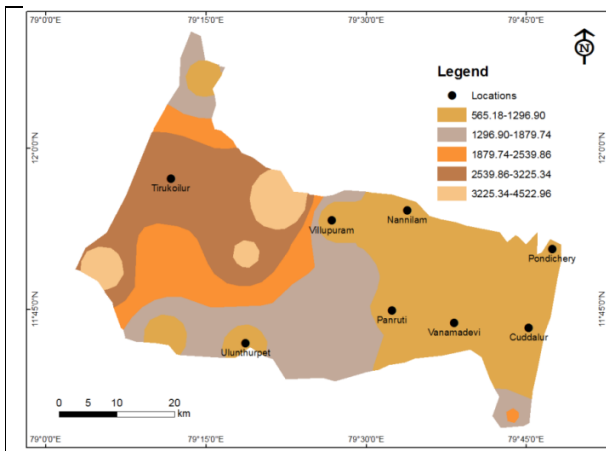
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Figure 3 Concentration of Electrical Conductivity in the study area
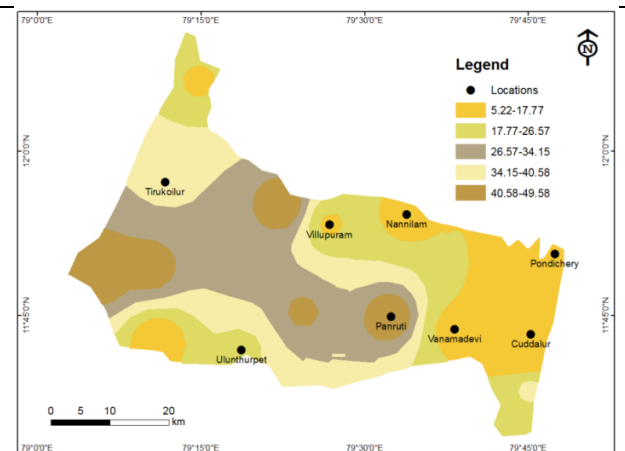

Figure 4 Spatial distribution of Magnesium in the study area
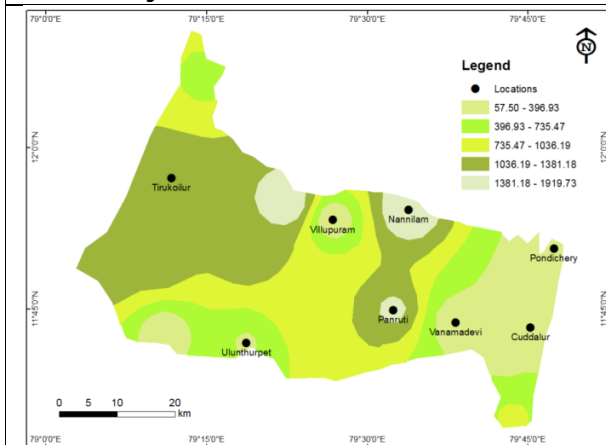

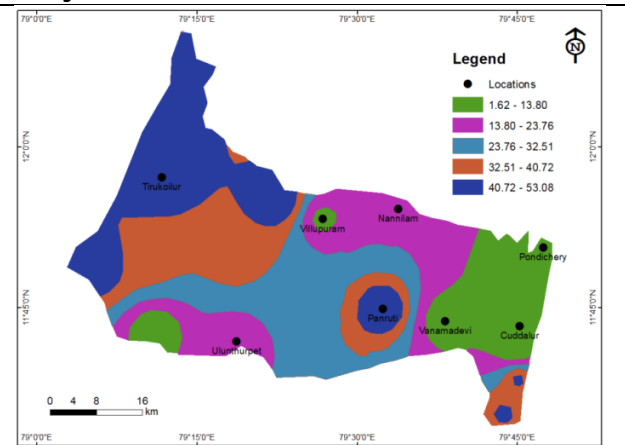**Figure 5 Spatial distribution of Sodium in the study area**
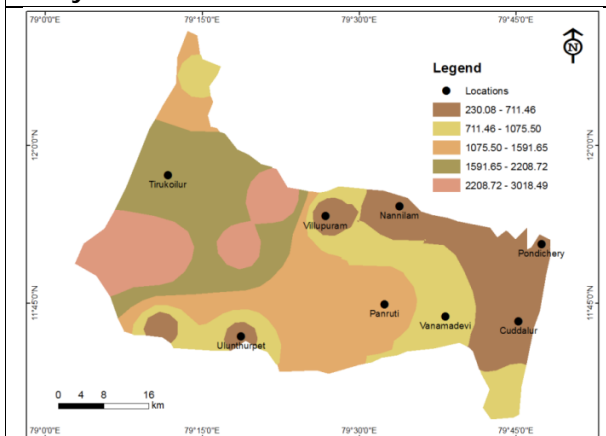

Figure 6 Concentration of Sulphates in the study area

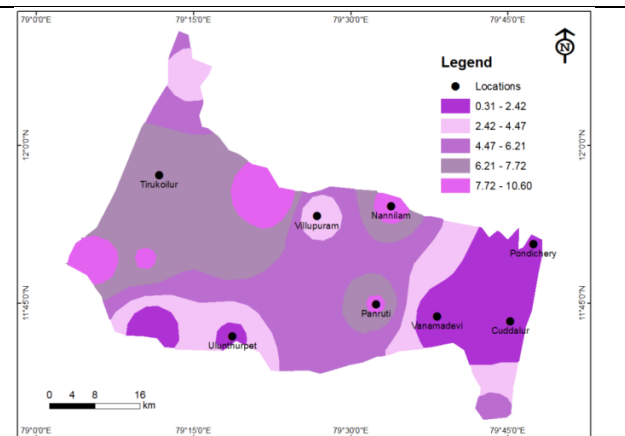**Figure 7 Concentration of Total Dissolved Solids (TDS) in the study area**

Figure 8 Seawater mixing index of the study area
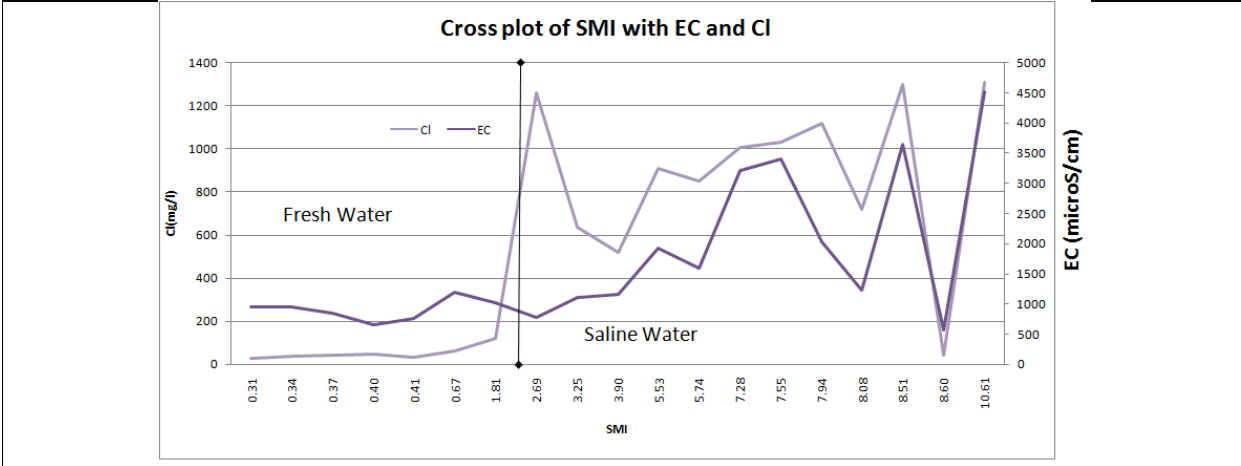
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Figure 9 Cross plot of seawater mixing index in the study area

RESEARCH ARTICLE

A Study on the Correlation between Drug Information Queries and Incidence of Medication Errors in a Tertiary Care Hospital

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ABSTRACT

The study was conducted to understand the relationship between "drug information services" and incidence of medication errors and unwanted drug-related outcomes. Two-tail bivariate correlation test was performed to establish the relationship between the incidence of medication errors, ADRs and allergic reactions, and the number of drug information queries received. The number of queries from prescribers expressed a linear relationship with the incidence of improper dosage regimen, with a correlation coefficient of -0.879 and a p-value<0.01. Incidence of patient non-compliance exhibited a linear correlation with the number of queries from pharmacists. The number of queries from the nurses correlated linearly with the incidence of allergic reactions, having a correlation coefficient of -0.824 and a p-value<0.01. The number of research evidences-related queries had a linear relationship with the incidence of drug interactions, with a correlation coefficient of -0.890 and a p-value<0.01. The relationship between the incidence of ADRs and the number of safe use of drugs-related queries was linear, so as the relationship between unnecessary drugs in prescriptions and number of queries related to drug interactions. The study demonstrates the potential of the inflow of drug information queries from healthcare professionals to reduce the incidence of medication errors and unwanted therapeutic outcomes.

Keywords: allergic reactions, correlation, drug information services, incidence.

INTRODUCTION

Drug information centres (DICs) play an inevitable part in disseminating drug information in a critical attempt to ensure patient care to be optimum [1]. After these long years after the establishment of the drug information centres (DICs), they have covered so much that they take an irreplaceable status in the healthcare department. They remain

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the ideal source of drug information which is retrieved from scientific data stores and databases [2]. The DICs work on improvement of the quality of healthcare and outcome by offering an evidence-based information on medication usage. The WHO recommends that independent DICs can be established, the prime attitude to be promoting rational drug use [3]. DICs work at an aim to provide information on quality and safe use of medicines so as to optimize healthcare outcomes. The DIC pharmacists strive towards offering precise and timely information on drugs and therapy [4]. Drug information centres render support to clinical decision making but they get little attention [5]. Relocation of independent DICs in hospitals and healthcare settings improves the utilization of the drug information services [6]. Medication errors are very common in prescriptions for a very long period from the past. They have the intense capability to affect the therapeutic outcomes even to the extent of producing toxic reactions. Medication errors can worsen the health conditions and can delay the process of recovery. Importance was not given to medication errors in the past. After the advent of pharmacist intervention in to the prescriptions, the necessity for an expert to analyze prescriptions and detect errors in prescriptions, became necessary and routine in healthcare systems nowadays.

Although medication errors are not wholly responsible for adverse drug events (ADEs), adverse drug reactions (ADRs), and allergic reactions, identification of medication errors in prescriptions can reduce the unwanted medication outcomes in huge. The drug information pharmacists by their drug information services can prevent medication errors in prescriptions and they can familiarize healthcare members to ADRs and allergic reactions. They have a considerable role to prevent, detect, and report ADRs[7]. Underreporting of ADRs remains a serious concern in India, and pharmacovigilance programmes should take initiative to identify and report ADRs across the country [8]. Researches on DICs are being conducted from the recent past to assess the activities and potential of drug information services. Researches on medication errors and unwanted medication outcomes are not uncommon and reports on various studies are being published in short frequencies. Studies highlighting the role of DICs in reducing the incidence of medication errors and unwanted medication outcomes should be undertaken and the importance of drug information services should be deduced and reported. This study was carried out in an attempt to identify the potential relationship between the drug information services and the incidence of medication errors and unwanted medication outcomes, which in turn may become an evidence to support the inevitability of drug information pharmacists and their service in reducing medication errors and unwanted medication outcomes.

MATERIALS AND METHODS

The study was an observational study, and it was carried out in the Drug Information Centre of Vivekanandha Medical Care Hospital, Tiruchengode during the period of 20 months from March 2018 to October 2019. It is a 500 bedded multispecialty hospital offering medical treatment at various departments. Drug information queries received during the study period were selected for the study and for further analysis. Queries with back-ground information were not included in the study. Human volunteers were not enrolled in the study.

Measures and analyses
The inflow of drug information queries was measured which was represented by the number of drug information queries received after the start of the study. The entry of queries was made month by month for 20 months. Then the drug information queries were classified on the basis of various aspects of a prescription and therapy. The incidence of medication errors, ADRs, and allergic reactions during the study period was obtained from the clerkship reports of the interns. The number of drug information queries was correlated with the incidence of medication errors, ADRs, and allergic reactions.

Statistics
The incidence of medication errors, ADRs, and allergic reactions were described by descriptive statistical techniques. Correlation was tested by two-tailed bivariate correlation tests using IBM's SPSS v27.

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RESULTS AND DISCUSSION

In the first month of the study 47 queries were received at the drug information centre. At the end of the study, after a period of 20 months, a cumulative total of 720 queries were received at the centre.

Incidence of medication errors, ADRs, and allergic reactions
The drug information queries were segregated as per the category of the requestor. Then the queries were classified according to its type and its relationship with prescription and drug therapy outcomes. The study results showed that there was a clinically significant incidence of errors in prescriptions. Prescribing errors contributed 66.8% of the total number of medication errors. Among them, polypharmacy contributed 7.7%, omission error occurred at a rate of 8.3%, wrong dose contributed 8.1%, and wrong frequency contributed 7.5%. The incidence of drug interactions happened to be 14.9%, administration error being 9%, and dispensing error occurred at a rate of 5.4%.

An Indian study detected 21.9% prescribing errors[9]. Among the prescribing errors the incidence of polypharmacy was 84.5% which was higher than that reported internationally, while, clinically significant drug interactions were noticed in all the prescriptions[10]. In some cases, the incidence of prescribing errors ranged between 29% and 56% of medication errors[11]. A 4 week prospective study conducted in United Kingdom reported that, of the 36,200 prescriptions analyzed, 1.5% were found to have prescribing errors. It also reported that dispensing errors occurred at a rate of 1–24 %[12]. In the hospital settings of Qatar, the most common errors in the prescriptions were prescribing errors contributing 87.9%, administration errors being low at 6.3%, and dispensing errors at 5.1% which relates with the current study. Among the prescribing errors, the rate of incidence of wrong dose was found to be 36.1%, and wrong frequency to be 14.6%[13]. Omission error was found to be the most frequent medication error which occurred at a rate of 15.5%[14]. A Nigerian study reports that ADRs had an incidence of 6.5%, while its prevalence rate was 10.1%[15]. Patients of all age-groups are equally vulnerable to ADRs and the incidence of ADRs is equally distributed among the population[16].

The variations among the study reports may be due to the differences in prescriber expertise and competency, insufficient update in knowledge, neglecting the importance of rational drug use, and not realizing the need of the indigenous population. The patient compatibility and preferences also decide drug dose and regimen selection, which in turn definitely affect the contents of the prescription, and hence impact the medication outcomes.

Correlation
The correlation between the number of drug information queries from various healthcare professionals, and the incidence of medication errors and drug-related outcomes showed that there was a linear relationship between the variables (Table 1). The correlation between the number of drug information queries from prescribers, and the incidence of inappropriate drug class, inadequate/excess dose, and improper dosage regimen in prescriptions was linear with a correlation coefficient of -0.941, -0.928, and -0.879, respectively. The statistical significance was at the 0.01 level for all the correlations. The correlation between the number of drug information queries from pharmacists and the incidence of patient non-compliance showed a linear relationship with a correlation coefficient of -0.892 and a p-value < 0.01, while, the incidence of drug substitution was not found to be linear with the number of queries, with a correlation coefficient of -0.014 and a p-value of 0.970. The number of drug information queries from nurses and the incidence of ADRs expressed a linear relationship with a correlation coefficient of -0.904 and a p-value < 0.01. The incidence of allergic reactions showed a linear relationship with the number of queries from the nurses, correlation coefficient being -0.824 and p-value < 0.01.

The number of therapeutic protocols related queries had a linear relationship with the incidence of polypharmacy in prescriptions with a correlation coefficient of -0.951 and a p-value < 0.01. The number of research evidences related queries showed a linear relationship with the incidence of drug interactions and inadequate/excess dose of drugs in

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prescriptions, correlation coefficients being -0.890 and -0.887, respectively. The significance was at the 0.01 level, statistically. The incidence of unnecessary drug and drug interactions in prescriptions was linear with the number of drug interactions related queries with correlation coefficients -0.939 and -0.918, respectively, both with a p-value < 0.01. The number of safe use of drugs related queries exhibited a linear relationship with the incidence of ADRs, allergic reactions, and patient non-compliance with correlation coefficients -0.962, -0.917, and -0.830, respectively, all with a p-value < 0.01.

The correlation tests between the number of drug information queries and the incidence of medication errors, ADRs, and allergic reactions showed a linear correlation (Figure 1), and this demonstrates that the inflow of drug information queries in to the drug information centre from the healthcare professionals has the potential to reduce the incidences of medication errors and unwanted drug-related outcomes. Incidence of untoward therapy-related outcomes affects the therapeutic plans and regimens, and hence affects the prognosis of pathological states. An important challenge in managing medication outcomes is underreporting of ADRs[17], so, timely reporting of ADRs is very important in assessing and by that improving the quality of drug information services.

ACKNOWLEDGEMENTS

CONCLUSIONS

We conclude that hospital-based drug information centres offer services that improve the knowledge about drugs and therapeutic strategies, which thereby has a potential effect over the incidence of medication errors in prescriptions and unwanted drug-related outcomes. The drug information pharmacists' expertise should be utilized to the fullest by the healthcare professionals in hospital settings, and assure positive therapeutic outcomes.

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Table 1. Correlation between number of drug information queries and medication errors/outcomes

Number of DIQs	Incidence of medication errors/outcomes	Correlation Coefficient	p-value
Number of DIQs from Prescribers	Inappropriate Drug Class	-0.941	< 0.01*
	Inadequate/Excess Dose	-0.928	< 0.01*
	Improper Dosage Regimen	-0.879	< 0.01*
Number of DIQs from Pharmacists	Patient Non-Compliance	-0.892	< 0.01*
	Drug Substitution	-0.014	0.970
Number of DIQs from Nurses	ADRs	-0.904	< 0.01*
	Allergic Reactions	-0.824	< 0.01*
Number of Therapeutic Protocols related DIQs	Polypharmacy	-0.951	< 0.01*
	Wrong time	-0.408	0.242
Number of Research Evidences related DIQs	Drug Interactions	-0.890	< 0.01*
	Inadequate/Excess Dose	-0.887	< 0.01*
Number of Drug Interactions related DIQs	Unnecessary Drug	-0.939	< 0.01*
	Drug Interactions	-0.918	< 0.01*
Number of Safe use of drugs related DIQs	ADRs	-0.962	< 0.01*
	Allergic reactions	-0.917	< 0.01*
	Patient Non-compliance	-0.830	< 0.01*

DIQs → Drug Information Queries

* → p-value < 0.05 is considered statistically significant
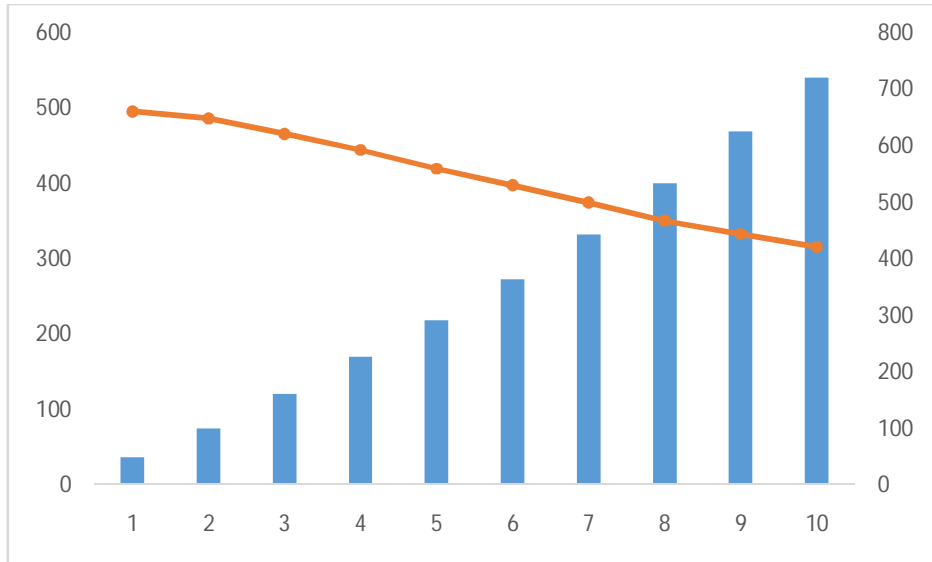
Figure 1. Correlation between number of drug information queries and incidence of medication errors/outcomes
· Cumulative number of drug information queries received during the study
· Consolidated incidence of medication errors and unwanted drug-related outcomes

RESEARCH ARTICLE

Rumour Detection and Analysis in Social Media

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ABSTRACT

Anyone can hook up with anybody supported their space of interest. Special features in this platform allow many people to share their thoughts, opinion, ideas etc., which can help others to learn. Now a day's many don't have an habit of reading newspaper as well, so they depend on e-news. But, how genuine this data is? This needs to be analyzed. To resolve this problem this paper has an idea of how to increase the True information by reducing the Falsity in the post, so that correct information reaching our readers. More the genuinity in post many followers will be for the post.

Keywords: Fake news, Rumour Detection, Veracity, Stance Social Media.

INTRODUCTION

Twitter, Facebook, and Weibo are some of the most popular online social networks (OSNs). These features result in a phenomenon known as "viral propagation," which refers to the dissemination of information over a vast area in a short period of time. Understanding and learning about technology, as well as finding new areas for startup business, may all have a positive or negative effect. Tweets have potential to disseminate viral "Rumours" which is not a strong message that contains deliberately no reality facts. Fake news' rapid dissemination has the potential to have disastrous consequences for individuals and culture.

Misinformation and false statements can quickly spread across social media. This is made worse by the fact that
- anyone can publish (incorrect) details, and
- It is difficult to verify it.

For example, the latest corona virus outbreak (COVID-19) has gotten a lot of attention and is causing a worldwide health crisis. On social media, there has been a flood of information about the COVID-19. The COVID-19 is now mostly being debated on social media, with some false details or rumours circulating. Rumors are considered to be a

form of public opinion on virus because they propagate rapidly [2]. Rumors are more dangerous than viruses in the fight against COVID-19 because they frequently cause negative Internet opinion storms. When widely disseminated, it will cause a feeling of tension and nervousness. As a result, detecting or identifying rumours is a challenging work.

Survey

Many studies have been conducted on the detection of rumors in social media. Present research primarily creates a rumour detection intelligent system which can pull out appropriate textual features from social networks. Work has carried out to pull out some expressive words which adds to the meaning / message of tweets in assembled in order to increase the detection correctness because pandemic based rumours typically has some highlighted words which will give most of information compare to regular posts .By employing an ensemble learning approach (which combines multiple individual models and provides superior prediction power). We are attempting to analyze a model that detects rumour as early as possible in this paper. Current public access websites such as Facebook and Twitter has no model that can identify information spread on the media as a rumour and stop the spread as soon as possible before it causes a problem. Research was conducted with extensive experiments on the Weibo platform to validate the model. The results of the task show that it is a high detection accuracy for rumour detection.
Users post and his/her interaction on Twitter using tweets, which is the actual information placed on Twitter.

Tweets are composed of two main components:
➔ the information in the post and
➔ the person who placed it.

Aside from posts, the "Chinese Twitter" is also known as 'Weibo.' Started with the idea of " # " where user can access his interested content with this idea. Difference between Chinese twitter and twitter is in terms of number post weibo is very attractive and commenting on these post were also more but Twitter tend to relate more with the current global events and news stories . Data shared on Twitter requires no checking it is not necessarily be correct data so it can be also distributed very fast, resulting in the spread of unconfirmed and unverified statements. Huge amount of data will be provided by Weibo for research this is not reliant on any information suppliers.

Communication related Features: On the platform of Weibo, Communication related features has more forwarded information, resend tweets, tags for tweets, which characterize the information traditional communication method. The progress done on retweets has been displayed in Figure 2. The total amount of standard pandemic Message in Social Platform mentioned above has 200 more compare with mean number of rumours.

Related Works

Unwanted information is Rumours. This is classified as shown:

Information can be Factual or Rumour. Figure 3 It is either intentionally or unintentionally misleading. Misinformation is defined as information that has been disseminated in the public domain incorrectly without proper credential or complete data and have no intention of misusing or disturbing anyone. Disinformation, those type of tweets which are deliberately disseminated in order to misdirect readers and spread a wrong rumour. Disinformation is categorized as harmless type of rumour , fraud tweets , tweets related to condemning others ,and page 3 rumour related to for example Bollywood depending on writer's motivation and the nature of the post. Humorous rumours are the most harmless type of rumour. Sources disseminating similar to tweets make up and get lot of popularity and will result in a humorous spin. The goal or intention of posts is to just deviate or attract audience. Some sensitive words are proved as negative first itself, and these are used for specific users. The connected updates on same have planned foremost updated results thus far has been classified into 3 important categories: DLL, GNN. Propagation tree related strategies.

Proposed Model

Having the concept of inserting huge amount of natural language what we use along with surrounded world information which is used by humans is inserted as a intelligent quotient in the fake news design model. The task at hand is to create a differentiation idea that can analyze the severity of pandemic tweets [3,4]. The posts were manually tagged after being pulled from Twitter. Location, Tweet At, Original Tweet, and Sentiment are all provided.

Most studies use four stance categories:
1)Input Text,
2) Rumour detection,
3) Rumour Tracking
4)SDQC Methodology(Support ,Deny, Query, Comment
5) TRUE / False [reduction].
Early detection can be done based on stance classification.

SDQC- Supports, Deny, Query And Comment
➔ Support: reader always accepts the post.
➔ Deny: reader always has a freedom of not accepting the post.
➔ Query: reader any time can ask for proof for post.
➔ Comment: reader can always write or post comment for post.
Veracity Classification: This research will only distinguishes if a rumor is "True", "False", and "Unverified"

The Data Consolidation function aggregates data from multiple worksheets or workbooks into a single worksheet that you can easily update. Data cleaning [5, 6]: is the process of identifying and correcting errors in a dataset that may have a negative impact on a predictive model. The term "data cleaning" refers to a wide range of tasks and activities aimed at detecting and correcting errors in data.

Predictive modelling: This employs information along with figures to forecast outcomes using tracking system. These system will do the analysis field interest and TV rating to technological advancements and corporate earnings.

• **Data transformation:** this step will become important because it always perform information collection and maintenance. Depending on the needs of the research, this will have variety of modules such as converting data types, cleansing data by removing nulls or duplicate data, enriching the data, or performing aggregations.
– **Data integration:** is the process of collaborating tweets out of various origin which end up in giving a final structure of information, allowing reader to comment, ask and change the content and come out with some figures.
– **Dimensionality reduction:** techniques are those that reduce the number of variables in a dataset.
Data Synthesis: Sentiments are classified as group of 5 types: Extremely Positive, Extremely Negative, Negative, Positive, and Neutral.

We can give system which closely resembles human actions. Tweets take action in order to achieve their objectives. This can be modelled using the approach as follows:
➔Trust (concerning in environment),
➔Desires and wants
➔Reasoning
➔Intentions (retain the chosen course of action).
A model is the set of concepts which is described with all the above features where the analysis can be made on the actual tweet and later classify as Rumour or Non Rumour. Based on the history of the tweet and time of post the propagation can stopped at the earliest.

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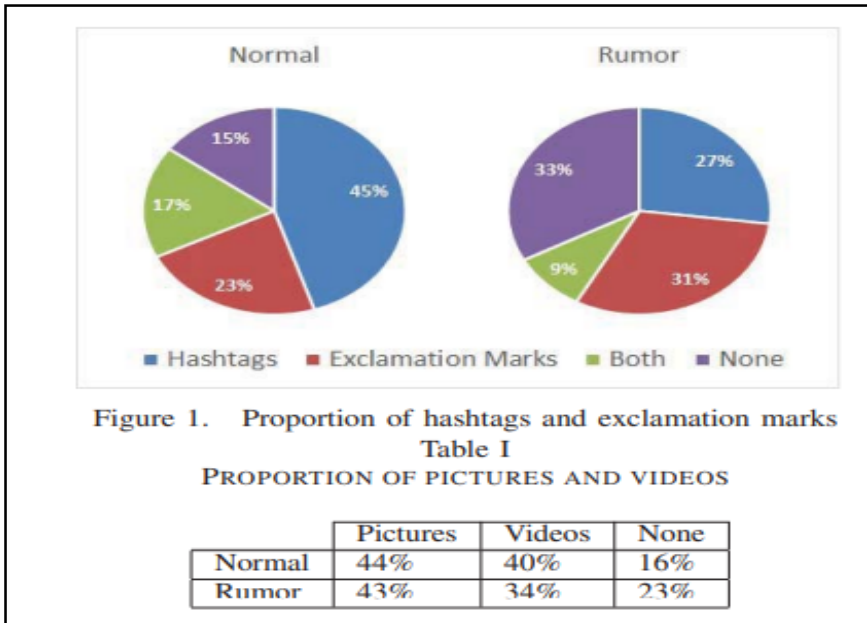
Figure 1.   Proportion of hashtags and exclamation marks

Table I
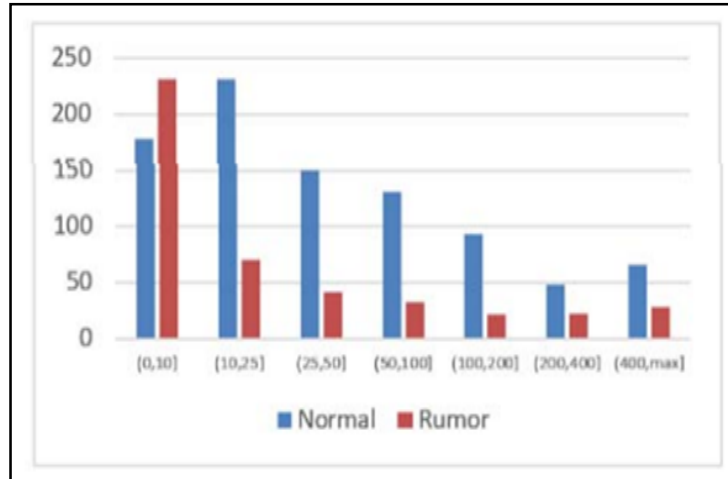
PROPORTION OF PICTURES AND VIDEOS

	Pictures	Videos	None
Normal	44%	40%	16%
Rumor	43%	34%	23%

Figure 1. Proportion of hastags and exclamation marks

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Figure 2. The number of Repost in Weibo
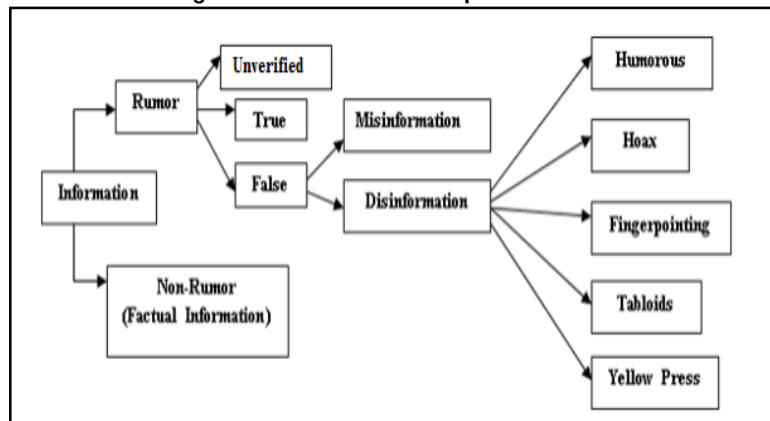
Figure 3. Classifications of Rumours.

Figure 4. Proposed Rumor Model

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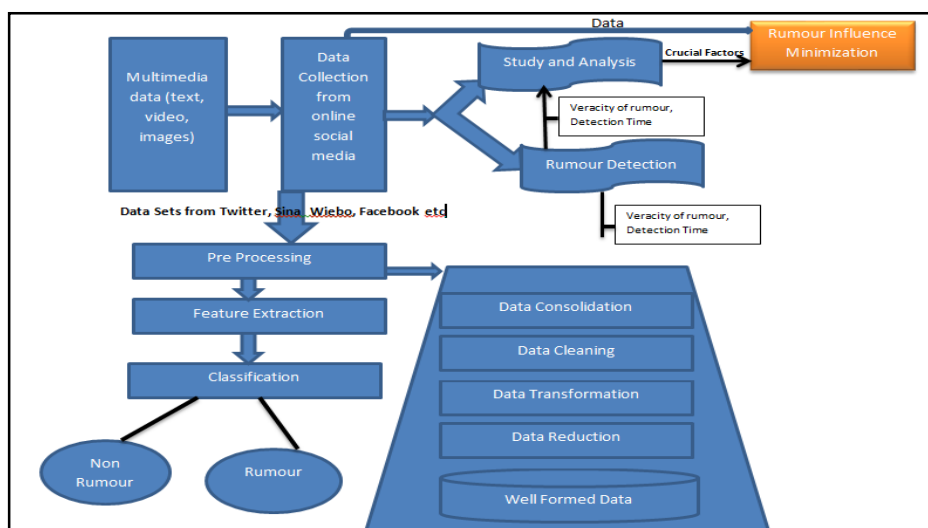
A Legal Study on Scientific Justifications under Sanitary and Phytosanitary Measures and Competence of India

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ABSTRACT

SPS Agreement is one of the most important agreements of WTO. It provides certain measures to the member states to protect human and animal health. But these measures should be based on scientific justifications. Word scientific justification has been misused by member states on various occasions. Misuse of scientific justification under SPS Agreement leads to restrictions on the various food products from developing countries. Because of these restrictions the economy of developing countries suffers a lot. The economy of countries like India is based on agriculture and dairy industry. But in the era of globalization it is also necessary to meet the criteria set by International organizations like WTO. Before 2006 lots of laws were there to deal with food safety issues in India. To consolidate the laws of food safety in the year of 2006 India enacted The Food Safety and Standards Act. Except this legislation there are various rules and regulations in India related to food safety. But still there is space for more improvement on the part of India. It is also evident that on few occasions measures applied by developed countries are arbitrary and beyond the scientific justifications. On many occasions these measures are challenged by India and other developing countries before WTO.

Keywords-WTO, SPS Agreement, Scientific Justifications.

INTRODUCTION

Agriculture is one of the most important sectors for India. It contributes round 18% in GDP. More than 70 % rural Indians are dependent on agriculture . Indian agriculture has registered impressive growth over last few decades. The food grain production has increased from 51 million tonnes (MT) in 1950-51 to 291.95MT during 2019-20. There

are various other components of agriculture eg Dairy Farms and Milk Production. Dairy sector contributes the large share in agricultural GDP. Recently the focus of International Community has been shifted to the SPS measures because developing countries are not capable to meet the high expectation of technologically advanced countries. Advancement of technology created hindrances for developing countries in the field of international trade. And same has also applicable in the field of Agricultural products which includes dairy products. Advancement of technology also allows member states to identify the food borne illness and other risks associated with lower food safety. SPS Agreement is not alone to deal with food safety issues in international trade regime but there is another provision namely Article XX of GAAT. Article XX GATT provides exceptions to the core principle of WTO which is liberalization of Trade among the nations. By using Article XX of GATT, member state can restrict the trade when it is necessary to protect human, animal or plant life or health.

Science Based Obligations under SPSA

SPS Agreement also provides the measures taken under SPS agreement should be rational to the protection of human and animal health and most important thing is that these measures should be based on scientific evidences. And these scientific evidences need to be supported by various principles given by WTO Dispute settlement body. WTO members may take risk reduction measures based on their own risk management objectives, referred to as the member's "appropriate level of protection" or "acceptable level of risk". The member states of WTO are allowed decide their appropriate level of health protection. As long as member states of WTO are not using arbitrary measures it is permissible under WTO regimes. In *EC-Hormones* case it was held by appellate body of WTO that there shall be a "rational relationship" between the SPS measure used by state and the risk to human and animal health. Following that, in the Japan-Apples case the principles related to control negligible risk should be very strict. States needs to be careful while dealing with negligible risk and adopting various SPS measures.

The regulatory measures under SPS Agreement are manly based on risk assessment by collecting scientific evidences. In some cases WTO Appellate body give flexibility while deciding the cases related to measures under SPS Agreement. In famous case of *EC-Hormones* appellate body adopted two alternative approaches, first is *de novo* and second is *deference.* Finally Appellate body provides that restrictions should be based on *objective assessment of facts.* The WTO Appellate body had a difficult task in hand while deciding cases related to SPS measures and scientific justifications. Because it is the responsibility of Appellate body to take care both the core principles of GATT and SPS measures adopted by member states on the basis of scientific evidences. The Appellate body's approach in another landmark case *US – Continued Suspension* sets new trends while examining the scientific methods adopted by the member states of WTO.

SPS Barriers Faced by India

In recent years Situation of India is not different from other developing countries; it has faced barriers from developed countries on the name of food safety under SPS Agreement. India is largest exporter of tea and presence of pesticides in Indian tea is major concern faced by India in international market. Germany complained about high levels of Ethicon in Darjeeling tea. There are few instances where complained has been made by EU about high level of Bicofol in Assam and Terai tea. Germany also rejected Teekanne Darjeeling gold Brand tea because of high levels of tetrafidon. On the other hand UK accepted the same tea without any negative observations. India and china raised this issue before SPS Committee in March, 2005.Similirly UK has some very strict regulations related to exported marine products. On the grounds of lack of hygiene and insufficiency of infrastructure EU banned fisheries product export from India. On the basis of reports of community inspection EU Claimed that Indian marine products contaminated by microorganism, which is harmful to human health. Indian mangoes export faced challenges because of EU arbitrary rules and regulations related to mango pulp. Indian buffalo meat was banned by EU on the grounds of prevalence of certain diseases. Various Indian food products were rejected by EU on the ground of high level of Aflatoxin. Similarly Because of use of sudan red Indian red chili powder was rejected by various Countries. On the report of FVO mission team EU rejected Indian milk products. On the grounds of Sanitary and phytosanitary measures Netherland rejected Floriculture consignments from India.

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On the basis of above mentioned paragraph it is clear that Developed countries have set high and arbitrary criteria under SPS Agreement. Sometimes it seems to be unscientific and without scientific evidences.

Indian Laws and SPS Obligations

Since SPS Agreement came in to force, Developing countries are facing major issues related to food safety because of lack of technology and effective rules and regulations. The story of India is not different. Before 2006 there was not any specific legislation to deal with issue of Food safety. India is federal state and Article 246 of Indian Constitution provides distribution of power between center and state governments. According to seventh schedule both Centre and state governments are responsible to enact legislations for the food safety in India. The following laws and regulations are responsible for food safety in India Food Safety and Standards Act, 2006.Food safety and standards Act 2006 was enacted by Indian Parliament to consolidate laws related food safety and standards. This piece of legislation was long awaited by the country because of high International standards. Under this Act a definition of wide range of food products has been given. For example primary food, infant food, misbranded food, substandard food, unsafe food, food additive and other categories of food products are mentioned under this act. The Food Safety Authority of India and the State Food Safety Authorities are two main authorities responsible for effective implantation of said legislation. Act also provides provisions for penalty in case of degraded quality and sanitizations of food products. Even a misleading advertisement also attracted the penal provisions of the Act. One unique characteristic of the legislation is good manufacturing Practices. Legislation also fixed the responsibilities of various stakeholders of food manufacturing industries for example manufacturers, packers, wholesalers, distributors and sellers. Another major step taken by government of India is establishment of export inspection council the ECI was set up by Indian Government under section 3of the Quality control and inspection Act.

CONCLUSION

The core Principle of WTO is free trade between the member states. It is clearly evident from Article I and Article III of GATT. Both National Treatment Principle and Most favored nation principle clearly indicates that arbitrary ban on imported products is not permissible. But still the health of human and animals secured an important role in WTO regime. Parent Document of WTO which is GATT provides exceptions to the core principal of WTO. Article XX of GATT says that member state can restrict the trade if it is necessary to protect the health of human and animal. SPS Agreement also says that member states are allowed to put restrictions on the free trade if it is necessary to protect the human and animal health. According to Article 2 of the SPS Agreement restrictions should be based on scientific justifications. It is evident that most of developed countries misused this provision and arbitrarily banned food products from developing countries.

India is also a victim of same strategy of developed countries, when various food products were rejected by US and EU. Definitely India needs to strengthen its food safety laws and technical support to meet the criteria set by various WTO Agreements. But it is also evident that the approach of developed countries is arbitrary and need to controlled by international organizations like WTO.

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RESEARCH ARTICLE

The Emerging Trend of Artificial Intelligence in International Arbitration: An Arbitration Law Analysis

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ABSTRACT

Arbitration is believed to be the most appropriate alternative to adjudicate a dispute between the parties with a procedure akin to national court adjudication. The pivotal characteristics of arbitration is time and cost efficiency and final justice, but users of international arbitration often find a contradicting situation. To overcome the conundrum of time and cost efficiency in arbitration proceedings, various trends have immerged, such as artificial intelligence, online arbitration and others addressing the concern. The development in the information technology sphere and the ability to better utilise software accumulating data and processing information have bring about a change in the perception of the working of the international arbitration community. Artificial Intelligence is a computer program which has the capability of performing human like cognitive functions. These are autonomous machines which can process data and solve problems just like humans but with certain limitations. So, at inception the question which shadows our mind is, whether artificial intelligence take over arbitration? The author in this chapter undertakes a descriptive research shedding light on the various aspects of the emerging trend of artificial intelligence in international arbitration. Firstly, the author lays down the underlying rational explaining the definition and role of artificial intelligence in international arbitration and the need to resort to such novel technology. Secondly, the author explains the benefits of using artificial intelligence in international arbitration and its impact on the overall cost and time of international arbitration; followed by the challenges which are faced in integrating artificial intelligence in international arbitration proceedings and its effect on the enforceability of the award and legal professionals and lastly the conclusion.

Keywords: Artificial Intelligence; International Arbitration; Benefits; Challenges; Integration.

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INTRODUCTION

Artificial Intelligence (AI) is the next big thing which possess the capability of taking over the world in a single sweep. Jobs from all walks of life are under the threat of an automated machined which can emulate their work with ten times the speed and negligible error margin, making then consistently accurate. The revelation of being taken over by AI is unsettling but whether it is for good or worst, is yet to be revealed. The pivotal role of arbitrators is to make a decision upon certain set of facts by applying the principles of law. And what if this process of decision making can be perfectly emulated by a software encoded by an information technology personnel then the question which appears in our mind is – will AI take over international arbitration?

AI threatens to disturb the international arbitration practice as it possesses the capability to process the information akin to that of an arbitrator. Moreover, whereas the arbitrator takes six to eight months to render an award the software can perform similar functions quite quickly. AI is also capable of self-learning from the past-data entered into its database. This article sets out the basic understanding of AI, how AI can assist international arbitration and what all challenges does AI poses to International arbitration Technology has the stunning ability to overhaul established practices and assumptions of human behaviour. Despite traditional resistance, technology has crept into international arbitration [1]. Paul Cohen and Sophie Nappert claim that we are on the edge of vital revolution by AI, citing the reasons, "There is widespread dissatisfaction among arbitration users with the time and cost of proceedings and the 'business-as-usual' indifference of the arbitral community, at the same time as technology is becoming available and affordable to address users' grievances about the process" [2]. AI can assist and improve the international arbitration practice in multifarious ways but is far from taking over the entire process due to the essential characteristics of a human of comprehending and analysing and altering the decision keeping in mind the principles of equity and justice.

UNDERSTANDING ARTIFICIAL INTELLIGENCE

The creative minds of the movie directors and writers of science fictions novels of early 1950's can be given some credit for the formulation and innovation in the field of AI, as featured early in the AI history are the movies and novels – displaying machines acting like humans but with superhuman capabilities. The first scientific inquiry into AI was made by Alan Turning, when he published a paper focusing upon the question whether machine will be able to think, for which he formulated a test, now known as the "Turning Test" [3]. Turning test is successful if a machine can talk or interact with humans without them letting know that they are not talking to actual a human. Internet and the power of processing chips in computer immensely contributed to the development of AI in the 1990's and further helped in the crystallization of the modern-day AI. With ever-increasing speed and processing power, and with ever-more data, it seems only a matter of time before AI machine learning algorithms will be "better" than humans at arbitrating disputes – that is to say, they will perfectly recall all the testimony, all the documents, and perfectly match these to the applicable legal principles. This in turn raises the question of what people expect from a dispute resolution process in the first place. Is it possible that the role of humans in arbitration can be completely eliminated or might a flawed but human presence in arbitration remain indispensable for the legitimacy of the process.

There are multiple definitions of AI. I have selected only two. The Oxford Dictionary defines AI as the "theory and development of computer systems able to perform tasks normally requiring human intelligence, such as visual perception, speech recognition, decision-making, and translation between languages." [4]. John McCarthy, a late computer scientist and arguably the one who coined the term, describes AI as "making a machine behave in ways that would be called intelligent if a human were so behaving" [5].

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Interestingly, both definitions use human intelligence as a reference point. They describe AI in comparison to 'tasks normally requiring human intelligence' and 'ways that would be called intelligent if a human were so behaving.' The Oxford Dictionary lists a number of tasks for which AI and human intelligence may be compared. This includes, for instance, visual perception, speech recognition and last not the least translation between languages. Over the years, we have come to accept that computers are generally better than humans in doing those tasks.

Specialized literature about AI distinguishes artificial intelligence (AI) from artificial general intelligence (AGI) [6]. AGI can accomplish any goal, including learning new things. To illustrate this, think about a chess-playing computer program: it might be good at playing chess, maybe even beat a human chess champion, but is unable to learn how to write a novel. There is also a distinction between weak AI and strong AI [7]. Weak AI programs mimic human thinking and reasoning abilities without actually having them, whereas strong AI programs have the ability to think or reason independently, without merely using pre-programmed ways of human thinking or reasoning.

The idea that computer programs can learn how to learn is not easy to apprehend. With the current state of the art, AI is best suited to operate in documents-based procedures, whereas e.g. interviewing witnesses, or more generally managing a courtroom is not yet technically realistic. A precondition for AI-assisted dispute resolution is thus that the dispute resolution process is either online or at least highly electronic. While automatization is advancing quickly, there are no indications that the technological frontier is near to creating actual intelligence in the sense of a sentient consciousness anytime soon.

INTIGRATION OF ARTIFICIAL INTELLIGENCE AND INTERNATIONAL ARBITRATION: BENEFITS
Domestic arbitration is in somewhat a narrow space and is influenced by multiple factors such as the politics of the country, domestic laws, normative orders, socio-cultural opinions and last not the least the judiciary. Whereas International arbitration enjoys the autonomy of choice and liberal interpretations encompassing modern technology within its ambit. Uniformity is the essence of International arbitration which is fostered by United Nation Commission on International Trade Law, Model Law on International Commercial Arbitration of 1975 (UNCITRAL Model Law) and the New York Convention on the Enforcement of Foreign Award (New York Convention).

The use of AI in International arbitration is more likely then in domestic arbitration, as in international arbitration there are fewer chances of it been against public policy. Technically, there are no express prohibitions in a definition of an arbitration agreement that the arbitrator must be human. An arbitration agreement by AI could technically be recognized under the definition of the UNCITRAL Model Law [8] and its resulting awards could be enforced under the New York Convention [9].

So, the issue of whether a robot can be appointed as an arbitrator or not, is best answered with the principle of party autonomy in international arbitration. That is to say, if the parties agree to appoint a robot arbitrator then it would be considered a valid appointment and arbitration proceedings. Apart from independently appointing a robot arbitrator parties can also agree on usage of AI tools and software in facilitating the arbitral proceeding by aiding the arbitrator in reaching a binding, efficient and fair award expeditiously. In that respect the benefits of using AI in international arbitration are as follows.

Amalgamation of AI and Human Arbitrator
The chances of objection are high if a sole bot arbitrator is appointed but if a bot arbitrator is appointed alongside two human arbitrator the chances of objection decrease substantially. But still issues may arise regarding the imbalances in influence of the AI versus the human arbitrator [10]. In order to eliminate the objection and influence of AI onto the human arbitrator the role of AI in arbitral proceeding discussion would have to be definitely outlined by the technicians. Few fundamental issues are to be chalked out before proceedings with amalgamation of AI with human arbitrators such as [11].

a. Would the two appointed human arbitrators ignore the AI completely?
b. Can the AI be appointed as the presiding arbitrator of the proceeding?
c. How much reliance is to be placed on the decision of the AI if there is a deadlock between the two human arbitrators.
d. What if the human arbitrator disagrees with the AI arbitrator?

Combining AI with human Arbitrator can expedite the arbitration process and also reduce the margin of error as well provide a confirmed un-biased decision based on careful scrutiny of facts and analysis of previous awards on similar facts. It could assist the tribunal to render an award expeditious. Using a bot arbitrator could also result into reduction of arbitration costs as a bot arbitrator would be paid less than a human arbitrator.

AI Aiding Human Arbitrator
Software which relies on complex algorithms to compute information in a systematic manner and provide in-depth analysis of text, relevancy and critical analysis of arguments are no doubt are of great benefit to the arbitration process. Basically, the acceptance of an arbitral proceeding by a human arbitrator with the assistance of such automated software is more than completely replacing the human arbitrator with an AI. There are multiple ways to harness the true potential of AI and maintaining the legitimacy of the process, such as:

Conducting research and summarising the applicable law
We all are familiar with software such as NVIVO, IBM SPSS and others, which socio-legal and statistical researchers often use to analyse qualitative and quantitative data in order to arrive at a definitive inference regarding the data collected. Now reflecting on the technological development in use of AI in the field of dispute resolution, IBM has developed the world's first AI attorney named "Ross" which has been utilised to deal with a law firm's bankruptcy practice along with fifty human lawyers [12]. Ross was developed on the IBM's cognitive computer called Watson, which was initially used in the medical field [13].

Ross is capable of performing such function which no lawyer can do so efficiently, it can read and comprehend impossibly large and growing database of legislation, precedents, and academic research papers. In its modus operandi, when a question is posted to ross, it first formulates a hypothesis and compiles research and thereafter generate responses along with references and citations, to back up its conclusions. Moreover, as more data is fed into ross's database it possesses the capability of learning from its own experience and improve its accuracy and speed. The marketplace for legal research has reached its saturation and there is plethora of legal search engines which can generate accurate and relevant legal material and citation with a click of a mouse [15]. No question regarding the credibility and legitimacy of these technological research tools has ever been raised either in litigation or arbitration. Using AI software such as, ross in international arbitration for summarizing and analysing enormous legal database, cases, legislation, and documents is likely to be widely accepted in the coming years as good methodology.

Computing and analysing the party's submission
AI can be used for analytical reasoning and tasks in international arbitration such as for determining the weight of different pieces of evidence produced by the parties. Using AI for such purpose would definitely be more controversial as it inspires more objections regarding the legitimacy and validity of the process. According to the varying degree of resources and time available to the parties, they can opt for the intensity of analytical processing task to be done by AI software and the process of using AI for analytical process shall be made transparent to the parties by the developer upfront.

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Ensuring the correctness of the human arbitrator decision by comparing it to the decision of the AI
Paul Cohen and Sophie Nappet has suggested using AI to rectify the unconscious biases of the arbitrators [15]. Checking the tribunal's decision against the AI's decision could also serve as a useful precaution, but the results of this checking exercise are likely to add very little value to the tribunal's final decision. In addition, a sophisticated AI capable of providing an alternative decision could cost a disproportionate amount to develop and license.

CHALLENGES IN INTEGRATION & IMPLEMENTATION
Technological advancement in the field of information technology has its advantages as well disadvantages. The use of AI in international arbitration provides ease of work and delegation of clerical work to the software but with the gradual shift and development, the entire process of arbitration is been attempted to be conducted by an autonomous machine. The shift from autonomous legal research software to AI arbitrator can be risky for the current international arbitration regime. The limitation in integrating and implementing AI in international arbitration can be elucidated as follows.

Legal work is far more complicated than it looks, misplacement of a single word can change the entire meaning of the sentence and the spirit of the law. Drafting of comprehensive arbitration clause is a tiresome and exhaustive work which requires practice and years of experience. And a computer program, at least in the beginning, is as good as its creator and the available data set. The downside of integrating AI in international arbitration is that much of the arbitrator's work is not published in the award and arbitration is one of the mechanisms wherein confidentiality is crucial. The lack of available data to the software developer might slow down the growth of advancement in machine learning in the field of international arbitration as data is the key to an efficient and successful AI software. The use of AI would imply the replacement of arbitrator and reducing the time taken by the arbitrator to render the award, but at what cost, the limitation of AI is, that, "much of the arbitrator's work is not published in the award. For instance, the choice of the arbitral seat when parties are unable to agree, the exercise of discretionary powers, or the way that tribunals deliberate is not readily available information for computer engineers to feed into the machine. Therefore, to develop a truly spectacular international arbitration AI, which will be able to compete with the best human arbitrators, the best minds of the community must cooperate with computer engineers in this project. The cooperation, cost and commitment required to accomplish this seem nearly impossible"[16].

Moreover, the risks of using AI in arbitration proceeding also includes the risk of computational bias which might lead to unfair awards, the problem of maintaining the fundamental tenet of international arbitration of equal right to be heard and due process [17] and last, however, not least, "no one knows why and how a program arrives at the predictions AI makes. The fact that AI decision-makers will not be able to provide reasons in the same manner as humans, and thus cannot fulfil these fundamental prerequisites of justice, makes it sceptical that AI will replace human decision-makers anytime soon – even assuming that computer programs can arrive at correct outcomes" [18]. The legitimacy of reasoning is difficult to integrate into an AI system as the parties always prefer to know the reason for any particular award.

CONCLUSION

The recent trends in international arbitration and the emergence of such trends as challenges to international arbitration practice are both the two sides of the same coin. The trends (such as the use of AI in international arbitration) are developed in order to provide an innovative solution to an existing problem, but the complications in implementing these solutions give rise to challenges. As pointed out by Sundaresh Menon, the chief justice of the Supreme Court of Singapore, "Justice can sometimes be done through the very simplest and humblest of processes, not by the longest or the hardest. After all, the shortest distance between two points will always be a straight line" [20]. The development in the technology and the impetus to data-driven analogies have influenced the overall perception of how international arbitration community works. The very first question which pops in our mind is,

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will AI take over arbitration? There are many ways that technology can improve and support international arbitration, but AI is far from taking over arbitration entirely, moreover there are limitations and risks for using AI which gives rise to challenges in international arbitration.

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RESEARCH ARTICLE

Artificial Intelligence and Nanomedicine: Legal and Ethical Challenges in India

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ABSTRACT

Nanotechnology deals with the study and manipulation of structures at the extremely small or at a nano level i.e. the analysis of structures that cannot be seen through naked eyes. It focuses on the application of extremely tiny things that can be utilized across a wide range of various science fields, such as chemistry, physics, engineering, and so on. Nanotechnology is extensively used in numerous industrial and consumer sectors and has the potential to grow further and expand globally. It has increased the speed of memory chips, clean the environment, cure cancer, or concoct super-weapons of untold horror, revolutionized the entire spectrum of life having a big impact on digital assets. It is used not only to store and transmit data but also for tiny Nanomaterials or sensors that are now being used in clothing and textiles to repel harmful pollutants. Despite having great development in nanotechnology, there are a handful of very specific legal concerns, including public trust, Information transparency, issues of environmental impact, potential risks & ethical concerns, some are the determination of hazards and risks, justice, privacy and promoting respect for persons. In medicine, nanomaterials can be used to deliver drugs to targeted areas of the body needing treatment, however, it poses few threats also. Nanomedicine is a novel as well as a challenging field of research in terms of its governance. Its multidisciplinary essence poses challenges for the regulatory framework for legislature and judiciary. In India, a clear framework for the regulation of nano-medicine is lacking. The research paper sketches some of the regulatory challenges which affect the current development within the field of nanotechnology and highlights the suggestions dealing with such challenges. (277 words)

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Keywords: Nanotechnology, Nanomedicine, Regulatory Challenges, Law, Artificial Intelligence

INTRODUCTION

Nanomedicine, a combination of nanotechnology and diagnostic, diagnostic, and therapeutic drugs, has greatly improved the effectiveness of the treatment of more complex and deadly diseases by keeping the therapeutic dose in the target area [1]. It is a hub for a variety of technologies that attract worldwide attention because of its tangible benefits such as efficiency and effectiveness. Nanomedicine is not new to the market but can be traced back to ancient times which means Bhasma - an ayurvedic metallic or mineral remedy treated with herbal juices or decoction and produced a certain heat by the puta system of Ayurveda, which is itself well known in the Indian subcontinent and is widely recommended for the treatment of many diseases. Bhasma is said to be made from naturally occurring nanoparticles, which are supplied with many other Ayurveda drugs [2]. The market of Nanomedicine in India is expected to grow to USD 1.6 Billion in another 10-15 years. And also, expected that India to be among the top three healthcare markets by 2020 [3].

Artificial intelligence (AI) discusses the mimicry of human mental processes through machines, especially computers that include speech recognition, learning, consultation, problem-solving, learning from experience, and self-improvement without any specific action. AI has a wide range of medical applications and is useful for diagnoses, especially to detect small differences from baseline, to detect outbreaks of early epidemics, and imaging diagnoses. Medical AI, for example, the IBM Watson that will be used in oncology, helps oncologists produce appropriate and customized treatments for cancer patients. IBM Watson gathers information from medical journals, leading oncologist technology, textbooks, and clinical data and analyzes patient medical records, and provides treatment options based on this information. An oncologist can use his or her information and expertise to search for simple treatment options [4]. The Government of India has been supporting the R&D Departments for further research on Nanomedicine but when it comes to the regulatory framework there are no specific guidelines/ laws/ acts which deal in the usage and manufacturing of nanomedicine [5]. The authors specifically in this paper, identify the existing laws related to nanomedicine and what are the challenges in them, and the requirement of specific law for nanomedicine.

Concept of Nanomedicine
There is no internationally accepted definition of nanomedicine, so in layman, nanomedicine can be defined as a nanoscale intervention in humans to diagnose, prevent and treat disease. Scientific analysis was used to test new nanomedicine methods in India using a two-step strategy that included quantity and analysis for a period of 5 years from 2010 to 2015 to identify participants, market styles, and patent filing [6]. There are some methods used to map the nanomedicine innovation landscape in India mentioned in Figure 1 [7].
Nanomedicine also provides certain benefits to citizens in numerous ways such as in the form of drug or the form of treatment of critical disease by using nanotechnology, some of the benefits are listed below [8].:
- Drug Delivery
- Small Size of Nanomedicine Devices
- Repairing Tissues within the Body
- Early Detection for Disease

Relation of Nanomedicine and Artificial Intelligence
Artificial Intelligence - the intelligence displayed by machines, in contrast to the natural intelligence observed by humans and animals which includes consciousness and sensitivity [9]. In simple terms, to build a machine integrated with human intelligence designed in such a way that you think like humans and imitate their actions [10]. AI (Artificial Intelligence) applications are limitless - used in many different sectors and industries. However, nanotechnology incorporates the knowledge of engineering, chemistry & physics; AI relies heavily on biological stimulation to make some of the most effective paradigms such as neural networks or evolution algorithms [11].

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Artificial Intelligence in the medical field has been used extensively for the benefit of citizens, from online appointment planning, online access to medical facilities, digital medical records recordings, reminders including follow-up appointments, and immunization dates for women and pregnant women on drug scale algorithms and drugs and also opposing effect warnings while prescribing a combination of many drugs. Because the technology is developing similarly the treatment of assorted disease also getting simpler with the assistance of algorithms employed in AI [14]. Nowadays, devices have developed in such a way that heath function is inbuilt such as smartwatches which calculate the heart rate of the person or blood pressure and much more. These smart watches are AI-based, it collects data of from the watch and stored in a mobile application installed from there the person can check his previous status report and work accordingly to improve his health.

Nanomedicine has been a controversial topic these days, in the medical research field, used in many fields including drug delivery, vaccine development, antibacterials, diagnostics and imaging tools, high-performance testing platforms etc. biometric, or hybrid objects [15]. To provide more enhancement in the field of nanomedicine, artificial intelligence is also linked with the same. Not only AI but also related technologies used to select the right combination of nanomedicine and to maintain the appropriate level of medication in the blood or target area to improve the efficacy of treatment [16]. However, it is also believed that Nanomedicine-enabled AI will lower the translation bench to the bedside level [17]. Combining both AI and Nanomedicine fields can enhance not only research but also study in each discipline that might lead to all sorts of new tools for gaining insight and communication technology [18].

Existing Indian Framework

Besides the benefits of nanomedicine there is a need for laws or guidelines to regulate nanomedicine, the Indian Government framed certain laws that indirectly deal with nanomedicine, there is no specific regulation in place related to nanomedicine. The DST (Department of Science and Technology), created a functioning group for the regulation of nanotechnology, settled a program called the Nano-mission, developed the National Regulatory Authority Framework Roadmap for Nanotechnology. The Nano-mission is uniquely responsible for the development of draft guidelines and best practices for the safe management of nanomaterials [17] [18]. The CSIR promoted the Nano-SHE project, which is "Nanomaterials: Application and Impact on Safety, Health and Environment" – toxicological evaluation of nanomaterials [19]. In 2006, the Department of Medicine commissioned the development of nanomedicine vaccines at the NIPER Mohali, which later in 2012, handed over to NIPER Kolkata. A national center for pharmaceutical nanotechnology is proposed by the DOP to be established in NIPER Kolkata which will deal with nano-toxicology testing and drug and devices [20].

Researchers have explored, since 2009, the challenges that Indian policymakers and regulators need to address to effectively regulate nanomedicine. *For example,* patents for nanotechnology have been extensively tested, and Sharma and Chugh[21]. have explored the challenges associated with patenting nanoparticles in therapeutic and therapeutic applications. Several researchers in India have pointed out the issue of nanotechnology risk management concerning human health in terms of labor, environmental, and toxicity safety. The appropriateness of the analysis of the various actions, policies, and guidelines of nanomedicine is listed in Table 1. All medications, delivery systems, diagnoses, and medical devices inclusive of traditional medicine are regulated in India under the 1940 Drugs and Cosmetics Act. However, nanomedicine is not explicitly defined, it works based on its drug definition which includes drugs and devices - intended for the diagnosis, prevention, and treatment of diseases. The Drug Price Control Order 2013 and the Essential Commodities Act 1955 assured public access to drugs. The proposed Consumer Protection Bill 2015 which seeks to replace the Consumer Protection Act 1986 places a responsibility on the product to ensure the consumer is safe [22].

Legal Issues Involved in Nanomedicine

The major issue in nanomedicine which India is facing is no specific laws for regulating nanomedicine. A nanotechnology control framework that can serve as a potential template for nanomedicine management. Linked

directly to human health, nanomedicine creates unique challenges and calls for the formation of a specific management framework. Also, the current law of drugs and medical devices does not specify nanomedicine and is not sufficient to deal with complex problems with nanomedicine. Additionally, integrated products such as nano-device and drugs are not enclosed by a single law, and difficulties with the combination of biological and electronic products have not been discussed. *Let's say*, in Europe and the USA, nanomedicine is treated as a drug or a tool or like both, leading to the use of medical devices and drug regime regimes. This adds to the uncertainty in the regulatory approach affecting the research and development and profitability of nanomedicine [23] [24].

Another issue is the lack of debate about ethical, and public health and safety, concerns about new technologies may be the high position that science and its employees enjoy in the world. Not surprisingly, products such as silver-nano washing machines or insecticides containing nanoparticles are still being marketed within the Indian market without the opportunity analysis related to their use. This is without being a govt. has admitted that nanoparticles of the same size as human cells are inserted into the lungs and "can cause damage by direct operation of the corpse by passing through other organs or by absorbing blood."[25].

CONCLUSION

Nanomedicine is a combination of nanotechnology and medicine, diagnostic and therapeutic drugs, and the field of technology that combines fields that attract global attention because of its tangible benefits such as efficiency and effectiveness. It provides numerous benefits to the citizens and combining with AI i.e. Artificial Intelligence has boosted the research and the usage of the same. India ranks in 3rd position in the Nanomedicine market. However, with the advantages, there are some issues involved in Nanomedicine, in regard to its regulatory framework. Existing Indian laws and legislative enactments are not sufficient to provide the proper regulatory framework. There is no specific guidelines describing or dealing with Nanomedicine. India needs a proper law to regulate to overcome the legal challenges and also ethical issues involved therein.

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Table 1: Analysis of different statutes and guidelines

ACT	SCOPE	SHORTCOMINGS
Drugs and Cosmetics Act, 1940	Importing, producing, selling, distributing drugs	Description of nanomedicine is not included Only in vitro diagnostics are controlled Note of active ingredients only; in the case of encapsulated drug, the drug is the main ingredient, not the nanomaterial General drug marketing requires authorization based on equity studies without regard to safety studies Excludes compound product Nutraceuticals and cosmaceuticals are not currently regulated under the Act This Act provides for post-marketing action but has no effect
Drug and Cosmetics Bill, 2013	It extends to RNA, genetically modified	Does not cover combination product Does not define nanomedicine

|		
	organisms, vaccines, stem cells, genetic therapeutic products. Proposes to specify medical devices	
Drug Price Control order, 1995	Controls pricing of drug	Describes "active pharmaceutical ingredients or bulk drug" as any chemical, biological, herbal, or herbal medicine including salts, esters, analogs, isomers, and derivatives, corresponding to the standards set in Drugs and Cosmetics Act, 1940 According to this definition, most nanomedicine can be replaced
Guidelines on Similar Biologics, 2012	Similar biologics	Nanomedicine is not described in the guidelines The guidelines have a back-to-back marketing action, but are limited to responding to biologics or allergies; however, there are no provisions for their demolition or environmental impact assessment
Bio-Medical Waste (Management and Handling) Rules, 1998	Management and handling of bio-medical waste	The rules did not extend to institutions
Draft Bio-Medical Waste (Management and Handling) Rules, 2016	Management and handling of bio-medical waste	"Occupiermeans the person in charge of the management of the facility and the facility of medical waste, including the hospital, nursing home, clinic, veterinary center, veterinary facility, veterinary laboratory, blood bank, health care facility and clinic establishment, regardless of their medical system whatever name they are called Due to this definition, the rules do not apply to institutions
Draft Guidelines and Best Practices for Safe Handling of Nanomaterials in Research Laboratories and Industries, 2016	Safe management of nanomaterials	Guidelines state that hazardous nanomaterial waste containers will be collected and disposed of as hazardous waste following standard procedures However, it is not yet known what is the best way to dispose of nanomaterial waste No precautionary or enforceable measures are provided to ensure compliance with these guidelines
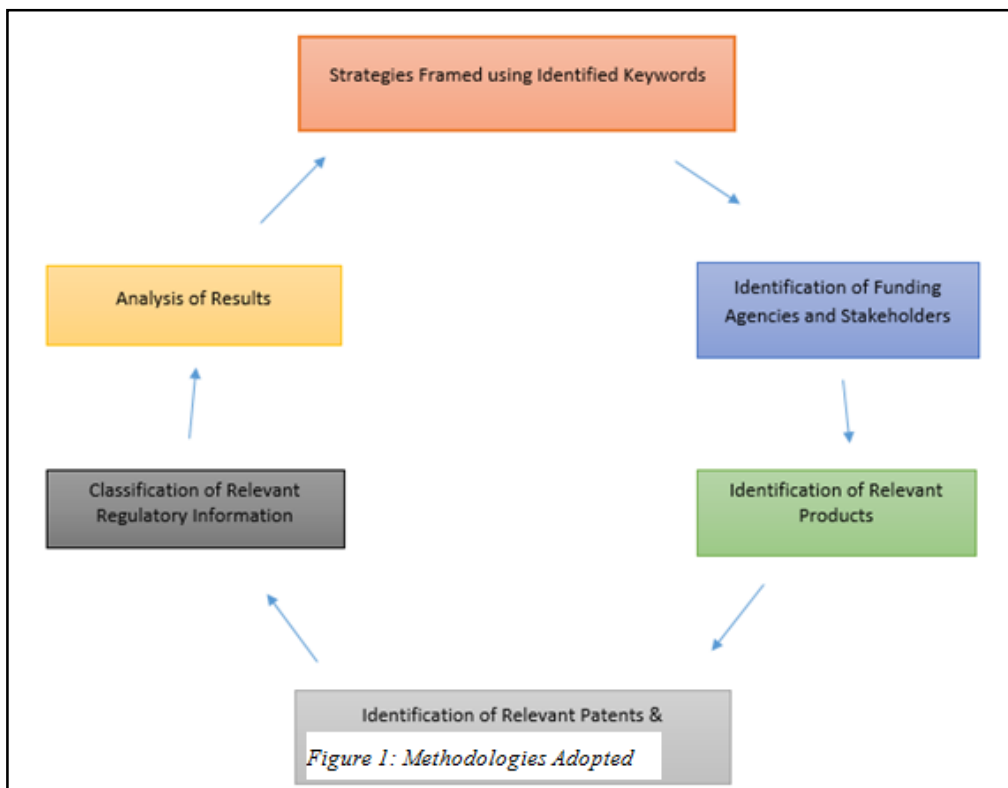
Figure 1 : Methodologies Adopted

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Challenges in Named Data Networking

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ABSTRACT

NDN is developed to overcome the limitation of TCP/IP based network. This article presents a comparison between NDN and TCP/IP based on parameters like transmission delay, DNS overhead, mobility, etc. The comparison shows that NDN is more efficient than TCP/IP. However, there are few challenges which NDN is facing, such as security, naming convention, etc. This article compares TCP/IP based network with NDN based network. Then we have discussed the challenges related to NDN.

Keywords: named data networking, TCP/IP, NDN.

INTRODUCTION

When the TCP/IP was developed (in the 1970s), at that time, the main problem was communication among hosts. According to the Cisco Visual Networking Index (VNI) Complete Forecast Update (2017-2022) [1], by 2022, global IP traffic will reach an annual run rate of 4.8 zettabytes per year. Now the use case of the Internet has changed from communication to content sharing. Thus, the TCP/IP, which was initially developed for communication, has to bear the burden of this great demand of the content. In TCP/IP, the communication hosts have to establish a connection first, and then the data is transferred. Thus, the IP address of the host having the content should be known before establishing the connection. Many solutions such as P2P, CDN, etc., as an overlay have been tried to make TCP/IP able to bear this burden. But these solutions are not optimal as the content has to face delay due to the underlying network. Many TCP/IP issues are yet to be resolved, like DNS overhead, mobility, delay due to the underlay network, and security.

New types of networks have been developed to overcome these issues; these networks are called Information-Centric Networks [2]. In ICN, each content has a unique name used for routing, forwarding, publishing, and fetching the content. Some of the most promising ICNs are Data-oriented Network Architecture (DONA) [3], COntent

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Mediator architecture for content-aware nETworks (COMET) [4], Content-Centric Networking (CCN) [5], and Named Data Networking (NDN) [6].

NDN is the most promising candidate for future Internet architecture among all the ICNs. NDN is one of the four projects funded by the U.S. National Science Foundation under its Future Internet Architecture (FIA) Program. NDN solves these problems by giving a unique name to each content and fetching content using this name. The content is secured as each content is signed by a publisher; a consumer can verify the content using the publisher's public key. Thus, NDN network is more robust then the TCP/IP based network. Currently, NDN is deployed on tested across various countries. The NDN router can be emulated by installing Network Forwarding Daemon (NFD) on the system. There are many NDN applications which runs over the NFD. These applications are NDN ping, NDN browser, NDN multi-chat server, etc.

This article discusses the comparison of the TCP/IP and NDN based network. Then, we have discussed the challenges faced by the NDN. The rest of the article is organized as follows. Section 2 presents the NDN architecture. Section 3 describes the comparison between NDN and TCP/IP. Section 4 shows the challenges which NDN is facing. Finally, Section 5 concludes the article.

NDN ARCHITECTURE

Ndn Names
NDN names are constructed by combining name components, which are separated by "/" as a delimiter. An example of NDN name can be "/AjjTak/MorningNews.mp4/89". NDN names depend on the applications involved in the conversation.

Ndn Packets
NDN uses two different types of packets for request and response. The interest packet is used for requesting the content. The data packet has the user's actual data; this data packet acts as a response to the interest packet.

Ndn Data Structures
NDN data structures are shown in Figure 1.There are 3 different types of data structures involved in the NDN forwarding pipeline. These data structures are– Content Store (CS), Pending Interest Table (PIT), and Forwarding Information Base (FIB). CS act as a cache that stores the data packets according to a cache replacement policy like First In First Out or Least Recently Used (LRU). PIT stores metadata (name and incoming interface id) of the NDN router's pending requests. FIB has entries having named-prefix and the interface from which the matching content should be forwarded. It is similar to a forwarding table in TCP/IP. Recently Used (LRU), etc. FIB is used to decide the interface through which the interest packet should be forwarded.

Ndn Forwarding
NDN forwarding pipeline is shown in Figure 2. On receiving an interest packet, the router first looks into the CS of the NDN. If the matching data packet is found, then it is returned to the requester else; a lookup is performed in the PIT. If a matching PIT entry is found, then the incoming interface is appended to that entry. Else, a PIT entry is created for the request, and the interest packet is forwarded from an interface given by the matching FIB entry On receiving a data packet, the routers look into PIT for the matching entry. If the entry is found, then the data packet is forwarded by all the interfaces present in the matching PIT entry, and the router caches the data packet. Else, the data packet is dropped.

NDN VS TCP/IP
This section compares the TCP/IP with NDN based on transmission delay, mobility, security, DNS overhead, and address space.

Transmission Delay
In the traditional network, each request of the host is filled by the Client-Server model's servers. P2P networks maintain data structures called DHT (Chord, Pastry, Kadmila, etc.) for mapping content to different hosts in a P2P

network. However, these P2P networks are not so efficient as packets have to face the delay due to the underlying network. There are few other solutions like CDN, which reduces transmission delay significantly; however, maintaining a CDN server for each application is costly. Currently, CDNs are used by big companies like youtube, Netflix, etc. NDN supports in-network caching using CS. CS caches recently requested contents. When the router receives a request for content, then the router first looks into the CS. If the content exists, then it is replied back. Thus, popular content is cached locally so that it can satisfy the consumer's request.

Mobility
TCP/IP cannot handle the mobility of the hosts. Mobile IP is an extension of TCP/IP to support mobile hosts. Communication in NDN involves producers, consumers, and routers. Routers are generally static, but the producers and consumers can move. In NDN, if the consumer moves, there is no problem as the communication does not depend on the consumer's ID (in TCP/IP, it is IP address). Also, the producer's mobility problem can be solved by moving the data produced by the producer to an easily accessible location.

Security
Basic TCP/IP does not have any in-built security features. In TCP/IP, the channel is communication secured by protocols such as TLS. NDN is focused on securing data itself rather than the communication channel. In NDN, the producer signed each data, which can be verified by the consumer by obtaining the producer's public key.

DNS Overhead
In TCP/IP, the DNS is necessary as it maps URL to IP address. In NDN, there is no need for any DNS as the communication is done using the content's name.

Address Space
The address space for a IPv4 address is $2^{32}(4,294,967,296)$ addressesand for IPv6 address is 2^{128} which is very large. Mostly IPv4 is used as a network layer protocol in TCP/IP due to challenges related to the deployment of IPv6. Network Address Translation (NAT) is used inside the local network so that the scarcity of the IPv4 addresses can be removed. However, the NAT based solution is not good as it restrict certain applications. NDN does not have any address of host. However, in NDN the publisher listens to a named prefix. This named prefix is used by the customer to demand the content. This name can contain letters, digits, and even special characters thus NDN has nearly infinite name space.

Challenges In NDN
Security Attacks
NDN is secure as the producer signs the data packet. However, NDN is prone to a few new attacks which are specific to NDN. These attacks are Intrest Flooding Attack (IFA), Cache Privacy Attack (CPA), Cache Pollution Attack, and Content Poisoning Attack. IFA occurs when the attacker floods the PIT with malicious entries by requesting interest packets for which no data packet exists; these entries remain in PIT till timeout. In CPA, the attacker tries to find out the already cached privacy-sensitive content in the NDN router by observing the delay in the retrieval of the data packet. As these contents are privacy-sensitive so it may expose user privacy that may be used by the attacker to harm the user. In the cache pollution attack, the attacker requests a large number of unpopular contents to decrease the NDN router's hit ratio; this attack degrades NDN performance. In the content poisoning attack, the attacker (which can be a malicious consumer, router, or producer) tries to inject poisoned data packets into the CS. A poisoned data packet is a data packet whose signature is either invalid or valid signature generated using a wrong key.

Naming Convention
NDN has a well-defined name structure in which each name consists of "/" separated name components. However, the name's semantics totally depends on the application involved in the conversation as there is a wide variety of

web applications. So it is a challenge to design standards which can be followed by most of the application for fetching and generating the content.

Information Discovery

A consumer can generate interest packets that may match the corresponding data packet or may not. It is necessary to find out the need of the customer using the interest packet sent by the customer. Thus, mapping the interest packet to the correct data packet is a challenge in NDN.

Name Confidentiality

Content can be easily made confidential by encrypting it. Authorized users can only decrypt this encrypted packet. However, the names of the content are visible. Thus, there is a need for a mechanism to prevent unauthorized users from seeing the interest packets' name, enabling them to understand the request type and pattern.

CONCLUSION

As time goes on the burden of content on the network increase. This burden needs solid foundation of ICN. NDN which is one of the most promising candidates for future network; can solve the problems faced by TCP/IP. This article discusses NDN, its comparison with TCP/IP, and challenges which NDN is facing. Finally this paper conclude a comparison between NDN and TCP/IP based on parameters like transmission delay, DNS overhead, mobility, etc.

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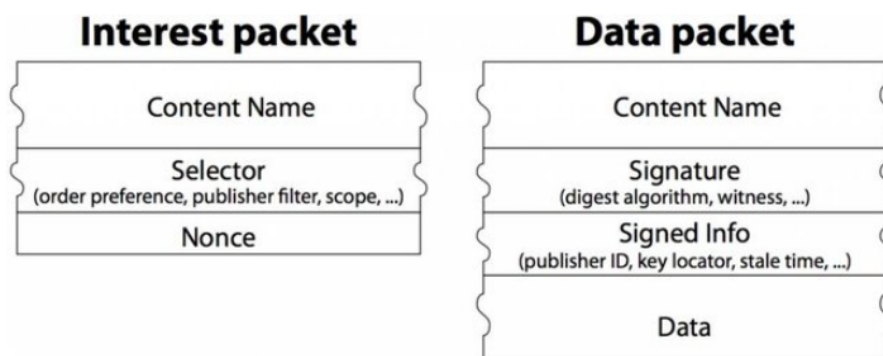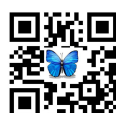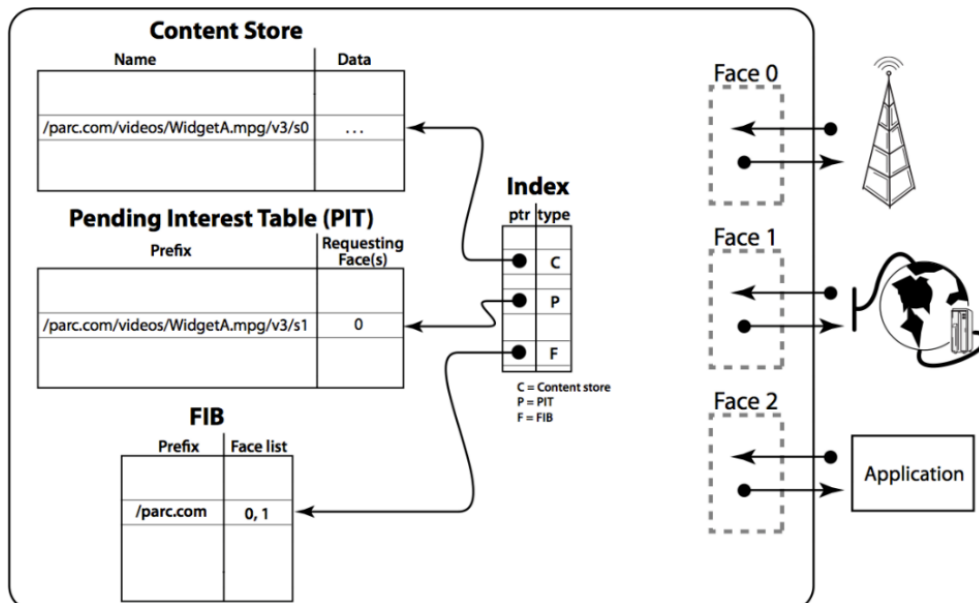
Figure 1: Packet Format in NDN
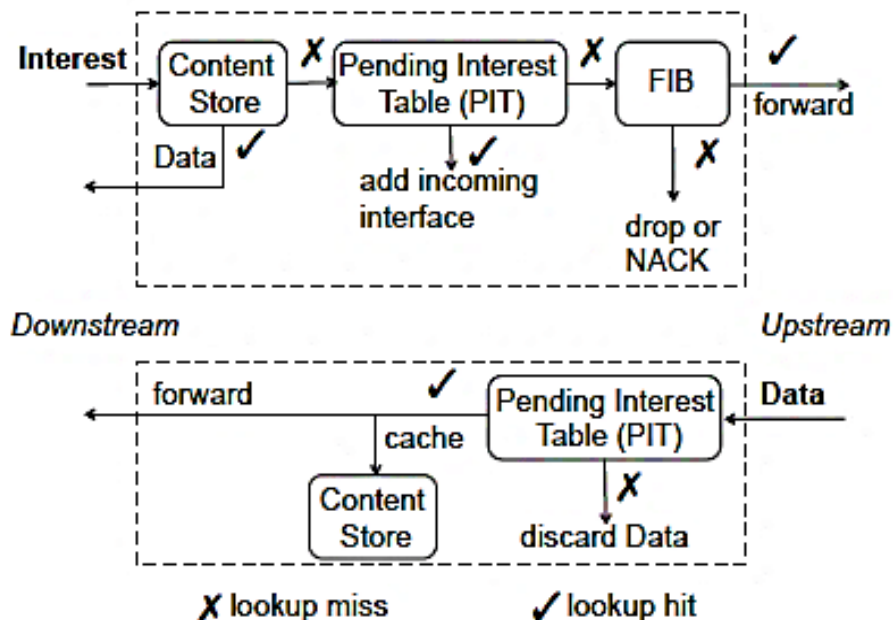
Biru Rajak

Figure 2: NDN Data Structures

Figure 3: NDN Forwarding Pipeline

REVIEW ARTICLE

Herbal Alternatives to Endodontic Therapy: A Review

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ABSTRACT

The sole purpose of any branch of medicine is to strive to make human life happier and healthier with the available resources. India being rich in flora and fauna has boosted herbal industry in all streams of medicines and is recently taken a boon in many dental procedures serving as an effective source of treatment for various diseases. The purpose of this article is to review the herbs which can be an effective alternative in endodontic therapy and encourage employing wherever possible to ensure a curative treatment in herbal way knowing the potential toxicity of synthetics [1]..

Keywords: Medicinal plants, Herbal extract, endodontic treatment

INTRODUCTION

The main rationale of the root canal treatment is to remove the diseased tissue, eliminate pathogens from the radicular part(root canal)of tooth and prevent its recontamination; A very large variety of synthetic antimicrobial agent have been introduced in market and have been used over the long years as root canal irrigants, intracanal medicaments, and root canal sealer, Due to controversies around antimicrobial effects and their cytotoxicity the usages of herbal alternatives in dentistry has gained popularity in recent decades. Recent literatures have quoted their potential antimicrobial activity, biocompatibility, anti inflamatory and antioxidant properties. They are safe, affordable, less toxic, and most important show less chances to developing microbial resistance which makes their use more recommendable.

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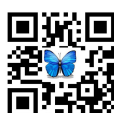
Herbs As Irrigants: The root canal irrigants should be nontoxic and possess a broad antimicrobial spectrum against microbial pathogens. They have capability to dissolve necrotic tissue present in canal and inactivate endotoxins. They prevent the formation of smear layer or dissolve it once it is formed and should not cause any anaphylatic reaction.

***Curcuma longa* (Turmeric):** Curcumin, a member of a ginger family possesses anti inflammatory2, anti oxidant3, anti microbial4and anticancer activity5. A study has shown turmeric having antimicrobial efficacy against *E. Faecalis* and thus can be used advocated as herbal alternative for sodium hypochlorite for root canal irrigantation. This herb can also be used in re treatment cases of root canal.6

Propolis: It is a resinous substance from honey bees and is collected from the trees of poplars and canifers7.It shows good antimicrobial activity against *S.sobrinus* and S. *Mutans* , and owing to properties of antioxidant9 and anti inflammatory activites11 it is a cariostatic agent12 and used in mouth rinses12 and in the management of periodontal therapy13 . Ethanolic extract of propolis can promote bone regeneration and induce formation of hard tissue bridge in pulpotomies or pulp capping. In the comparative study to show antibacterial efficacy of propolis, sodium hypochlorite and saline as root canal irrigants when compared and it was shown that propolis shows equals antimicrobial activity to sodium hypochlorite.(14).

***Acacia nilotica* (Babool):** Acacia nilotica also popular known as "gum Arabic tree, and Babool" shows good anti microbial[15]. anti oxidant[15]. anti fungal [16]. anti viral [17]. and antibiotic activity [18, 19,20,21.].

***Azadirachta indica* (Neem):** Neem possess good anti viral [22]. anti fungal [23]., anti bacterial [23]. and anti carcinogenic activity [24]. properties thereby making it as a good endodontics irrigants. Extract from Neem leaf is used to treat dental plaque and inflamed gingiva. The use of neem is advantageous as it is not likely to cause the severe harms to patients that might occur through sodium hypochlorite accidents. The study conducted by Naiyak Arathi *et al* shows that ethanolic extract of neem had significant anti bacterial efficacy against *E.faecalis.* [25]. A study compared the effects of herbal extracts such as *Morinda citrifolia, Aadirachta indica* and green tea where most to least effective irrigants were: *Azadirchta indica*, sodium hypochlorite, green tea, *Morinda citrifolia* and saline. Thus, proving it as an effective herbal alternative to the more commonly used root canal irrigant sodium hypochlorite. [27].

***Aloe barbadensis* miller(Aloe Vera):** Aloe vera shows good antimicrobial and anti fungal activity. In a study when anti microbial effect of water, alcohol, chloroform extracts of aloe vera gel were investigated chloroform extract of aloe vera showed good anti bacterial efficacy against *E.faecalis.* (28) It also has been found to be effective against the resistant micro pathogens commonly found in the root pulp.

***Morinda citrifolia* (noni):** Also known as" Indian mulberry" has a wide range of uses due to its biocompatibility, anti microbial, anti inflammatory, anti viral, anti oxidant and analgesic properties. *Morinda citrifolia* one of the first herbal alternatives given for a root canal irrigant. In a study when *Morinda citrifolia* was compared with Chlorhexidine as anti microbial endodontic irrigants it revealed to have good anti bacterial activity which is attributed due to its contents alizarin, scopoletin, aucubin and asperuloside. [29].

Triphala(Green tea polyphenols): Triphala's fruit is rich in citric acid which helps in removing the smear layer. The chelating property makes it an effective alternative to sodium hypochlorite for root canal irrigation. (29) They have significant anti-oxidant, anti-cariogenic, anti-inflammatory, thermogenic, probiotic and anti-microbial properties. [30]. Use of Triphala has been preferred over the traditional root canals irrigants due to their curative properties such as anti oxidant, anti inflammatory and radical scavenging activities. [31].

***German chamomile* (tea tree oil**): German chamomile possess good anti inflammatory, analgesic and anti bacterial properties. It is also reported as an antiseptic, anti fungal agent, anti bacterial agent and a mild solvent. The active component in tea tree oil is terpinen-4-ol which is responsible for the above properties. [32, 33].

Salvadora Persica Solution (Miswak-siwak): In a study conducted Salvadora Persica extract had shown a good anti bacterial effect against both aerobic and anaerobic bacteria with its efficacy being maximum at 15% when compared with 5.25%Sodium hypochlorite,0.2% Chlorhexidine and normal saline. [34].

***Myristica fragrans* and *Terminalia chebula*(Nutmeg):** *Myristica fragrans* have good anti microbial property which is mainly attributed to to its chief component myristic acid. Tannin is responsible for the anti microbial action of *Terminalia chebula.* [35].

Herbs as Chelating Agent: -Chelating agents are claimed to remove the inorganic component of the smear layer from root canal dentin, being commonly used for final irrigation during endodontic treatment

Triphala(Green tea): The chelating action is due to the presence of citric acid in its fruits. The presence of tannins, quinones, flavonoids, gallic acid, and Vitamin C makes it an ideal agent to remove the smear layer. 35,36Green tea in low concentration has been tested to be able to create an inhibition zone around *E. faecalis* slightly lesser than NaOCl 1%. The antimicrobial effect increases in higher concentrations of extracts of green tea [37].

Lemon Solution: Lime is rich in citric acid which is effective in clearing the smear layer, thereby acting as a chelating agent.38

Herbs as Intracanal Medicament

Propolis: Poplars, conifers, and Generic clusia flowers are its prime sources;(39,40)Study has reported the efficacy of propolis as an intracanal medicament in the root canals, suggesting it as an alternative intracanal medicament. [41].

***Azadirachta indica*(neem)**: Popularly known as Margosa .Literature proves that Candida albicans is one of the most common fungus seen in the root canals42. According to a comparative study conducted, NaOCl and propolis groups exhibited highest antimicrobial efficacy against *C. albicans.* It was followed by the *Azadirachta indica* (neem) group[43,44]. Thus can be used as an intracanal medicaments

Carvacrol: It is rich in antimicrobial property that is emitted by bacteria cell membrane and its disruption. The prime use of carvacrol is inhibiting Escherichia coli and Pseudomonas aeruginosa, repair of periapical tissue, and stimulating pulpal fibers, thus making it ideal for endodontic usage.[45].

***Arctium lappa*(burdock):**It can be used for intracanal dressing due to the presence of ethyl acetate. In endodontics, it is primarily used to treat root canal infections as it prevents the formation of biofilms and is effective against harmful pathogens [46].

Lemon Solution: It has shown antibacterial properties making it an ideal root canal medicament without any harmful effect [47].

***Casearia sylvestris*(wild sage)**: Being rich in phospholipase A2 inhibitors it has an ideal anti-inflammatory property to use as root canal intracanal medicament [48]

HERBS AS ROOT CANAL SEALER – Root canal sealer should be radio opaque, not stain the tooth structure, dimensionally stable, be easily mixed and introduced in to the canals, bacteriostatic and non irritating to

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periradicular tissues. Herbal plants such as [*Emblica officinalis* (Amla), *Myristica fragrans* (Nutmeg) and *Salvadora persica* (Miswak) *Glycyrrhiza glabra* (Licorice), *Mimusops elengi* (Bakul), and *Tinospora cordifolia* (Guduchi) are rich sources of bioactive compounds that possess antimicrobial properties. Mixing their extracts with traditional endodontic sealers can produce additive antimicrobial effects against microbes found in inflamed pulp [49,50,51,52,53].

Herbs For Re-treatment (G.P solvents): Solvents have been used in the past to soften and dissolve gutta-percha. In clinical practice, refined orange oil, tetrachloroethylene and xylene are used for softening the gutta-percha during nonsurgical endodontic retreatment [54,55].

CONCLUSION

The potential side effects of synthetics and keeping in mind the safety aspect using herbal approach as substitute in endodontic therapy may seem to be a more viable option. Moreover, they not only heal but bring us closer to nature. More tests and clinical research are needed to discover better treatments and usage of these herbs and to analyze their side effects if any. One major benefit of herbs is in the root canal disinfection. Intracanal medicaments are popularly used for disinfecting the canal. At present, the usage of natural extracts in dental products has gained popularity due to an inclination toward natural treatments.

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Table 1. depicting various herbal extracts with their potential usage in endodontic therapy

S.No	HERBALNAME/BOTANICAL NAME	USE IN ENDODONTIC PROCEDURES	EFFECTIVE AGAINST	REFRENCES
1	Turmeric (*curcuma longa*)	• Root canal irrigants, • root canal sealer	• *E.faecalis* • *Streptococcus mutans* • *Candida albicans* *E.faecalis biofilm*	Prasanna neelakantan,*et al* [6].
2	Propolis	• Root canal irrigants, • intracanal medicaments, • root canal sealer	• *E.faecalis biofilm* • *streptococcus mutans* • *Candida albicans* • *streptococcus sobrinus*	IkenoK,*et al* [7]. Ozan F,*et al* [12]. Tyagi *et al* 201355
3	Babool(*acacia nilotica*)	• Root canal irrigants,intra canal medicaments	• *E.faecalis* • *E.faecalis biofilm* – • *streptococcus mutans*	Rosina Khan,*et al*20 Dhanya Kumar *et al* [21].
4	Neem(*azadirachta indica*	• Root canal Irrigants • intra canalmedicaments	• *E.faecalis* • *E.faecalis biofilm* • *Candida albicans*	NaiyakArathi,*et al* [26].
5	Aloevera(*aloe barbadenis* miller)	• Root canal irrigants, • intracanal medicaments	*Streptococcus mutans* - • *E.faecalis* • *E.faecalis biofilm*	B. Sureshchandra,*et al* [28].
6	Noni(*morinda citrifolia*)	• Root canal irrigants, • Root canal sealer	• *E.faecalis biofilm* • *Streptococcus mutans* • *E.faecalis*	Prabhakar J,*et al*
7	Green tea(triphala)	• Root canal irrigants, • intra canal medicaments	• *treptococcussalivarius* -*Streptococcus sanguis* -*Lactobacillus vulgaris* • *E.faecalis*	Madhu Pujar,*et al* [31]. Prabhakar J,*et al* [29].
8	Tea tree oil(*German chamomile*)	• Root canal irrigants, • intra canal medicaments	• *Streptococcus mutans* • *-Candida albicans* • *E.faecalis biofilm*	K uday,*et al* [33].
9	Mishwak(*Salvadora persica* solution	• Root canal irrigants, • Root canal sealer,i • ntracanal medicaments	• *Candida albicans* • *E.faecalis* • *Streptococcus mutans*	Al- subawi,*et al* [34].
10	Nutmeg(*Myristica fragrans*)	• Root canal irrigants, • Root canal sealer	• *E.faecalis biofilm* • *Candida albicans*	Thilla S Vinothkumar,*et al* [35].
11	Amla(*Emblica officinalis*)	• Root canal sealer	• *E.faecalis biofilm* • *Streptococcus mutans* • *E.faecalis*	Devi MT, Saha,*et al* [49].

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12	Bakul (*Misuspos elengi)*	• Root canal sealer	• *Streptococcus mutans* • *E.faecalis*	SonaliSaha,*et al* [50].
13	Licorice(*Glycyrrhiza glabra)*	• Root canal sealer	• -*E.faecalis* - *Streptococcus mutans*	SonaliSaha,*et al* [50]. Sedighinia *et al* 2012[4]
14	Guduchi(*Tinospora cardifolia)*	• Root canal sealer	• *E.faecalis biofilm* • *Streptococcus mutans* • *E.faecalis*	SonaliSaha,*et al* [50].
15	Orange oil(citrus sinesis)	• Gutta percha solvent	• *E.faecalis biofilm*	Mushtaq M,*et al* [52]. Yadav HK,*et al* [51].
16	Burdock(*Arctium lappa)*	Inracanal medicaments	• *Streptococcus mutans* • *E. faecalis*	Gentil M,*et al* [46].
17	Wild sage(*Casearia slyvertris)*	• Intracanal medicaments	• *Streptococcus mutans* • *E facelis*	Silva FB,*et al* [47].

RESEARCH ARTICLE

Conducting Polymer as Active Layer for Sensors

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ABSTRACT

Conducting polymer have been extensively exploited in diverse Applications with immersive results polyaniline made attractive as sensing elements for gases and biological agents polyaniline allow room temperature sensing of large number of toxic gas and pollutants with high selectivity and sensitivity. Polyaniline has gained importance due to its environmental stability, good conductivity and gas sensing ability. Nanoparticles to deliver both hydrophic and hydrophobic drug molecules. In this synthesis of polyaniline matrix was fabricated by galvano-static electro deposition method. Structural and morphological characterizations were carried out using Scanning Electron Microscopy (SEM) and focus on advantage of nanoparticles.

Keywords: Conducting polymers Nanoparticles, Preparation, Advantage of nanoparticles,

INTRODUCTION

Nanotechnology defined as design characterization, production and applications of structures, devices and systems by controlling shape and size at nanometer scale. Where conventional techniques reach their limits, nanotechnology provides opportunities for the medical applications [1-2]. Nanotechnology is associated with nano-meter sized objects [3]. Living organisms are made up of cells. These cell parts, however, are nano sized [4]. Nanotechnology basically deals with design, production and characterization on nano sized particles [5]. Fine particles have the range of 100-2500nm and ultrafine particles have the size of 1- 100nm [6]. They can also be designed to improve the pharmacological and therapeutic effects of the drugs [7]. They also have a very high surface area and they permit many functional groups to be adhered to them which in turn, can bind to tumor cells [8]. Recent studies have developed a number of nano-sized particles such as metals, semiconductors and polymeric particles utilized in molecular imaging and particulate delivery vehicles [9-11,]. Polyethleneimine liposomes, silica nanoparticles, micelles and chitosans play an important role in drug delivery with minimized side effects [12, 13]. They have also been utilized as anticancer agents [14]. So, basically, nanotechnology deals with construction of artificial cells,

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enzymes and genes or repair in the synthesis of protein [15]. In this review, we discuss the preparation, charectrasation, advantages and limitations of nanoparticles.

P Eparation of Nanoparticles

There are many method for preparation of nanoparticles Solvent Evapouration method, Double Emulsification method Emulsification Diffusion method Nanoprecipitation

Advantages of Nanoparticles

A nanoparticle offers numerous advantages in drug delivery system. These advantage include, but are not limited: Nanoparticles have much significant advantage over conventional and traditional drug delivery system. As a targeted drug carrier nanoparticles reduce drug toxicity and enhance efficient drug distribution [16]. By using polymers drug release form nanoparticles can be modified which makes polymeric nanoparticle an ideal drug delivery system for cancer therapy, vaccines, contraceptives and antibiotics.[17] Useful to diagnose various diseases Enhanced stability of ingredients Prolonged shelf life Change the method of drug delivery to improve customer acceptance or reduce manufacturing costs [18] .

Characterization of Nanoparticles

The characterized of Nanoparticles using microscopic techniques as scanning electron microscopy (SEM), transmission electron microscopy (TEM) and atomic force microscopy (AFM).

Synthesis of Pani-Hcl Matrix

All the chemical used in the investigation were analytical reagent grade The electro polymerization of aniline was carried out by Galvanostatic technique. The Polyaniline Matrix was synthesized from an aqueous solution of distilled water containing 0.2 M aniline and 1 M of Hydrochloric acid (HCl).

RESULT AND DISCUSSION

Galvanostatic Studies of Pani-Hcl Matrix

The PANI-HCl Matrix was synthesized on ITO coated glass from 0.2 M concentration of aniline and 1.0 M of HCl at 1.0 pH and temp 27 °C. The behavior of the potentiometric synthesis formation of dimmers and oligomers. After this, potential remain constant suggesting that building up of the film proceeds according to the same reaction along the full thickness of the polymer as shown in Figure 1.

SEM Studies

The SEM micrograph for synthesized PANI film with optimized process parameters is shown in Fig 2. It is fibrillar like structure good porosity,

CONCLUSIONS

The PANI-HCl matrix have been successfully synthesized on ITO glass plate has uniform matrix and has conductivity that was confirmed by four probe technique the SEM showed porous and fibrillar structure which is suitable for immobilization of biocomponent and on optical fiber for chemical optical biosensors.

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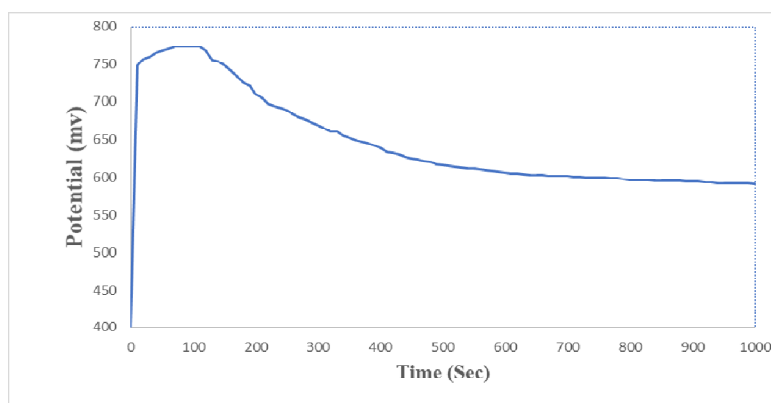
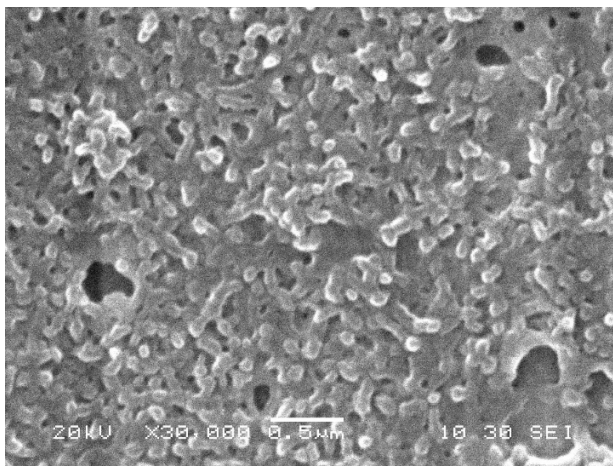**Figure 1. Potential-time curves obtained synthesis of polyaniline Matrix**

Gaikwad

Figure 2. SEM micrograph of PANI-HCl matrix synthesized at 1.0 pH, 0.2 M aniline, 1.0 M HCl T=27 ºC.

RESEARCH ARTICLE

Exploring the Interfaces between Artificial Intelligence and Intellectual Property Rights

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ABSTRACT

AI refers to the capacity of computers to perform cognitive functions, such as thought, perceiving, learning. The AI strategy is described as a collection of coordinated government policies with a clear objective of maximizing potential benefits and minimizing potential AI costs to the economy and society. Human progress has created unprecedented opportunities with an equal potential of being wisely or improperly exploited. As a general matter, Lethal Autonomous Weapons Systems (LAWS) are weapons with little or no human involvement that can pick, detect and engage targets. AI-enabled systems tend to operate in a manner that looks like simple computers and gadgets. As AI systems are increasingly involved in innovation processes, however, legal scrutiny is required to address these issues. We have already found that situations of artificial intelligence are rapidly emerging.

Keywords: learning, computers, artificial intelligence, targets.

INTRODUCTION

Artificial Intelligence (AI) is not a new phenomenon. Computer scientists such as Alan Turing, Marvin Minsky and John McCarthy have developed much of their theoretical and technological support over the past 70 years. In a variety of industries and governments, AI has already existed to some degree [1]. Today, thanks to practically unlimited computing capacity and declining data storage costs, we are on the verge of the exponential era of AI as companies learn to unlock the value hidden in vast quantities of data. The world view is divided into two following the development of a concept of artificial intelligence wherein one is convinced that AI can bring about a paradigm shift and an improved human quality of life, the other argues that AI can overcome any human mind in all fields,

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and that these machines are going to rewrite their own software and codes to reprogram themselves into the greatest entity [2]. AI refers to the capacity of computers to perform cognitive functions, such as thought, perceiving, learning. Originally conceived as a device capable of imitating human intelligence, AI has developed in ways well beyond its initial conception. With incredible advances in data collection, processing and computing power, smart systems can now be deployed to take on a variety of tasks, allow networking and increase productivity. As AI's capabilities have significantly increased, so have its use in an increasing range of fields. The truly revolutionary essence of technology, but the evolving stage of its global acceptance, gives India an opportunity to define its own brand of AI leadership [3].

Technology tends to develop at a rate superior to the law. As artificially intelligent technologies, particularly machine learning, continues to expand, the need for legal guidance on this topic has increased exponentially. The head-on collision between Intellectual Property (IP) rights and AI raises several concerns. The present study focuses on the concerns which arise because of the interface of AI with the IP laws and suggests some changes that will help in making the law accommodative of this emerging technology.

Global Expansion of AI

The AI strategy is described as a collection of coordinated government policies with a clear objective of maximizing potential benefits and minimizing potential AI costs to the economy and society. As this technology transforms more and more markets, the global demand for AI is expected to cross $37 billion in revenue by 2025 and contribute up to $16 trillion to the global economy by 2030. Throughout the world, governments are now changing gear, taking a more active role. Until recently, the prevailing government approach to AI policy issues has been focused on offering research funding opportunities. They are now setting regulatory limits and offering incentives to protect the socio-economic structure of their societies while also creating certainty for companies [4].

The efforts undertaken by the UN regarding the Artificial Intelligence, where United Nations Interregional Crime and Justice Research Institute (UNICRI) has launched the Artificial Intelligence and Robotics Program at the beginning of 2015 and UNICRI has signed an agreement to open the Center for Artificial Intelligence and Robotics in the Netherlands, with the help of the Hague Municipality and the Netherlands Ministry of Foreign Affairs. From a criminal and safety perspective, the Center commits itself to the threat and benefits of AI and robotics through awareness building, training, sharing of information and stakeholder harmonization. To this end, UNICRI has formed a broad international network of collaborating partners, including the International Criminal Police Organization (INTERPOL), the International Telecommunications Union (ITU), the Institute of Electrical and Electronics Engineers (IEEE), the Responsible Robotics Foundation, the World Economic Forum, the Centre for Future Intelligence (CFI) and many others [5].

The Permanent Mission of Georgia in cooperation with the United Nations Interregional Crime and Justice Research Institute (UNICRI) organized the side-event "Chemical, biological, radiological and nuclear (CBRN) National Action Plans: Rising to the Challenges of International Security and the Emergence of Artificial Intelligence," to include a briefing aimed at raising understanding of artificial intelligence and autonomous robotics' existing and possibly future capabilities. Potentially, this technology has far-reaching effects, changing the dynamic of defense and security governance. A crucial first step in ensuring responsible growth and minimizing possible future abuse is to foster a thorough understanding [6]. During the meeting, which was attended by 130 participants from more than 65 countries, Ms. Cindy Smith, Director of UNICRI, said:

Human progress has created unprecedented opportunities with an equal potential of being wisely or improperly exploited. We have a collective responsibility to prevent the deliberate misuse of new breakthroughs. These complex threats are not confinable to a single state: in this area no country, no region can advance and play safe in isolation. The threats we are addressing are globalized and involve unpredictable consequences, for this reason countries have paradoxically to look beyond their own borders to guarantee the security of their citizens. By developing a common

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security vision, sharing knowledge and expertise we can make the most of advances in technologies and reduce our vulnerabilities. Even in difficult times, we have to remind ourselves that only through dialogue, mutual trust and cooperation we can improve our world [7].

As a general matter, Lethal Autonomous Weapons Systems (LAWS) are weapons with little or no human involvement that can pick, detect and engage targets [8]. Although there is no uniquely agreed concept of Rules, the term usually encompasses a wide variety of possible arms systems, ranging from fully autonomous weapons that can initiate attacks without human intervention to semi-autonomous weapons that require affirmative human action to carry out a mission. LAWS critics concentrate mainly on fully autonomous weapons, dubbing and challenging the capacity of LAWS 'killer robots' to respect human life and comply with International Humanitarian Law (IHL). Others, including the U.S. government, anticipate the technology's possible benefits, claiming that the automated targeting characteristics of LAWS could potentially improve the capacity of states to meet IHL requirements through improved precision and performance.

In view of the priorities and objectives of the Convention on Certain Conventional Weapons (CCW), the first formal meeting of the Group of Governmental Experts (GGE) on emerging technologies in the field of lethal autonomous weapons systems was held in Geneva from 13 to 17 November 2017 [9]. With two sessions in April and in August, GGE stepped up its work in 2018. At a meeting held in Geneva from 9-13 April. In April 2018, the work on shared understandings and values that began in 2017 continued and resulted in a set of potential guiding principles at the end of that year's August session. The GGE report offers four policy choices, including a potential legally binding restriction that can be built using the guiding principles accepted and the building blocks. The GGE report offers four policy choices, including a potential legally binding restriction that can be built using the guiding principles accepted and the building blocks [10]. The AI for Good series is the leading forum for dialog on artificial intelligence by the United Nations [11]. The ITU organizes the annual "AI for Good Global Summit" for International dialogue, as the UN ICT specialized organization, with the goal of developing a mutual understanding of emerging AI technologies' capabilities.

Patent on AI Inventions

In today's technological world, the relationship between patent laws and AI is expanding. In order to simplify basic functionality and, above all, reduce human effort, AI has been widely used. AI-enabled systems tend to operate in a manner that looks like simple computers and gadgets. It works much more complexly, however. Today, based on their own main lessons, AI-enabled systems are ready to perform tasks, creating the capacity to invent anything for them. Whilst this is an important technological development, from a legal point of view it raises new issues. This section of the present paper first explores the idea of patents, develops its interplay with AI systems, and finally discusses the dilemmas generated by this interaction. The exclusive right to an invention may be considered as a patent [12].

Any product or process that provides users with a new way of carrying out a certain task, including that which offers a new solution to an established technical problem, has been considered to cover the 'invention'. By law, the holder of such a right is entitled, for a limited period of time, to forbid anyone from making, selling or even using the patented invention. Therefore, for the benefit of the original inventor, the right granted in such an instance may be said to legitimize the existence of a monopoly [13]. An 'inventor' is defined as *a person or a group of people who have invented or discovered the subject-matter of the invention* under U.S. Patent Law [14]. It removes any assumption that supports the notion that inventions or, rather, the likelihood of innovations being produced by something other than humans have tried to be included in the legislative objective in the United States [15].

As AI systems are increasingly involved in innovation processes, however, legal scrutiny is required to address these issues. Such an insight is hardly seen in the efforts of the European Union to allow nations to extend national legislation generally for the copyrighted category of computers and other devices [16]. While this is a progressive

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step in the direction of recognizing the creativity displayed by these systems when producing poetry, artwork. Although the AI system undoubtedly has access to prior art, is it completely autonomous or capable of deciding whether or not its invention can account for something new because of its supervised human scientists who feed information? With regard to the issue of innovative phase, it is certainly more difficult for a professional person to figure out whether creativity is difficult to decide by means of the AI system that the possibilities for improvement on existing models or ideas are certainly more difficult to achieve.

In order to make decisions on new situations, technology needs, first of all, to equip these systems with knowledge comparable to human beings. It should also be remembered, when reading patent cases, that, simply because what they do is technological rather than creative, the Court opposes patents on programmes [17]. It is a significant factor, since AI runs mainly on computer-based systems, subject to changes made by its human inventor. In addition, the Court opposes program patents.

This dichotomy between man and robot inventors highlighting moreover the difficulty of patenting AI-invented programs. However, with countries such as India removing their strict computer requirement with novel hardware eligible for an AI-powered program's patent, they develop software that can be used on generic machines; this will mean practical usage, maybe in more than one area, allowing industry to comply with the requirement for patent industrial implementation. Typically speaking, current laws and regulations need to be streamlined so that technologies can be issued with AI patents. However, there is a need for a greater review of the issues, as many barriers and disputes exist with regard to patentability and other aspects.

Authorship and Ownership of AI Creations

The misunderstanding about the position of AI is not recent and goes back to 1974, in which, in one of its reports, the National Commission on New Technical Uses of Copyright Works (CONTU) argued that the development of an AI capable of producing independent work is theoretical and not realistic. In 1986, when it evaluated it again, the Office of Technology Assessment (OTA) revisited the subject. OTA disagreed with CONTU and demanded that AIs be declared valid copyrighted co-authors of works [18]. Thirty years later, the debate around the AIs center lies in the fact that, on the one hand, computers cannot be as creative as people, and the other disagrees on the basis of imagination concept.

Ada Lovelace [19] is one of the toughest critics who defended AIs. She finds that a machine lacks creativity because of its rule-bound behaviour. The argument behind her theory is that the creativity is the ability to do the unexpected, unlike machines and computers sometimes, that does not follow the usual routine. The same goes for authors who call their own writers' machines, since they process works that are already present and infer much of their work from existing ideas [20]. There are, for instance, many copyrights for films based on the idea of 'Romeo and Juliet.' In the music industry too, there are similar events. They depend on decisions such as Cummins v. Bond [21] challenging the Court with an author questioning if it was possible to document a work in the name of Jesus. The Tribunal ruled that, regardless of any subjective editorial decision being exercised during the trials, the non-human nature of the source of a work could not be an obstacle to copyright. This decision is being expanded to include AI science papers, which are also a non-human research project. This decision is endorsed by AIs. Even if nations agree to award copyrights to the works of an AI, the question of who gets the copyright remains obscure and difficult to understand. It is because, as a right holder, the present status of law requires a legal personality, something that an AI lacks, unless it is granted in its name to the creator [22].

There is, however, a loophole in that, which is as to what happens if the AI program is a transaction, whether the copyright is given to the creator or the purchaser. In countries such as England and New Zealand, where the copyright is given to the programmer in AI-authored works, the response is in favour of the writer, through legal fiction. It still doesn't, however, answer the above question. The essence of the criminal responsibility of AIs is another concern with the new scheme. When AI was founded, nobody expected the wonders it had achieved, and it

would not be shocking to think that this would continue to increase so that AIs would become an autonomous entity in the future. A specific issue would then arise as to the potential criminal obligation of the AI. If the current position continues, the creator would be responsible for such an act, notwithstanding the absence of *mens rea* or *actus reus.* Accordingly, according to the IP Law, there are some gaps in the current status of AIs [23].

Integration of Artificial Intelligence and Intellectual Property Rights
We have already found that situations of artificial intelligence are rapidly emerging. There may be a few chances for certain people to face the infringement test for the artificial intelligence work or innovations created alone or in collaboration with others in the coming decades. Debates and discussions on this subject have already started as it is in the initial stage and the sector is evolving and we have not yet come up with the settled legislation. There may also be a conflict situation that could arise in the future if the works/inventions were produced by any AI robot as to how the adjudicator could distribute the amount of royalties between AI Robots, owners, donors, etc. If the machine does not take advantage of the financial fee, who will gain from the AI Robots consideration sum. Many unresolved problems are to be addressed and the judicial issues of this agenda solved only if we are able to smoothly and effectively merge AI and IPR. To resolve the curiosity of this century, all intellectuals and experts must come together [24].

The National Institute for Transforming India (NITI) Aayog, a political think tank organization in India, recently published a paper for discussion [25]. Many expect that AI will be able to develop, apply and grant patents within a few years, and that will be the real challenge. And a challenge to the very central principle of IPR. Several reviews and research studies have been published on the effect of the AI on the IPR system. The US Copyright Office, for instance, revised its definition of authorship following a Court case involving a self-taking monkey in 2016 to clarify that it does not accept computer-creation works or pure mechanical processes that function automatically or spontaneously. The copyright law only allows for the defense of "products of intellectual work" created within the creative forces of the mind [26]. According to the draft report of the European Parliament to the Commission on Civil Law Rules on Robotics, "AI [superior] human intellectual ability could be at risk for society." The draft report stresses the importance of "preserving the capacity of humanity to manage its own creations in order to avoid this risk" [27]. To date, several developments in digital technology have been made, and this has contributed to global debates on re-examining AI copyright specifications.

The San Francisco court ruling dismissing a copyright patent for a selfie taking macaque monkey also shows the stance against AI [28]. Different copyright authorities worldwide have already stated that they have not registered work created by computers. Confusion on similar lines can occur when AI-enabled machines build new technologies. Without any human interference, who would hold the patents on novel innovations filed by AI computers? Does the computer / robot possess future inventions? What entity will enforce certain rights if proprietary rights are distributed to multiple entities? And if an AI plagiarizes an innovation or reproduces an invention, how can the harm be calculated? There are some fundamental but confounding problems with patent laws now. Under US Patent Law, an 'inventor' is defined as an individual or a group of persons who invent or discover the invention's subject-matter [29]. This means that non-human inventions are not permitted to be patented. The role of AI in the latest technological technologies has led the world to focus on patent law. Such a perusal may be undiscerned in the EU's efforts to permit countries to expand their national legislation by taking into account computer-produced copyrightable works and other innovations, in the form of intellectual creation.

While this is a liberal step towards recognizing the ingenuity displayed by these systems when creating poetry, works of art, etc., due attention must also be paid to the inclusion of inventions and patent applications by AI systems and robotics. First of all, we need to recognize the underlying concepts of the patent system in the form of patent grants for computer and AI inventions. Patents are considered to be a mechanism that protects the inventor's rights so that he or she can reap financial benefits from them. It is a kind of encouragement provided to inventors by the state to create new and enhanced works. Others claimed that the inventions produced by the granting of patent

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rights to Artificial Intelligence would speed up advancement, thus allowing for advances that human imagination would not have been possible. Others have also argued that patent rights, regardless of whether people create inventions or AI, do not promote innovation. Further patents resulting from AI-generated innovations would, according to this view, increase social costs and monopolies and impede the entry of new companies, thus hindering innovation. There is a challenge to the current situation of AI under the IPR, whereby recognition of the work generated by AI is a step into the future, but its implementation is the real challenge.

AI Strategies and Policies in India
Artificial Intelligence is about to disrupt our world. Combined with innovations in data collection, analysis and computer processing, AI offers smart devices opportunities to supplement, improve and add to the intellect of human beings, to enrich people's way of living and functioning with high level cognitive processes such as thinking and comprehension. AI is a constellation of technologies that improve the intelligence of machines and mimic human senses, understands and behaves. In order to actively experience the world around them through computer vision and audio processing, you can obtain and process images, sound and voice. AI systems can analyze and understand the data gathered through the natural language processing and the deduction motors. An AI system can also take action in the real world through technologies like expert systems and inference engines. AI systems are finding ever-wider application to support these capabilities through organizations as they expand in complexity.

In his 2018-2019 budget address, the then hon'ble Finance Minister Mr. Arun Jaitley directed NITI Aayog to create the National AI Program in order to direct research and development in new and emerging technologies, recognizing the ability of AI to transform economies and the need for India to strategize its approach. In conjunction with the above, NITI Aayog has adopted a three-pronged approach including exploratory proof-of-concept AI projects in different areas, developing a national strategy for creating a vibrant AI ecosystem in India, and collaborating with various experts and stakeholders [30].

While evolving the national strategy for AI, the key thrust was to recognize applications with maximum social impact, to learn from the best in the world when it comes to recent technical developments in AI, and to leveraging methods that democratize access to and further growth of AI. From the application perspective, the approach is to recognize sectors that may have the potential to have the greatest externalities when implementing AI solutions and therefore enable the government to play a leading role in the development of the AI implementation roadmap. For example, the agriculture sector in India, which forms the base of India's economy, needs multi-layer technology infusion and coordination between a number of stakeholders. Private-sector initiatives can neither be financially optimal nor successful on a stand-alone basis, and thus sustained government action to resolve established problems and constraints is required. Thus, India's approach to implementing AI must be driven by the optimisation of social goods rather than by the maximization of top-level growth. From a technology viewpoint, the approach is to optimize the benefit of late-movers. Recognizing that India is a long way from consistently delivering home-grown pioneering AI technology solutions, adapting and innovating technology to India's specific needs and opportunities will help it leap forward while at the same time developing a fundamental R&D capability aimed at ensuring long-term competitiveness. Resolving India, given the complexity and multi-dimensional aspects of most of our economic and societal challenges, can easily be extended to the rest of the emerging and developing economies. An integral part of India's AI strategy involves addressing common and complex global problems that can be addressed by technology involvement, and India's size and opportunity environment provides the perfect test bed for sustainable and scalable solutions [31].

Summations
The emergence of the machine age was largely influenced by the industrial era of invention and technological progress. What is called 'Artificial Intelligence' has resulted in an effective integration of automation technology with basic human intelligence. Artificial Intelligence is used in almost every field of the world today, ranging from self-employed cars, healthcare, aviation, banking, entertainment, training, heavy industry and so on. Every day,

computers are conceived and incorporated with higher and higher learning and critical thought. AI is entitled to contest the key patent law requirements. The patenting of AI-made inventions would be used as a catalyst for new, superior technology, which could hardly be achieved only with human creativity [32].
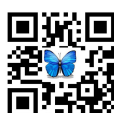
India is a new hub for artificious intelligence patent applications and a country that affects the peak of publications, including the processing of computer, artistic and linguistic languages. A recent WIPO report details the forms in which India has proven to be one of the top 10 countries to file AI patents. According to the report, India ranked 8th since 2015 when it came to AI's 'first-to-file' scurry, and says that in previous years, the country has seen an unsustainable boom in that regard [33].

As the dominant subset of AI, machine learning covers one-third of all recognised inventions (134,777 patent documents) in which desktop learning-related patents have risen by 28 percent annually, with 20,195 patent applications filed in 2016 (compared to 9,567 in 2013). IBM was one of India's key contributors and a top contender in the global listing of AI patents, with a impressive tally of 5930 AI related patents. IBM inventors from India, according to current estimates, have filed over 800 patents, making the second largest contributor of the company's total patent in AI to cloud technology. A 4.5-fold inflation in filings in the domain of Natural Language Processing (NLP) was also seen in 2018 [34]. As progress on artificial intelligence has continued to spread, and as such methods have been widely used in consumer goods in recent years, it is no shock that the volume of patent submissions and the number of allowances has increased at a very fast rate.

Lastly, AI is bringing real value to businesses that need to address complicated problems. AI can empower IP professionals as part of IP management. Daily IP tasks can take time but AI technology allows professionals to focus their portfolio on more strategic decisions. It also increases accuracy while reducing the possibility of IP insight and intelligence as workers do. The real opportunity for IP professionals however lies in the fact that AI can supply in otherwise inaccessible and impenetrable data volumes [35]. AI can allow IP professionals to create business insights that can open up new opportunities, accurately value an IP portfolio and have a deeper sense of when and where the next wave of IP investment might come from.

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RESEARCH ARTICLE

Development and Organoleptic Evaluation of Gluten-Free Noodles after Reducing Their Anti-Nutrient Factors

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ABSTRACT

Mostly in recipes like noodles and pasta all-purpose flour- maida is used which is not healthy in the long run. Hence, the idea of the research was to develop a food product, which is a recipe liked by all but making it in a more-healthier way by replacing the unhealthy ingredients with the healthier ones so that the harmful effects on the health could be prevented. In this product, all-purpose flour was replaced by taro root flour, rice flour and amaranth flour to make noodles which could be enjoyed without worrying about its effects on health. The review of literature was obtained for this research by search of various databases so that verified and accurate results for the study could be found. The total of 156 studies were analyzed which were related to the main ingredients of the research. The databases African journals online, AGRIS, Europe PMC, Google scholar, Science direct, Semantic scholar, Springer Link and Elsevier were utilized for the systematic search of the literature.In the present study 4 samples of noodles were developed containing different proportions of taro, rice and amaranth flours.The raw ingredients were processed so that the antinutrients in the ingredients used are removed effectively and a nutrient dense good quality product could be developed.Flour proportion of the respective samples were taken and were kneaded with water until firm yet soft dough was obtained. Then the noodles were prepared passing through extruder. The noodles were tested for cooking quality. Results of sensory evaluation showed that Sample A which contained 40% taro flour, 40% rice flour and 20% amaranth flour was the most acceptable among all the other samples in terms of all sensory attributes and was scored the highest in sensory evaluation test. Sample A got in a total of 558 marks out of 700. Out of which it received 78 marks in colour, 77 in aroma, 82 in texture, 84 in taste, 78 in chewiness, 77 in consistency and 82 in overall acceptability, each out of 100. The results after analyzing all the researches and the results of sensory

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evaluation proved that a good quality in terms of texture and other physical attributes, nutrient abundant noodles could be prepared by taro, rice and amaranth flours in 40:40:20% ratio.

Keywords: Taro, Amaranth, Rice Flour, Noodles

INTRODUCTION

Nutrition is the most important and most neglected part of our lives. Nowadays, people are so busy that they often neglect the most important aspect of life which is health. They tend to work very hard to lead an easy and effort-free life. The more technological facilities people have, the more they are closer to effort-free yet unhealthy life. Due to the prevalence of metabolic diseases, awareness is increasing regarding the importance of food and maintaining good health. So, the Food Industry is flooded with nutritious food products and snacks which are ready to eat and cook. So, keeping the nutritional quality intact, In the present study Noodles are being prepared by using three different flours and their anti-nutritional factors are being removed.

Taro Root - Taro root is a nutritious root vegetable which is rich in various minerals, anti-oxidant properties, anti-inflammatory properties but it is not very much liked by children as well as adults. Hence, noodle prepared from its flour can be enjoyed by children as well as adults. In this way, they could be benefitted by its nutrients and it can occupy its place in their plates. It is also a nutritious gluten less flour [1]. However, due to its anti nutritional factors such as oxalates and phytates, its nutrients cannot be completely utilized by the body and that is why it is not much used in various recipes. Hence, in this recipe the anti nutritional factors of taro root are removed by washing, soaking, blanching, boiling, drying so that the bioavailability of nutrients could be improved. Various researches have proved that these processing methods reduce a significant amount of anti nutrients from the product and makes it more nutritious [2].

Rice flour- Rice Flour provides a good consistency to the product and is also rich in nutrients which can impose good health benefits. Being rich in various minerals and vitamins and having good water holding and binding capacity it is a good option to be used in this product. It is also a gluten-free flour that contributes to being a more-healthier option [3,9].

Amaranth -Amaranth is rich in fiber and contains various nutrients such as protein, iron, manganese, magnesium, phosphorus etc. and helps in prevention of various diseases and lifestyle disorders such as obesity, diabetes mellitus, hypertension, hyper cholesteremia. It also has anti-inflammatory and anti-oxidant properties. Amaranth flour is also a gluten-free flour which can impact health in many positive ways as it has an abundance of nutrients. This flour is highly neglected and is not widely used by the people [4,7]. It can also be considered a super food. By incorporating it in this product it can be made easily available to people and it can reach their plates and be the part of their diet more quickly [20].

REVIEW OF LITERATURE

Table 1 to 4

MATERIALS AND METHODS

Ingredients for the Flour Preparation
Raw amaranth seeds, taro root, basmati rice, mixer grinder, sieve

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Ingredients Required For the Dough Preparation
Flour, oil, salt

Ingredients Required For Noodle Preparation
Extruder

Ingredients Required For Cooking the Noodles
Raw noodles, boiling pan, cooking pan, oil, salt

Steps for The Systematic Review
The three main ingredients of the study were taro, rice and amaranth. 156 studies related to the main ingredients were analysed for the study. All the studies related to the topic were analysed and were excluded and included in the study accordingly.

Inclusion Criteria
The field of the study was nutritional biochemistry, botany, food science, food processing, therapeutics, nutrition and dietetics. All the main ingredient-based studies related to the field of the study were included in the study. Those studies that were done within the period of 40 years that is from 1980 to 2020 were included for research. There were some studies whose full content was not available and only abstract was available, then in that situation, only those studies were included whose abstract provided the required information with a verified method, experiment and definite conclusion.

Exclusion Criteria
Studies older than 40 years that is before 1980 were rejected from the analysis. The main ingredient related studies but with different field background were rejected. Such as the studies including biotechnology, inorganic chemistry, economy, cultivation and gene therapy were rejected.

Conducting the Research
Review of the study literature was attained through systematic search which included researches and review papers published within 40 years that is from 1980 to 2020.

Databases
The databases African journals online, AGRIS, Europe PMC, Google scholar, Science direct, Semantic scholar, Springer Link and Elsevier were utilized for the systematic search of the literature. The search only included articles and researches published in the English language.

Data and Tools Management
The total of 156 studies were analysed which were related to the main ingredients of the research. out of those 81 studies were rejected based on the aim of the study which lacked relevance with the field of the research and did not meet the study requirement. 75 studies were selected for further analysis as the aim of the studies met the criteria of the study. Out of 75 selected studies 23 were further rejected because the full text of these studies was not available and the abstract available failed to provide the verified information and lacked proved definite results and conclusions. Hence, 52 studies were finally selected and further analysed and studied in detail for the literature review. Flowchart of study selection process is given in figure 1.

Method for Product Development
Method for the Flour Preparation

Taro Root Flour Preparation

Raw taro corms were properly washed, peeled and finely sliced. Then the slices were blanched thrice for 3 minutes in boiling water and then in cold water. For this, the slices were first immersed in hot water for three minutes and then in cold water for three minutes. Then the slices were sun-dried for 3 days and were turn every 6 hrs for proper drying. After the slices were properly dried, the dried taros were ground in a mixer grinder until a fine powder was obtained. The flour was sieved to obtain fine particle like consistency to develop good quality noodles.

Rice Flour Preparation

Rice was thoroughly washed to eliminate all kinds of impurities, dirt and dust. Then the washed rice was soaked in water for 3 hrs at room temperature. The soaked rice was then removed from the water it was soaked in and then were shadow dried until they were completely dried yet a little moist. Then the rice was ground in a grinder until a fine powder was obtained. Then the flour was sieved to obtain evenly distributed fine particle size flour.

Amaranth Flour Preparation

Amaranth seeds were washed and then soaked in water for 3 hrs. after soaking the seeds were shadow dried until they were completely dried. Afterwards, the dried seeds were roasted and then ground to obtain fine powder-like consistency. Then the powder was sieved to obtain evenly distributed fine particle size flour.

Method for the Dough Preparation

All the three flours were mixed in controlled proportions in 4 different bowls and 4 samples were made. In each sample, the quantity of rice flour was kept fixed because various studies have proved that rice flour contributes to good quality noodles and was considered the best flour for developing structurally and nutritionally healthy noodles. Each bowl was labelled with its sample no. The proportion of flours used in each sample is mentioned in table 5. Flour proportion of the respective samples were taken and were kneaded with water until firm yet soft dough was obtained. After the dough had formed, a little oil was rubbed on its surface and then kneaded so that the smoothness of dough could be achieved.

Method for Noodle Preparation

A small ball from the dough of sample A was taken and was rolled and passed through the extruder. The same procedure was repeated for all the samples.

Method for Cooking Noodles

Raw noodle threads from sample A were kept in boiling water for 2 minutes in a boiling pan. Then the boiled noodles were carefully taken out from the pan without breaking them and were kept in a bowl of cold water for 2 minutes. Then the threads were taken out from the cold water and were kept in a bowl and the bowl was labelled with the sample no. The same process was repeated for all the samples.

Sensory Evaluation

All the four samples labelled with their sample no. were kept at a serving area. All the panellists were requested to come one by one and taste all the samples and give their marks and ratings on the evaluation form by referring the 9-pointer hedonic scale mentioned in the form. After the evaluation was completed, all the ratings recorded in the forms were combined and evaluated to obtain the final result.

Sensory Evaluation Form

The sensory evaluation form was based on the 9-pointer hedonic scale. The evaluation was done based on colour, aroma, texture, taste, chewiness, consistency and overall acceptability of the product. At the top of the form, the space for mentioning the name of the panellist, date of the evaluation and the name of the product was provided. After which 9-pointer hedonic scale was given so that the panellist could refer it and give their ratings accordingly. The ratings in the hedonic scale were as followed: 9 for like extremely, 8 for like very much, 7 for like moderately, 6 for like slightly, 5 for neither like nor dislike, 4 for dislike slightly, 3 for dislike moderately, 2 for dislike very much, 1 for dislike extremely. After which the evaluation table was provided to give the ratings under the respective sample numbers based on sensory parameters. At the end of the form, the space was provided for the panellists to give their signatures.

RESULTS

Panellists reported that Sample A was just like noodles available in the market in terms of texture, taste, aroma and consistency while they found Sample D very soggy, unacceptable and had a bad aftertaste. They liked sample B very much after Sample A and liked Sample C moderately. They liked Sample A the most in all the criteria, then sample B, then sample C and at last Sample D.While cooking, in Sample D, noodles tend to break the most and Sample B highly retained its shape, length and noodle-like consistency followed by Sample A and Sample C. Blends of Taro flour, Rice flour and Amaranth flour were prepared for the production of noodles. For Taro flour for removal of Phytates and Oxalates - method is given below – Figure -2

DISCUSSION

Noodles available in the market are made structurally and physically acceptable and suitable for human consumption by using low nutritious cheap ingredients and by incorporating several processing techniques that give a good appearance to the product but further deteriorates its nutritional composition.Mostly in recipes like noodles and pasta all-purpose flour- maida is used which is not healthy in the long run. Hence, the idea of the research was to develop a food product, which is a recipe liked by all but making it in a more-healthier way by replacing the unhealthy ingredients with the healthier ones so that the harmful effects on the health could be prevented. The systematic review was done for this research, to obtain verified and accurate results for the study. The total of 156 studies were analysed which were related to the main ingredients of the research. In this product, all-purpose flour was replaced by taro root flour, rice flour and amaranth flour to make noodles which could be enjoyed without worrying about its effects on health. These flours have good starch content which makes them eligible to make products like noodles.Taro, Rice and Amaranth flours are highly nutritious and can contribute in developing nutritionally abundant and structurally acceptable food products but these also contain a good amount of antinutrients which reduces the bioavailability of other nutrients in the body. However, those antinutrient factors can be removed by various processing techniques such as soaking, germination, boiling etc.

In this study 4 samples of noodles were developed containing different proportions of taro, rice and amaranth flours. In this product, the flours used were prepared from the raw grains to ensure good quality and various processing techniques have been incorporated so that the antinutrients in the ingredients used are removed effectively.The proportion of rice flour in all 4 samples was kept equal as various studies have proved that rice flour made products are highly structurally stable and are of highly acceptable quality. Results of sensory evaluation showed that Sample A which contained 40% taro flour, 40% rice flour and 20% amaranth flour was the most acceptable among all the other samples in terms of all sensory attributes and was scored the highest in sensory evaluation test. Hence, a good quality in terms of texture and other physical attributes, nutrient abundant noodles could be prepared by taro, rice and amaranth flours in 40:40:20% ratio. The values of Oxalates and Phytates were also reduced to bare minimum so the anti-nutritional factors were also removed.

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Table 1: Quality rating criteria distribution

% relevance with the criteria	Quality category	Quality Rating	Classification based on the following required criteria: (Absence of values in result would subtract 10%) (in case of few values provided 5% would be subtracted)						
			Criteria based on Raw ingredient and its flour form:			Criteria Based on Ingredient based product form:			
			• Nutrient and anti-nutrient composition and physical properties of the raw ingredient. • Therapeutic benefits • Effect of processing on nutrient content • Effect of processing on anti-nutrient content • Effect of processing on physical properties.			• Nutrient content • Anti-nutrient content • Physical properties. • Therapeutic benefits • Effect of processing on nutrient content • Effect of processing on anti-nutrient content • Effect of processing on physical properties.			
						Pasta / noodles (30%) +		Baked products (15%) +	
90 – 100%	Very strong study	*****	Any 3 criteria	Must includeminimum 1 similar processing	Results proved with experiment	Any 1criteria	45%	Any 1criteria	25%

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70 – 90%	Strong study	****	Any 2 criteria	technique.		Any 2 criteria	50%	Any 2 criteria	30%
50 – 70%	Moderate study	***	Any 1 of the required criteria	Both similar and dissimilar processing techniques can be included.		Any 3 criteria	55%	Any 3 criteria	35%
						Any 4 criteria	60%	Any 4 criteria	40%
35 - 50%	Weak study	**	Any 1 of the required criteria		Results not proven with experiment	Any 5 criteria	65%	Any 5 criteria	45%
25 - 35%	Very weak study	*	Product-related any 1 criterion claimed with or without experiment.		The result may or may not be proven with experiment	Any 6 criteria	70%	Any 6 criteria	50%

Table 2: Characteristics and quality assessment of taro studies

S.no.	Author & year	Journal name	Aim of the study	Study description	Results and conclusion of the study TARO	Quality %	Quality Rating
1.	Aboubakar *et al.*, 2009	Journal of food engineering	The effect of various cooking conditions on the texture, chemical and structural properties of taro were studied.	Taro were processed in water, lemon juice, tamarind water and steam and the effects of these cooking mediums on the properties of taro were observed.	It was found that steaming caused higher level of softening of the taro slices as compared to boiling. Boiling method was found to be the most beneficial in removing the oxalate levels from taro.	75%	****
2.	Adane *et al.*, 2013	African journal of food, agriculture, nutrition and development	The effect of various processing methods on the nutrient and anti-nutrient content of taro were studied.	The nutrient and antinutrient content of raw taro were evaluated. The taros were boiled and fermented and the effects of these processing methods on the nutrient and anti-nutrient content of taro were also evaluated.	The study proved that Fermentation was highly effective in reduction of phytate content and boiling was effective in reduction of oxalate levels. Slight reduction in protein and fibre content was also seen while inclination in various nutrient content was also recorded.	90%	*****

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3.	Aprianita *et al.,* 2009	International food research journal	The structural properties of flours obtained from different tubers were studied.	The physical and chemical properties of flours and starches obtained from yam, taro, sweet potato was studied.	It was found that taro flour had the tendency to bind appropriately with low breakability which makes it appropriate to be used in various food products.	60%	***
4.	Fernandez and umar, 2018	Journal of south pacific agriculture	The processing and nutritive information of roots and tubers were discussed.	The processing, nutrient and anti-nutrient content of taro with its health benefits were discussed.	It was found that taro is highly nutritive but also contains high levels of anti-nutrient content which can be eliminated by various processing techniques. It was also proved to be a beneficial food for malnourished people.	100%	*****
5.	Nguimbou *et al.,* 2013	Food and bioprocess technology	Effect of temperature on the properties of taro were studied.	The taros were sliced, sun-dried and then grounded to flour. Then its nutrient and physical properties were studied.	It was found that processing improved its overall nutrient content, anti-oxidant levels and physical properties.	75%	***

Table 3: Characteristics and quality assessment of rice studies

S.no.	Author & year	Journal name	Aim of the study	Study description	Results and conclusion of the study RICE	Quality %	Quality Rating
1.	Akosa *et al.,* 2000	African journal of medicine and medical sciences	The effects of rice and maize flour composed oral rehydration solution in treating dehydration were studied.	88 children having dehydration symptoms belonging to age of 6 months to 42 months were chosen for the study. Half were given rice-based solution and other half were given maize-based solution for 4 hrs and the nutrient content of solution and their effects on treating dehydration in children were evaluated.	It was found out that both the solutions were rich in nutrients and were effective in treating dehydration symptoms in children.	70%	****

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2.	Bhattacharya *et al.,* 1999	Cereal chemistry journal	The physical and structural properties of noodles prepared from rice flour were studied.	The physical and structural properties of noodles prepared from rice flour were studied.	It was concluded that rice noodles had very good physical properties such as swelling, firmness, shape retaining, chewiness etc. that compliments a good quality noodle.	75%	****
3.	Bryant *et al.,* 2001	Cereal chemistry journal	Various characteristics of extruded rice flour were studied	Two types of rice flours were taken from two different varieties of rice and were processed at various moisture levels at two different temperatures to evaluate its physical properties and digestibility at those conditions.	It was found that the rice flour processed at temperature more than 100 degree Celsius had better digestibility rate as compared to those processed at 100 degree Celsius.	80%	****
4.	Chang *et al.,* 1986	Journal of food science	The nutrient composition of rice flour was analysed.	Two different varieties of rice were processed to obtain high protein flour and its nutritional parameters were evaluated.	Both the varieties of rice after processing yielded high protein flours and both the flours had almost similar amino acid levels. It was suggested that if these flours would be supplemented with limiting amino acids then being a complete protein its protein efficiency ratio would be much higher than that of casein.	55%	***
5.	Chinma *et al.,* 2015	Food chemistry journal	The influence of germination on the properties of flour obtained from 3 different varieties of rice were analysed.	3 different varieties of rice were germinated for 48 hrs and then were grounded to flours. Their physical and nutritive properties were evaluated.	It was found that after germination the nutritive, anti-oxidant and physical properties of flours relatively increased whereas, the anti-nutritional content got highly reduced.	62%	***

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Table 4: Characteristics and quality assessment of amaranth studies

S.no.	Author & year	Journal name	Aim of the study	Study description	Results and conclusion of the study AMARANTH	Quality %	Quality Rating
1.	Alencar *et al.,* 2016	LWT- food science and technology	The effects of amaranth and quinoa on the quality of gluten free bread were analysed.	The gluten-free bread was developed using amaranth and quinoa flour and its sensory and physical properties were evaluated.	It was found that the bread developed showed same physical properties as shown by wheat-based gluten bread. Yet, gluten free bread had higher levels of proteins and fats.	35%	**
2.	Olawoye *et al.,* 2017	Cogent food and agriculture journal	The effects of various processing techniques on the nutrient and anti-nutrient composition of amaranth seed were studied.	The nutrient composition of amaranth seeds was evaluated and the effects of fermentation, defatting, autoclaving, blanching and germination on the composition of seeds were calculated.	It was found that the processing techniques improved the overall digestibility of proteins and its bioavailability. It was also observed that processing greatly reduced the anti-nutrient content of the seeds. Anti-oxidant activities also improved after processing. The study concluded that processing techniques greatly improves the overall nutrient composition of the amaranth seeds and makes it highly beneficial for health.	90%	*****
3.	Chauhan *et al.,* 2015	Food science and technology	Nutrient composition and physical properties of cookies developed from amaranth flour were evaluated.	Raw as well as germinated amaranth seeds were grounded to form flour and cookies were developed from it. The nutrient composition and physical properties of both types of cookies were evaluated.	It was found that after germination fat and carbohydrate content in the cookies reduced whereas protein, fibre and anti-oxidant properties highly increased. Raw amaranth flour-based cookies were found to be better from germinated flour-based cookies in terms of physical properties. Yet the germinated flour-based cookies exhibited better nutritional composition as compared	55%	***

					to the raw flour-based cookies.		
4.	Chauhan and Singh, 2013	International journal of agriculture and food science technology	The effects of germination on the properties of amaranth flour were determined.	The various samples of amaranth seeds were germinated for different time intervals respectively, at 32 degree Celsius. Then the grains were dried at 45 degree Celsius for 18hrs and grounded to flour. The nutritional and physical properties of flour were evaluated for all the samples.	It was found that germination decreased the fat levels in amaranth and the sample germinated for 16 hrs showed highest protein levels, water absorption ability and lowest solubility levels.	65%	***
5.	Chavez *et al.*, 2012	Food science and technology journal	The effects of addition of amaranth in rice-based pasta were studied.	25% Amaranth flour and 75% of rice flour were used to develop pasta. The effects of addition of amaranth on the physical and nutritional properties of pasta were evaluated.	It was found that after the addition of amaranth the fibre and mineral content, the digestibility of proteins and textural and physical properties highly improved. It was also proved that amaranth and rice flours complement each other and forms a product of a high structural and textural quality.	70%	****

Table 5: Flour distribution in samples

Sample No.	Taro Flour	Rice Flour	Amaranth Flour
Sample A	40 %	40 %	20 %
Sample B	30 %	40 %	30%
Sample C	20 %	40 %	40%
Sample D	10 %	40 %	50%

Table 6: Results of sensory evaluation (Mean ± Standard Deviation)

Sensory parameters	Sample A	Sample B	Sample C	Sample D
Colour	7.8 ± 1.0	7.8 ± 0.7	7.6 ± 0.6	5.5 ± 1.6
Aroma	7.7 ± 1.1	6.8 ± 1.3	7.7 ± 0.6	5.2 ± 1.8
Texture	8.2 ± 0.7	7.3 ± 1.1	7.2 ± 1.0	4.5 ± 1.5
Taste	8.4 ± 0.9	6.8 ± 1.5	6.7 ± 1.7	4.3 ± 2.2
Chewiness	7.8 ± 1.0	7 ± 1.5	6.5 ± 1.2	4.4 ± 2.1
Consistency	7.7 ± 1.2	7.2 ± 0.7	6.9 ± 0.9	4.3 ± 1.7
Overall acceptability	8.2 ± 1.1	7.6 ± 0.8	7 ± 0.8	5.2 ± 0.9
Overall scores	7.9 ± 0.2	7.2 ± 0.3	7.0 ± 0.4	4.7 ± 0.5

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Table.7: Oxalate and Phytic acid content of Sample A

Parameters	Test Results per 100 gms of noodles	
	Before the blanching of the sample	After the blanching
Phytic acid	12 mg	0.79 mg
Oxalates as Oxalic acid	8 mg	0.04 mg
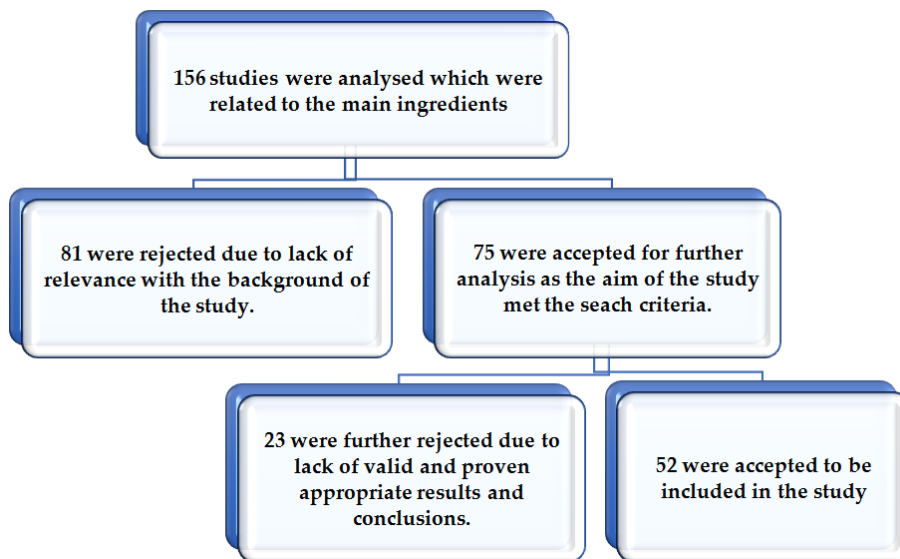
Figure 1: Flowchart of selection process
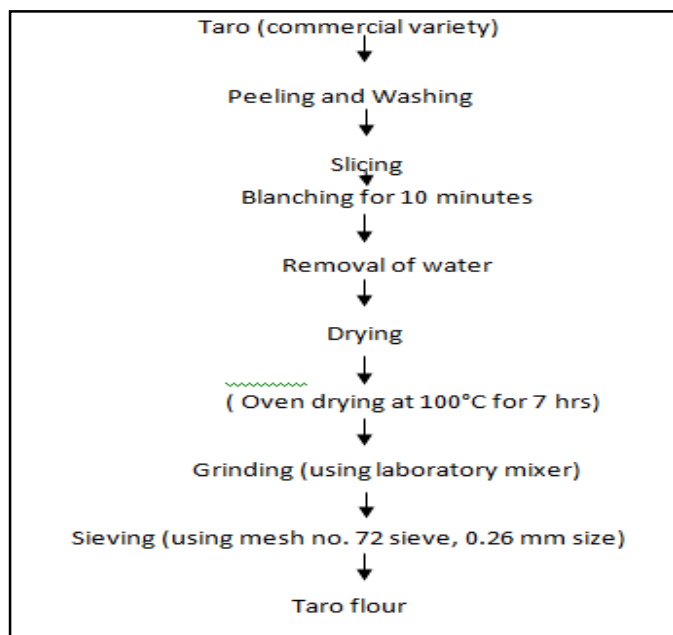
Figure 2: Taro flour for removal of Phytates and Oxalates - Method

RESEARCH ARTICLE

Effect of Temperature on Extraction of Metals from Fly Ash by *Thiobacillus ferrooxidans* and *Pseudomonas fluorescens*

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ABSTRACT

The study of interactions between bacteria, metabolic products, CFA particles and leaching products were studied. The term, metal is applied to the substance that has a silvery luster and is a good conductor of electricity as well as heat. The fly ash used in the experiment was collected from Parli Thermal Power Station premises at moist places away from dumping sites. X-ray diffraction technique (XRD) was used to determine the mineralogical composition of fly ash using Rigaku Rint 300series Diffractometer. Collected samples were transferred in the pre sterilized polyethylene bags and stored at 4 ^{0}C in refrigerator until use. The development of turbidity in the medium was assumed to be due to microbial growth. Bioextraction of aluminum, manganese and iron from fly ash was studied at different temperature. Production of ferric iron as well as H_2SO_4; hence dissolution of metal is increased

Keywords: *Thiobacillus ferrooxidans,* to microbial growth. *Pseudomonas fluorescens,* bacteria

INTRODUCTION

Fly ash is the incombustible matter which is left after all the organic components of the coal have been consumed during the process of coal combustion and is collected by means of mechanical electrostatic precipitators. Fly ash is composed of mainly silt-sized spherical amorphous ferro-aluminosilicate minerals and is generally characterized as having low permeability, low bulk density as well as high specific surface area. The ash particle generally ranges in size from 0.5 to 200 μ. Fly ash particles are mainly composed of silicon (SiO_2), aluminum (Al_2O_3), iron (Fe_2O_3), titanium (TiO_2), and manganese (Mn_2O_3) (Scheetz and Earle, 1998). Fly ash is the incombustible material matter which is left after all the organic components of the coal have been consumed during the process of coal combustion and is collected by means of mechanical electrostatic precipitators (Scheetz and Earle, 1998).

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The mechanism of bioleaching of coal fly ash (CFA) by *Thiobacillus thiooxidans* was studied by Brombacher *et al.* (1998)**.** The study of interactions between bacteria, metabolic products, CFA particles and leaching products were studied. It was demonstrated that bacterial growth and the amount of metals leached from the CFA were compared with biological and chemical interaction, which involve various components in this system. Kinetic model of CuS oxidation by *Thiobacillus ferrooxidans* and *Thiobacillus thiooxidans* bacteria was proposed by Domka (2001). The CuS oxidation with *Thiobacillus ferrooxidans* bacteria was found to be best described by the model of inhibition of the first order with respect to the substrate and product inhibitor, while the process with *Thiobacillus thiooxidans* and mixed cultures of these bacteria was best described by first order reaction with respect to the substrate. The term, metal is applied to the substance that has a silvery luster and is a good conductor of electricity as well as heat. Some metals, like alkali metals are relatively soft, malleable and ductile. Alkaline earth metals and metalloids are the other two categories proposed by chemists. There are various methods of metal extraction from their mineral ore. Bioextraction of metal is an important process as it minimized the production cost of the metals.

MATERIALS AND METHODS

Sample Collection and Physico – Chemical Analysis of Fly Ash
The fly ash used in the experiment was collected from Parli Thermal Power Station premises at moist places away from dumping sites. 1-2 kg fly ash was collected in air tight polyethylene bags sterilized with alcohol. The collected ash was washed with water to remove water soluble compounds and dried on hot plate. The collected fly ash was subjected to analyze the microbiological (microflora) and Physico-chemical characters such as colour of the ash, pH, Redox potential, conductivity, salinity and mineralogical characterization were analyzed as per the method of Black *et al.* (1965). The physical properties of the fly ash bulk density, maximum water holding capacity, porosity were analyzed as per the methods of soil analysis.

Mineralogical and Elemental Analysis of Fly Ash
X-ray diffraction technique (XRD) was used to determine the mineralogical composition of fly ash using Rigaku Rint 300series Diffractometer. Finely ground fly ash sample was analyzed with a glass slide mount using Cu.Ku radiation. A wide range goniometer was used. The Diffractometer was equipped with curved graphite monochromator and θ compensating site.

SEM and EDX Analysis of Fly Ash
The morphological changes in the surfaces of individual minerals were investigated by SEM (scanning electron microscopy) and the changes of chemical composition and element present on surface of the fly ash sample by Energy Dispersive X-ray (EDAX) analysis. Mineral samples were coated with platinum and subsequently examined in a scanning electron microscope Jeole 3500.

Chemical Analysis of Fly Ash
To assess the metals present in coal fly ash according to method, developed by Francis *et al.* (1999) the collected ash was washed with water to remove water soluble compounds and dried in oven at 100 ^{0}C temperature. 2 gm of oven dried fly ash was mixed with 6 ml of nitric acid (HNO_3) and kept as it is for 24 hours. After 24 hours sample was filtered. Filtrate was used for spectrophotometric analysis of aluminum iron and manganese after appropriate dilution.

Isolation of *Thiobacillus ferrooxidans*
For isolation of bioleaching microorganisms ore was collected from Radhanagari bauxite mine at various depths. Collected samples were transferred in the pre sterilized polyethylene bags and stored at 4 ^{0}C in refrigerator until use. From the collected soil samples 1 gm of bauxite ore was ground to fine powder and mixed in 100 ml of 9K medium

[composition g/l ammonium sulphate $(NH_4)_2SO_4$ – 3.0, magnesium sulphate $MgSO_4 7H_2O$ -0.5, potassium hydrogen phosphate K_2HPO_4 - 0.5, potassium chloride KCl- 0.1, calcium nitrate $Ca(NO_3)_2$ -0.01, ferrous sulphate $FeSO_4.7H_2O$- 21.00] (Silverman and Lundgren, 1959). The pH of the medium was adjusted to 2.0 with 10N H_2SO_4. The culture in 9k medium was incubated for 1 to 4 weeks until growth was observed microscopically or until a chemical change occurred in the medium compared with an un-inoculated control.

The inoculated flasks were incubated at 32 ± 2 ^{0}C for 1 to 3 weeks at 140 rpm constant shaking condition. The presence of iron oxidizing bacteria in the liquid 9K medium was indicated by the formation of a characteristics ferric precipitation and orange coloring of medium. A serial dilution of culture was spreaded on 9K solid medium. The inoculated plates were incubated at 32 ± 2 ^{0}C for 10 to 20 days residence time. To observe the colony size, shape, colour and other morphological features. Single colony was picked from the plate by using a sterile inoculation loop and streaked on newly made plates.

Isolation of *Pseudomonas fluorescens*

To isolate efficient indigenous bioleaching microbes from bauxite ore sample was collected and stored in refrigerator at 4 ^{0}C. To isolate dominant heterotrophic microbes LB broth was used. To isolate the indigenous microbes 2 gm of bauxite ore was inoculated with 40 ml of Luria Bertani (1951) broth in aseptic conditions. Inoculated flasks were incubated at 32 ± 2 ^{0}C for 4 to 6 days at 140 rpm constant shaking conditions. The development of turbidity in the medium was assumed to be due to microbial growth. Serial diluted turbid sample was streaked on solid LB agar medium. [Composition g/l trypton -10.0, yeast extract – 5.0, NaCl-5.0, Agar -15] and incubated for 48 hours. After 48 hours, grown dominant colonies were selected for further purification and biochemical identification.

Effect of Temperature on Extraction of Metals by *Thiobacillus ferrooxidans*

To study the effect of temperature on extraction of metals from fly ash bioleaching experiment was carried out in 250 ml Erlenmeyer flasks containing 40 ml sterilized 9K (Silverman and Lundgren, 1959). medium. 4g fly ash was added in each flask and flasks were incubated at different temperatures such as 10 ^{0}C, 20 ^{0}C, 25 ^{0}C, 30^{0}C, 34^{0}C, 38^{0}C, 42^{0}C, 44 ^{0}C 46^{0}C and 48^{0}C with constant shaking speed at 140 rpm for one month. The extracted metals were measured as earlier.

Effect of Temperature on Extraction Of Metals by *Pseudomonas fluorescens*

In order to study the effect of temperature on extraction of metals from fly ash, bioleaching experiment was carried out in 250 ml Erlenmeyer flasks containing the 40 ml Kings medium in each. The medium was sterilized at 121 ^{0}C for 15 minutes and 60 ml of inoculum (2.0 x 10^6 cells /ml) was added to it. The pH of the medium was adjusted to 7.2 the fly ash pulp density of 4 % w/v was added in each. Flasks were incubated at different temperatures such as 10 ^{0}C, 20 ^{0}C, 25 ^{0}C, 30^{0}C, 34^{0}C, 38^{0}C, 42^{0}C, 44 ^{0}C 46^{0}C and 48^{0}C with constant shaking speed at 140 rpm using incubator shaker. Experiment was run for 21 days and at the end of experiment, the final pH was measured and contents of the same were filtered. Analysis of metals was carried out by spectrophotometric method employed as earlier.

RESULT AND DISCUSSION

Bioextraction of aluminum, manganese and iron from fly ash was studied at different temperature. It was found that there was increase in aluminum, manganese and iron with the increase of temperature up to 38 ^{0}C whereas in case of *Pseudomonas fluorescens* metal extraction was increased up to 34 ^{0}C. Many authors' investigation shows that the efficiency of bioleaching is depend on temperature (Chen and Lin, 2000) with its optimal, at 37 ^{0}C ,however, the optimum incubation temperature ranging from 30 to 37 ^{0}C suitable for metal leaching from the industrial wastes, considering the increasing cost with increase in temperature (Gomez *et al.* 2000; Lee *et al.* 2001).

Increasing temperature in the range of 20 to 35 ^{0}C was found to be enhanced the biological oxidation rate of ferrous ions by *Thiobacillus ferrooxidans* (Nemati and Webb, 1997). Deng (2002) also studied the temperature effect in the

range of 20 to 45 ^{0}C. It was observed that the biooxidation range of iron and arsenic using *Thiobacillus ferrooxidans* was highest in the range of 28 to 32 ^{0}C which leads to production of ferric iron as well as H_2SO_4; hence dissolution of metal is increased.

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Table: 1 Effect of temperature on extraction of metals from fly ash by *Thiobacillus ferrooxidans*.

Temperature ^{0}C	Metal solublization in media (mg/g)			Bioextraction of metals (%)			Bioextraction Efficiency (%)
	Al	Fe	Mn	Al	Fe	Mg	
10 ^{0}C	64.20± 1.22	24.48±1.42	2.44± 0.86	26.09	26.04	17.42	25.74
20 ^{0}C	76.48± 1.64	26.58±1.21	4.64± 1.42	31.08	28.27	33.28	30.42
25 ^{0}C	82.90± 2.46	34.22±1.30	5.23± 1.88	33.69	36.4	37.35	34.56
28 ^{0}C	96.45± 2.44	40.10±2.43	7.04± 0.96	39.2	42.65	50.28	40.54
32 ^{0}C	142.32± 2.7	46.20±2.00	8.50± 1.65	57.85	49.14	60.71	55.65
35 ^{0}C	182.66± 4.22	76.80±2.67	10.2± 1.44	74.25	81.7	73	76.18
38 ^{0}C	186.24± 4.64	84.50±2.54	10.4± 1.34	75.7	89.93	74.57	79.44
40 ^{0}C	172.68± 1.34	86.42±2.48	9.68± 1.74	70.19	91.93	69.14	75.92

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42 ⁰C	164.82± 1.44	78.22±1.45	9.21± 1.62	67.24	83.21	65.78	71.25
45 ⁰C	134.44± 1.68	68.23±1.65	8.44± 1.55	54.65	72.58	60.28	59.63
C.D. (p=0.05)	38.03	20.08	2.17				

Table: 2 Effect of temperature on extraction of metals from fly ash by *Pseudomonas fluorescens*.

Temp.	Metal solublization in media (mg/g)			Bioextraction of metals (%)			Bioextraction Efficiency (%)
	Al	Fe	Mn	Al	Fe	Mg	
10 ⁰ C	6.83 ± 1.45	14.22 ± 3.45	0.32 ± 0.4	2.77	15.12	2.28	6.03
20 ⁰ C	22.46 ± 2.44	26.44 ± 2.42	0.86 ± 0.20	9.13	28.12	6.14	14.05
25 ⁰ C	26.96 ± 4.68	36.23 ± 1.88	1.20 ± 0.34	10.95	38.54	8.57	18.34
30 ⁰ C	36.04 ± 2.43	53.96 ± 1.54	1.96 ± 0.46	14.65	57.40	14.00	25.97
34 ⁰ C	40.21 ± 1.65	60.12 ± 1.44	2.86 ± 0.24	16.34	63.95	20.42	29.14
38 ⁰ C	37.48 ± 0.66	48.22 ± 1.78	1.48 ± 0.66	15.23	51.29	10.57	24.62
42 ⁰ C	31.28 ± 1.22	52.33 ± 2.45	2.40 ± 0.28	12.71	55.67	17.14	24.29
44 ⁰ C	26.84 ± 1.44	54.44 ± 3.40	2.10 ± 0.34	10.91	57.91	15.00	23.55
46 ⁰ C	21.46 ± 0.43	46.23 ± 4.22	1.98 ± 0.26	8.72	49.18	14.16	19.68
48 ⁰ C	18.22 ± 0.64	42.81 ± 1.43	1.10 ± 0.44	7.40	45.54	7.85	17.55
C.D.(p=0.05)	8.22	11.54	0.63				
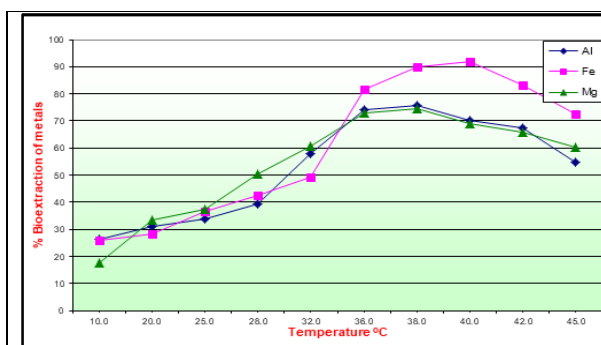
Fig.1: Effect of temperature on extraction of metals from fly ash by *Thiobacillus ferrooxidans*.
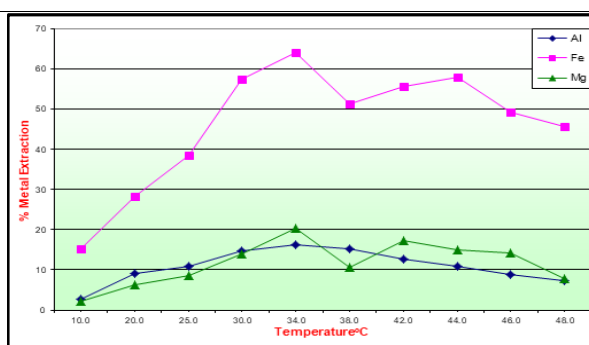
Fig.2 : Effect of temperature on extraction of metals from fly ash by *Pseudomonas fluorescens*.
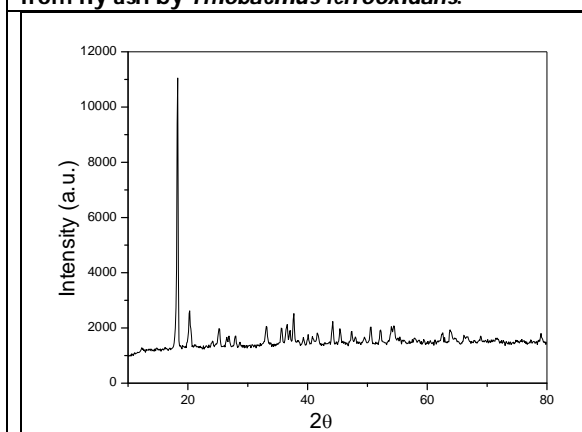
Figure 3: XRD pattern of Bauxite ore
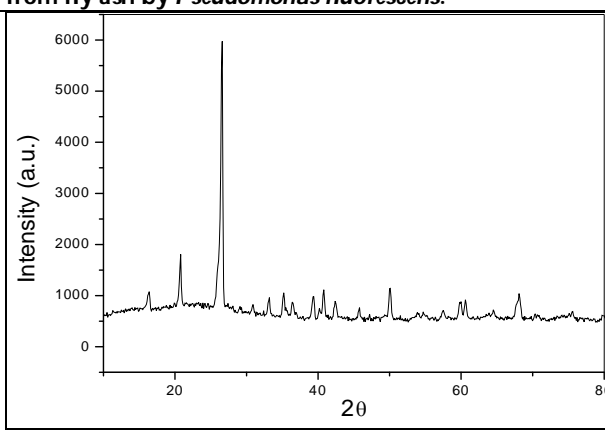
Figure 4: XRD pattern of Fly ash

a) *Thiobacillus ferrooxidans* **autotrophic growth on 9K solid medium**

b) *Thiobacillus ferrooxidans* **chemoorganotrophic growth on solid glucose medium**

RESEARCH ARTICLE

Implication of E-Contracts and Blockchain Technology in Legal Domain: A Critical Analysis

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ABSTRACT

Technology in our lives is a huge enabler. Many things have become easy, and our lives have become so enriched, because so many things in our lives are enabled by technology. Increasingly, digital technology has helped many lives in the current scenario. Blockchain is a complex software technology suite that generates an encrypted distributive ledger. The virtual currency generally referred to as 'Bitcoins' is one of the best-known applications of Blockchain technology currently in the news. The central innovation used to render the encrypted types of cash is Blockchain. It has been used in various fields, for example, finance, logistics, legal services, and industry. Traditionally, in the legal system and the procedure hefty amount of money, time is spent. In our everyday lives nowadays, contracts are very widely used and approved. Right from purchasing household goods from a supermarket to withdrawing money from ATM, all are govern through contracts. Electronic contracts mean contracts that are signed through agreement between two parties, through the use of any electronic means. They are often generally referred to as cyber contracts, online contracts or digital contracts. They are somewhat similar in nature to conventional contracts, which are paper-based and trade goods and services for a particular amount of consideration. The only additional aspect they have is that the contract mode, like the internet/other e-instruments, is digital in nature. If the law is completely objectivized, this large sum of money in the litigation will potentially be stopped. Complications in the legal process are created by the rigid litigation process, its scope and difficult interpretation of the law. This research paper deals with the simplification of legal processes by the use of Blockchain technology. The paper focuses on the idea of Blockchain

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technology; second, it deals with the need to change our existing legal framework on contract formation and third, the proposed model.

Keywords: E-Contracts, Blockchain Technology, CMS, Cyber world.

INTRODUCTION

Blockchain technology will revolutionized the age old legal industry due to its great features like immutability, crystal clear transparency and truthfulness for all kind of transactions executed in Blockchain network. Blockchain technology initially focused on the promotion of crypto currency called "Bitcons". Blockchain becomes the hot topic to be discussed among the researchers from every spheres of life. Blockchain technology has been applied in various areas [1] such as finance, logistics, education, and manufacturing as well as in age old legal industry. One of the vital features of Blockchain technology is thousands of connected nodes in a distributed network of blocks maintain consensus. The Blockchain network adopts a hash based proof of work distributed consensus algorithm.

Self-executing nature of smart contracts- a gift from heaven or a plethora of problems? As the role of Blockchain technology and its use is increasing day by day, the question is how and in what ways it can be best used in the present legal system which is very rigid. Although law firms that are facing challenges in their domain due to low demands from the corporate clients and stronger competition from nontraditional players are considering Blockchain technology as a futuristic hope. As of now the possible use of Blockchain technology in the legal field is the top priority among the law firms, corporate, legal scholars etc. The concept of governing technology by law has gained popularity with the ever growing use of smart contracts and blockchain technology in different fields. Nevertheless, the questions surrounding the legality and validity of these technologies, particularly in India, are full of uncertainty. In response to the various difficulties faced due to the conventional form of agreements, contemporary smart contract technology has effective solutions to deliver. India's reliability on digital transactions has been growing with the advancement of new technologies. In view of these growth changes, many sectors are gaining strengths due to hassle-free use of technology around the world. The introduction of blockchain technology is widely debated as a potential solution to the challenges faced by the various fields in the form of what is generally known as a 'smart contract'. At the same time, due to the lack of the current legislative system to govern something beyond traditional contracts, it has opened up a legal loophole. The need to bridge this legal gap makes it necessary to examine the technology from the legal scope and its relevant functions. Let us make an outline about Blockchain and Smart Contracts/e-Contracts.

Blockchain Technology

Blockchain technology has proved itself to be very successful in coping more than ever with realistic circumstances. By taking first mover's advantage of the introduction of blockchain technology in sectors ranging from upgrading banks to financial services to upgrading technology in the telecommunications and real estate sectors. Indian giant Tech Mahindra is already developing its business [2]. Real estate has also seen the rise of smart contracts around the world, not only in the realm of private sector players, but also by governments to consolidate land records on a public ledger in order to avoid issues such as counterfeit title deeds, benami, etc.

Blockchain Technology is the enabler. It maintains the data in an immutable distributed ledger connected to thousands of nodes as proposed by *Satoshi Nakamoto* in 2008. It has the capacity to transform the current Internet from "The Internet of Information Sharing" to "The Internet of Value Exchange [3]. As the crypto-currency "*Bitcoin*" captured the attention of public interest, blockchain technology became a frequently used and widely recognized word. This technology been used in a wide variety of fields, from finance to shipping [4], legal to medical field and Real estate, obviously, is no exception [5]. A 'blockchain' is a particular type of data structure used in some distributed ledgers which stores and transmits data in packages called 'blocks' that are connected to each other in a

digital 'chain'. Blockchains employ cryptographic and algorithmic methods to record and synchronise data across a network in an immutable manner [6]. In other words, it is a peer-to-peer distributed ledger that is cryptographically secure, append-only, immutable, and updateable only via consensus or agreement among peers [7]. In addition, this ledger functions much like a shared Google document, permanently documenting transactions between two or more parties and transmitting a copy to all interested parties, without the need for a third party to approve the transaction [8]. Each new transaction shall be reported in a new block and each new block shall be built on previous blocks and shall contain data stored on all previous blocks. Since all of these blocks are interlinked and stored on a variety of nodes, it is nearly impossible to hack them and alter or modify them.

E-Contracts/ Smart Contracts

Smart contracts, as explained by Nick Szabo, the computer programmer behind the idea of smart contracts, are "a computerized transaction protocol that executes the terms of a contract. The general objectives of a smart contract design are to satisfy common contractual conditions […], minimize exceptions both malicious and accidental, and minimize the need for trusted intermediaries" [9]. In this, a smart contract can be stored on a blockchain, interact with external data feeds, and then self-execute various other actions/processes such as payments, shipment of products or other actions including remedies in the case of breach which are based on conditional logic (programmed as traditional "if then" statements) and agreed verifiable proof of performance or other trigger events [10].

Smart contracts are codes which are not readable to humans [11]. In relation to other e-contracts or contracts performed by codes, anything outside the code is just commentary for the smart contract. The code is a necessary part of the agreement itself in the case of smart contracts, while other contracts executed by codes are only a method for executing the man-made contract. Using a digital signature, often using signature keys, the parties sign this agreement. Having pointed out how lucrative the newly implemented smart contract technology is for the commercial and legal realms, it is also imperative, in legal terms, to draw the very inescapable downside of the same, because smart contracts do not lack legal loopholes, which also raise serious questions in some jurisdictions about the validity and legality of smart contracts. The article will try to discuss the legal shortcomings of smart contracts and the difference between conventional contracts and smart contracts in the next section, retaining the emphasis on Indian jurisdiction.

Legal Restricts Of Smart Contracts

In order to understand the legality of smart contracts, it is also important to understand how these contracts vary from the conventional type of contracts, in which the drawbacks of smart contracts will also be revealed. The first and foremost distinction, which is a technological one and certainly also the most distinctive, is that smart contracts are self-executing in nature; they auto-operate on the basis of some pre-determined conditions as fed into the machine in the form

of codes [12]. These conditions are mutually agreed upon by the parties and once the conditions are triggered, the smart contracts self-execute by blockchain technology [13]. While, in the case of a conventional contract, the parties can opt not to comply with the pre-agreed conditions even at the expense of litigation and/or reimbursement in terms of judicial remedies; in the case of smart contracts, it is not possible to refrain from compliance with the contractual conditions, even if the party wishes to terminate the contract upon receipt, unless the party initiating the blockchain terminates it. In the execution of smart contracts, there is no human function and they are self-operating, once coded. Smart contracts may lack their 'smartness' due to the absence of human interference and prove to be ineffective in some situations, including circumstances covered under subsequent impossibility, force majeure etc.

The bulk of the gap between a smart contract and a conventional contract is created by another distinction. This is because smart contracts cannot be read by humans, but only by computers. For its non-validity and illegality, this constitutes a bone of contention. Although, on the one hand, those promoting smart contracts claim that the Indian

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Contract Act allows contracts that are not written very well, this is essentially a written contract that is clearly not readable to humans [14]. On the other hand, the problem with the unread ability of smart contracts to humans is that smart contract parties can question consensus-ad-idem by claiming that because of the unread ability of the same, they were unable to infer the exact same stuff as written in the smart contracts and that what is self-executed by the smart contract is not exactly what they meant it.

According to Section 13 of the Indian Contract Act, "*two or more persons are said to consent when they agree upon the same thing in the same sense* [15]."

It is also argued that the validity of smart contracts is compromised by Section 13 because it cannot be guaranteed that legitimate consent is obtained in the absence of the readability of codes. In such a case, it cannot be guaranteed that if the mind of the customer accompanies its signature to the contract, thus rendering smart contracts void. In smart contracts, signing is almost always electronic and often in cryptic form, unlike conventional contracts, the last distinction between the signing of the contracts. Though this is not a limitation in India, in multiple jurisdictions where digital signatures are not recognised, it could constitute a limitation. These electronic signatures, including cryptographic signatures, are recognized in India under the Indian Information Technology Act, 2000 under Section 2(ta) [16] of the Act as inserted by the 2008 amendments, which takes inspiration from the UNCITRAL Model Law on Electronic Signatures 2001 [17]. Since not all types of electronic signatures are reliable and can be manipulated, only those listed in the IT Act's Second Schedule are permitted [18]. Digital signatures, like the signature keys often used for smart contracts, require cryptographic signatures into account [19].

Legal Validity of Smart Contracts

It is pertinent to note that some of the limitations discussed above which can possibly pose a challenge to the legal validity of the smart contract in India. Based on the above discussion the non-fitness of self-execution in certain commercially complicated circumstances such as frustration, force majeure, etc. are the main limitations that could challenge the legal legitimacy of the smart contract in India. The non-readability to humans that renders the consent is another loophole of smart contracts. Electronic contracts are recognized in India under multiple provisions of the IT Act, specifically in Section 10 [20]. Within the wider range of e-contracts, smart contracts are a subset. Hence, in India, their validity is accepted. The touchstone for checking the validity of any contract is Section 10 of the Indian Contract Act [21].

It sets out the basic conditions of a valid contract, which are: free consent, negotiating parties, legal consideration, and a legitimate object. Along with these, any arrangement which is explicitly declared to be void under the Contract Act is also not a contract. In the current scenario, the element of "*any agreement expressly declared to be void*" and the element of "*free consent*" are at issue because of the respective limitations as set out in the preceding part. However, the author's opinion of both of these claims does not hold enough water to stand against the validity of the smart contracts, as all the limitations listed above are "exceptions and not laws." First of all, with regard to the claim of non-readability, it must be pointed out that, in most cases, the initiator of the smart contract lays down the important substance of the same in a language understandable to humans, thereby facilitating the opportunity for the parties to make a fair and reasonable decision when they are made aware of the important information of the smart contract in a natural language. Admittedly, it is also quite likely that it would not be appropriate to cover all aspects of the same, but any failure to include a word of high significance and commercial relevance would be regarded as an exception, as is also true in the conventional pen-paper contract. Such situations often exist and have arisen in the past in the cases of paper contracts, which are viewed as an exception and such a contract is deemed void and null. This does not, however, make the entire contract class void, and this also applies to smart contracts. In certain commercially complicated circumstances such as frustration, force majeure, etc., the statement of non-suitability of the self-execution attribute of the smart contract, which is indeed the main feature, also falls short on the same ground that such situations of frustration and failure, subsequently or otherwise, are exceptional situations. In these cases, in conventional contracts, contracts are left void and may also be held void in the case of smart contracts. Keeping it

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against the entire class is going to be bizarre and without any excuse. This added to the willingness of India to be open to embracing and accepting technologically advanced contracts as seen in the IT Act and others by accepting e-contracts and creating a favourable legal environment for the same, opening the door to the validity of smart contracts for the Indian legal sphere.

CONCLUSION

Throughout the study, the absence of a proper legislative structure to deal with this emerging area of blockchain technology, smart contracts centred on this technology, was evident. This truth is not consistent with the objective of the recent economic and other government policies of India, such as digitization, policies aimed at making India technologically advanced and the country's favourable attempts to attract foreign investment. Legislative and executive initiatives acknowledging the validity of smart contracts and the rules governing these emerging technologies will provide investors in the country with a secure, efficient and lucrative climate, taking players to a wide-growing market that is only in its nascent stages and promises illustrious effectiveness.

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RESEARCH ARTICLE

The Challenges of Artificial Intelligence (AI) in the Healthcare Sector

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ABSTRACT

When Covid-19 was ravaging the country, Artificial Intelligence (AI) which was till then relegated to the backseat, received tremendous spotlight in the healthcare sector to bridge the gap between doctors and patients. With its wide-ranging abilities, it could detect, treat varied diseases and ease the workload of hospital workers in a fraction of time and expenditure. Robots gave company to the socially isolated in quarantined facilities, arranged video calls of patients with their family members, became the emotional lifeline of patients, ferried test samples and alerted authorities on quarantine breach. For all the mounting leverages, the contentious yet compelling issues of patient safety, privacy and ethical challenges that tag AI, remain unaddressed. The legal framework hasn't been in sync with the technological leaps in the field. India continues to lack sufficient regulations on data privacy and this could result in abuse of information outside the settings of AI in the healthcare sector. Concerns such as who will be liable if the robot makes a mistake haven't received attention and as with any other responsible framework of services, liability is an essential component. The other significant issue plaguing the AI arena is the lack of testing standards and robot autonomy. Above all, the marginalised in the country are vulnerable to being used for clinical trials in the AI industry, without their consent.

Keywords : AI, Health, Covid-19, Robot, Legal, Framework, Regulation, Data, Privacy, Ethics, Clinical trial, Marginalised, Stakeholder.

INTRODUCTION

The year 2020 heavily impacted almost everything-from social interactions to the economy in its absoluteness. Frontline workers, healthcare professionals in particular were in grave danger of infection from Covid-19. As on February 2, 2021, the cumulative cases of coronavirus in India had touched 10,762, 206 and 154, 522 deaths [1]. In Maharashtra alone, 178 healthcare workers had died and 15, 877 healthcare infected by Covid-19 as on December 21, 2020 [2]. Across India, the initial few months following the national lockdown, implemented from March 25, were

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marked with predicaments as elective surgeries were kept on hold till the pinnacle of the pandemic waned [3]. With the viral infection raging, Artificial Intelligence (AI) was pushed to the mainstream treatment protocol in many hospitals in India to bridge the gap between patients and doctors.

How AI became the mutual connect between doctors and patients

AI is a field in computer science that has chartered an unprecedented transformation in the healthcare sector as it mimics human cognitive functions. With its wide-ranging, multi-disciplinary abilities, it can detect and treat varied diseases in the healthcare sector. It eases the workload of hospital workers by doing their work in a fraction of time and expenditure and also by providing remarkable insights of data on a mass scale. AI has made deep inroads in our daily lives. The FitBits and smartwatches that keep us informed and alert about vital health indicators, are the ubiquitous forms of AI that we use.

With the high incidence of infection among healthcare professionals, the use of robots which had till now been relegated to the backseat, received tremendous spotlight during the pandemic. Through the crisis, the Assam Medical College and Hospital in Diburgarh relied on two robots which delivered food and medicine to coronavirus infected persons in isolated chambers [4]. Even as the rest of the hospitals in the national capital and other metropolitan cities in the country were struggling to conduct elective surgeries, which got a severe dent especially during the initial two months of the lockdown, the Manipal Hospital authorities claimed to have carried out four surgeries per operation theatre in a single day. Dr. Somasekhar, who heads the department of surgical oncology in the hospital was contacted by the Association of Surgeons of India, to issue guidelines for the modified OT procedures pertaining to robotic surgeries, resulting in the Da Vinci's robotic system, which aided a variety of surgical practices, inclusive of intricate conditions like cancer. Covid-19 had made proximity between two persons a grave experience and robotic surgeries eased that encounter. The results were evident with an expeditious recovery, an improved turnover even as the robots disinfected surfaces, much rapidly than humans [5]. During the crisis, the extensive dearth of personal protective equipment across the country made headlines, almost every day. Robots in this context, helped slash the stress of health workers who were at risk of infection and working unprotected [6]. The AIIMS hospital in New Delhi deployed a humanoid robot in its Covid-19 wards and so did Fortis Hospital, Bengaluru, which came up with an interactive robot for screening medical personnel entering the hospital [7]. The Government Stanley Medical College Hospital in Tamil Nadu too deployed robots to serve food and medicines to patients in Covid-19 wards [8] and so did the Sawai Man Singh Hospital in Jaipur [9]. Robots have been in use for varied purposes in the country. Chennai has robot themed restaurants [10] and robots in Kerala aid the police personnel [11].

Robots have been given a grand welcome worldwide, with many countries in the West cutting off a major quantum of human to human communication in the quarantine facilities with infected persons. Robots have replaced the nursing professionals in isolated wards, where they not just arranged video calls of patients with their family members but also offered them emotional solace by interacting with them. This apart, they have also officiated in drug discovery, medical diagnostics, blood pressure and oxygen saturation from patients on ventilators, ferried test samples and alerted authorities on quarantine breach at health facilities [12].

Benefits of AI: Barely scratched the surface

The 2019 budget proposed the launch of a national programme on artificial intelligence. A report by Accenture had stated that India is estimated to add $957 to the economy by 2035 and AI is crucial to innovate and empower the present workforce. AI could add 1.3 % to the economy, the report had stated [13]. In June 2018, the NITI Aayog released, 'National Strategy for Artificial Intelligence,' evaluating the importance of AI in multiple sectors. That being said, the scope of AI is immense and uses, wide-ranging but what we have explored is only the bare minimal.

While robot intervention could be revolutionary in hindsight, they have to be well-thought through like any other groundbreaking innovation. Diagnosis of diseases is touted to be more accurate by AI computer programmes than an accredited doctor in certain cases in addition to the process being swifter and efficient by several degrees. The

perks of AI adoption in the field of medicine can be boundless as it can extend its role by partaking in the clinical decision making process and offering customised medicine. The leading-edge robots can even engage in purposeful exchanges. For all the mounting leverages, the contentious yet compelling issues of patient safety, privacy and ethical challenges that tag AI, remain unaddressed even as guidelines and policies on its utility in the healthcare sector have been lagging. Moreover, a clear picture of what AI can and cannot do to balance the scales of perils and gains, has been lacking [14].

The missing 'trust' factor

Apart from teething issues that healthcare professionals encounter in exploring this innovative medium, large scale adoption of AI in the industry is still wrought with many obstacles and concerns. The imperative discourse between the physicians and patients on understanding the roles of different stakeholders is nowhere to be found. A decisive link between a healthcare provider and the patient is trust. Will robots be able to attain that? Unless they are absolutely banked upon by every collaborator in the health setup from the doctors to patients, the dividends from AI cannot be effectively reaped. Nevertheless, both medical professionals and students must get trained in integrating AI in their work and ensuring sufficient focus on the ethical intricacies and clinical practices [15].

There is a raging debate going on worldwide about the use of robots in old age homes. In a country like Japan where over 23% of the population is elderly and vulnerable, there is a massive crunch in domestic labour. This in turn, has spearheaded unforeseen robotic development. However, robot aides drew a lukewarm reception due to lack of faith establishing that even the most intellectual walking-talking robots cannot supersede the human to human connection. It also proved that the bond goes beyond patient safety and begins by harnessing a state of certitude [16]. Following an international trial which revealed that robots can allay loneliness, machines that initiate conversations, play the favourite music, offer all practical help were planned to be introduced in old age homes in Europe. The prominent judgement on the move has been that it is brutal to set up robots as allies for senior citizens or the ill. Critics have commented that robots cannot provide compassion, a quintessential footing for any caring system and are worse than stuffed toys which have an edge over the former as they provide a tactile connection. Robotic technologies nonetheless, do have the ability to create a momentous impact but filling them in all places, can be redundant and destructive [17].

Legal framework lies ignored

Futurist Gray Scott remarked, "The real question is, when we will draft an artificial intelligence bill of rights? What will that consist of and who will get to decide that?"[18]. Though technological leaps have witnessed an upsurge, the legal framework hasn't been in sync with the breakneck growth in the AI sector. Several legal hassles arise but laws framed to deal with them are still woefully inadequate. Legal standards are significant as they help provide people a larger frame of reference on what they are allowed to do and not do [19]. The draft of the Healthcare Security Act released by the Ministry of Health and Family Welfare provides civil and criminal remedies for data breach. There had also been a proposal for the National Digital Health Authority, which would primarily concentrate on ensuring that data safeguards are in place. The country has proactively promoted the use of AI in healthcare, education and crime prognosis with the National Strategy for Artificial Intelligence of the NITI Aayog and the Report of the Artificial Intelligence Task Force in 2018 [20].

The realm of data dilemmas

AI by default involves exchange of data between patients and healthcare providers, resulting in a large-scale repository of information and algorithms. The network has consistently grown but India continues to lack sufficient regulations on data privacy. This could result in abuse of information outside the settings of AI in the healthcare sector. There is a pressing urgency to formulate guidelines to regulate the incorporation of AI in the healthcare arena.

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Who will be on the hook if the robot makes a mistake?
In a usual scenario, the medical professional is accountable for his/her negligence in the practice and faces penal action. The guidelines for AI however, do not help make that pivotal discretion on the basis of malfunctioning on part of a technology or utilisation of incorrect data. Should the accountability squarely fall on the particular healthcare professional? There is considerable ambiguity in the process of investigating where the glitch lies and pronouncing the extent of responsibility on part of the medical professional [21]. A decisive element that must be considered in this discussion is that robotic systems can operate in ways that are unexpected from their creators. Surgical robots present with serious issues in the law and ethics arena. It is not an unlikely scenario that clinical practices go wrong. What happens when these systems act against their manufacturers? The argument is to treat healthcare robots similar to any other manufactured product and the liability quotients attached to them when it comes to negligence. Only this will include a safety framework that will factor in the design process with utmost concentration on the ethical responsibilities of the manufacturer [22]. In case of an undesirable result during a robotic surgery, the physician, hospital and the manufacturer can be sued [23]. As with any other responsible framework of services, liability is an essential component but such key factors haven't been adequately addressed. Using AI can be deleterious if proper regulations aren't framed.

G.S Bajpai, chairperson of the Centre for Criminology and Victimology, National Law University, Delhi wondered on the course of action by a robot in unexpected situations such as loss of electricity supply and lack of access to the concerned doctor during a robotic surgery. He elaborated how complex circumstances are clouding the criminal laws in the courts of US and Germany where drones had inadvertently wounded another person. For AI to thrive, it must be founded on a strong, clearly spelled out legal framework for deploying AI enabled systems, which is missing in India [24].

#Privacy implications
AI research will inevitably involve large-scale data on genomics and lifestyle. This would then entail to subjects of informed consent and ownership of data [25]. Access to data deserves chief attention in the robotics industry and digital market and privacy is a fundamental right in India. Legal confrontations that arise out of the large aggregation of sensitive data and its protection, sharing, privacy and security must be maneuvered.

Lack of testing standards and robot autonomy
In 2019, the Food and Drug Administration in USA had warned that robotic procedures for cancer patients are neither safe nor evidence based and there was no scientific backing to the claim that they fared better than traditional procedures. In fact, reports revealed that patients of cervical cancer suffered [26]. A standard and clear set of regulations for testing of robots must be enforced with regards to safety, management, among other such consequential aspects. Debates on whether a robot should be controlled or not have been ongoing too. For the same, there is an acute compulsion for a concrete legal definition of AI incorporating its own rights, responsibilities and obligations, wherein the creator or manufacturer must be held accountable for any error in its functioning. Noel Sharkey, emeritus professor of AI and robotics at the University of Sheffield said that it will that be absurd to hold accountable a computer enabled system for a fault, as this will lead to manufacturing companies of AI enabled systems to escaping their responsibilities. Instead, the human faces behind such technology must be held to task [27].

Ethical challenges
Trials without consent on the marginalised
Ethical facets arise with respect to duty, responsibility and accountability of stakeholders from manufacturers, designers, medical staff and the patient. India has a dubious distinction of using the poor and sick persons in the country for clinical drug trials. The country serves as a home ground to both local and international pharmaceutical companies for its low-price clinical trials and sizable representation due to the diversified population. A case in point is the clinical trial of a drug without consent on the Bhopal gas tragedy survivors by a US based pharmaceutical company [28]. Such violations were yet again committed by the Hyderabad based Bharath Biotech on the survivors

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during the phase 3 trial of Covaxin [29]. In 2013, the Supreme Court was informed by the Centre that 'around 2, 644 persons had died in the clinical trial of 475 new drugs during 2005-2012, of which only 17 were approved for marketing in India'[30].

 Marginalised communities continue to be used as guinea pigs by multinational pharmaceutical companies for their trials, without their sanction or preference, whether it is for a drug or AI driven technology. When such information does reach them, such victims are helpless and either forced to opt out of routine medical treatment or give in. In most cases they succumb to such unregulated trials as they have neither the financial leverage nor the awareness. Concerns have also been raised on how technologies are utilising medical records and bodies of the marginalised for machine algorithms. An ethnographic study of AI enabled medical diagnosis conducted in the cities of Bengaluru (Karnataka), Madurai and Thiruppuvanam (Tamil Nadu) during 2016-19 had shown that in many laboratories in these places, diagnostic technologies were being utilised on patients without their approval. Contentions have also been raised that the digital infrastructure of surveillance being built by the Government of India through biometrics and facial recognition technology has been done at the expense of both economically and socially marginalised members of the community such as women, queer-trans communities, persons with disabilities, among others, who are being tracked [31].

AI industry must turn from being exclusive to inclusive

In 2011, IBM's Supercomputer, Watson won the popular US quiz show Jeopardy, following which its fame rose through the roof [32]. Pursuing the legendary win, the former co-partnered with many hospitals for application of AI to cancer care in the USA. It didn't take long for medical professionals to realise that erroneous recommendations in cancer treatment can have threatening end-results. Acing a game show and diagnosing cancer both required different kinds of training as the consequences varied too. They realised that training Watson with what constitutes 80 % of a patient's medical records-unstructured, coded and subjective details on a patient, discharge summaries, notes by doctors, was tougher. AI, on the other hand can excel with repetitive, non-complex tasks like routine eye surgeries, analysis of quantitative data in laboratory results, administrative work but cannot grasp text that is nuanced. It took healthcare professionals and data experts more than seven years to train Watson for a sheer seven types of cancer [33]. Meanwhile doctors in Netherlands and Denmark rejected IBM's signature brand, complaining that Watson's advice was tilted towards American patients and protocols of care [34].

Radhika Radhakrishnan, a feminist researcher in her ethnographic study on AI had alluded that across the world including India, the AI industry is dominated by male, cis, heterosexual, upper class, upper caste engineers, who are quite distant from the actualities of marginalised communities, whose lives they proclaim to revolutionise. It is imperative that we open our eyes to the larger socio-political context in which AI prevails and not just perceive them as technological frameworks. She further argued that "AI for social good" is just a trendy narrative, which in reality ignores the lived experiences of the sick and poor in the design of the AI systems. Further, technology driven decision-making could also be founded on prejudiced data that is hugely influenced by the particular socio-political inferences which in turn, translate into AI tools [35].

AI: the way forward

While it has the potential to harbour extraordinary transformation, the social, ethical and legal applications of AI enabled technology cannot be overlooked. Though AI is a tool, its utilisation squarely is a human preference [36]. With respect to discussions on how it can improve healthcare access to remote locations in the country where there is a massive crunch of skilled medical professionals, it is pertinent to remember that AI at best, can be complementary by enabling swift and efficient delivery of services and not a replacement for skilled professionals. Therefore, the use of AI must be strictly need based than driven by commercially motivated intentions [37]. Although AI is packaged with multiple benefits, it has to be cautiously used. Similar to any other technology, it can have critical implications if not founded on a solid legal framework backed by ethical concerns, both of which cannot be overlooked. Further, AI technology has to be inclusive of the needy and the diverse population of India right from the process of creation
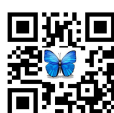
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to the point of its delivery. This could possibly happen only when there is a conscious choice to include in the process, stakeholders from a diverse background who have the lived experiences of the most marginalised in the nation. After all, robotic technology has to be human centric, customised and suited to the essential requirements of the people it aims to serve.

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RESEARCH ARTICLE

Morphological and Biochemical Facets of Arsenic Toxicity on *Vigna mungo* L

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ABSTRACT

A nutritive fodder black gram has great importance for overall health as it has anti-inflammatory properties, liver stimulant increases sperm count, and sperm motility. To study the tolerance mechanism of black gram under a simulated level of heavy, non-essential, and highly toxic arsenic metal (10 mg/L, 20 mg/L, and 30 mg/L), various biochemical parameters such as total amino acid, proline, phenol, reducing sugar, and catalase activity were measured and the changes were compared with control. The result showed more toxicity towards the root system as compared to the shoot system. Experimentally, a higher concentration of arsenic more than 10 mg/L reduced the protein content of the seed and affected all the parameters. Peroxidase activity was found to be slightly increased in experimental plants compare to the control plants. Statistical analysis like one-way and two-way ANOVA also showed the negative impact of heavy metal arsenic subjected to the black gram. Atomic absorption analysis (AAS), which also confirmed the deposition rate of arsenic metals in treated plants of AV88 and T9 cultivar, was more compared to the control plants under a high concentration of toxic arsenic metal.

Keywords: Arsenic, *Vigna mungo*; toxicity, Atomic absorption spectroscopy; Heavy metals; toxicity

INTRODUCTION

Heavy metals are important contaminants in the soil, metal pollution is continuously increasing and the root cause is the anthropogenic behavior that interferes with environmental activities. Metal ions are gaining increased attention due to their importance in mineral nutrition and toxicity studies. In recent years due to environmental pollution from industry, heavy metal toxicity was in great attention. Arsenic is a Vth group element in the periodic table along with

phosphate. Like phosphate, it also has the same carriers during uptake in the root of plasmalemma (Ullrich-Eberius *et al.*,1989; Meharg and Hartley-Whitaker, 2002). Arsenic is carcinogenic as well as mutagenic to the plants and it is also present in a minute amount in the animal (Eisler, 1994). In recent years, the toxicity effect of heavy metal gets more attention due to increasing environmental problems due to agriculture and industrial sources. Bioremediation of arsenic-rich soil is a major problem. Arsenic metal is not essential to the growth of plants and it is phytotoxic (Stoeva *et al.*, 2003). By creating ROS arsenic also induce oxidative stress (Hartley *et al.*, 2001). It also impacts the transport of minerals and readjustment of metabolic processes and growth inhibition (Tu *et al.*, 2003). Arsenic also creates environmental stress where thylakoids where the energy level exceeds the amount that can be dissipated by the metabolic pathways of the chloroplast (Dat *et al.*, 2000). Arsenic predominantly in trivalent (AsIII) and pentavalent (AsV) forms can be absorbed by plants which are interacted with the sulphydryl group and can replacement of phosphate from ATP. Therefore, plants, as well as a crop is grown on arsenic-containing soil show reduced growth, and yield; hence it can be said toxic (Carbonell-Barrachina *et al.*, 1998; 1998; Knauer *et al.*, 1999). It is a great threat to the aquatic and terrestrial plant and animal including human beings (Singh *et al.,* 2007). Heavy metals also create oxidative stress due to free radical generation (Azevedo *et al.*, 2005; Loureiro *et al.*, 2006; Singh *et al.*, 2007; Requejo and Tena, 2005). The major source of soil in arsenic is agricultural fertilizer and pesticides (Mahimairaja *et al.,* 2005). Heavy metals have been reported to reduce the contents of cytokinin probably as a result of hormone breakdown or by enhancing the activity of cytokinin oxidase. Especially short-living plants of the Leguminosae family absorb more metals from soil and are routinely used in phytoremediation. Black gram or urad dal holds a high protein value than most legumes. It is also an excellent source of dietary fiber, isoflavones, vitamin B complex, iron, copper, calcium, magnesium, zinc, potassium, phosphorus which offers several healing health benefits. Apart from the sources of protein for animal beings, pulses also contributing to the nitrogen content of the soil. As in pregnancy, there are a more chances of iron paucity. Black gram is rich in iron content and it helps in production of red blood cells. In such a way, it boosts the energy and fulfills the iron deficiency. Moreover, it is the richest source of vitamins, magnesium, potassium, calcium, phosphorus and fibre content which helps to maintain the cardiovascular system healthy (Girish *et al.*, 2012; Nitin *et al.*, 2012). In addition, it is a good liver stimulant too. Yet, it keeps away from the bone related disease and strengthens the nervous system withal. Ayurveda also prefers blackgram to cure diabetes, facial paralysis, nervous infirmity and for boosting the metabolism. Furthermore, paste of it also gives relief in aching muscles and joints as it can be applied topically on ached part. It brings more oxygenated blood and reduces the oxidative stress as well (Girish *et al.,* 2012; Nitin *et al.,* 2012).

MATERIALS AND METHODS

Seeds Samples and Sterilization
The experiment was conducted with seeds of *Vigna mungo* (L) cultivars T9 and Avani 88 which was procured from Mangalam seed, Palanpur (Gujarat). They were surface sterilized with 0.1% HgCl$_2$ and rinsed with distilled water to avoid any surface contamination. Thereafter, the seeds were sown in the agricultural field of Chhaniyana, Palanpur (24°06'41"N72°31'46"E), Gujarat. The aseptic condition was maintained and they were watered daily for the optimum growth of black gram. The sterilized seeds of two variants were germinated in ground soil with and without treatment of sodium arsenate.

Seed Germination
Uniform seeds of two varieties of black gram germinated were in various concentrations of sodium arsenate (10 mg/L, 20 mg/L, and 30 mg/L) with distilled water as a control in an agricultural field in a triplicate (2m X 2m) area. The germination begins from the 3rd day in both of the cultivars, the data of seed germination was recorded up to 30th d. After 30 days of sowing, percentage root length (cm), shoot length (cm), seedling vigour index, fresh weight (gm), and dry weight (gm) of seedling was recorded.

Germination Percentage

Percentage germination was calculated based on the 30th day by normal seedling growth recorded (Agrawal, 1987) as follows:

S/T X 100

S = number of normal seedlings.

T = Total number of seeds kept for germination

Seedling Fresh and Dry Weight

The seedling was taken to obtain the weight measurement using the single pan balance. Firstly, fresh weight (g) was attained and then it was oven-dried at (50 ± 2^0C). The weight was continuously measured till the weight become constant for measurement for dry weight. Data is based on the average of 5 seedlings from each triplicate.

Seedling Length

It is based on the average length of 5 seedlings of control and sodium arsenate treated at the end of the 30th day of germination in triplicate.

Seedling Vigour Index (SVI)

Seedling vigour index was calculated by Abdul-Baki and Anderson (1973) as follows

SVI = % Germination x Total Seedling Length

Protein Estimation

The total protein of plant parts was estimated according to the procedure described by (Lowry *et al.*, 1951). 0.5 g of leaf sample was taken in 5-10 ml buffer and ground it well with mortar and pestle. Once it milled, centrifuged it and the supernatant was collected for further protein estimation. Here, bovine serum albumin was used as standard. Each tube of sample extract and working standard were made up to 1ml by adding distilled water. A test tube with just 1 ml of deionized water served as the blank. Then, 5 ml of reagent C (2 % Sodium Carbonate in 0.1N Sodium hydroxide and 1% sodium tartrate) added to each tube. Stirred it well and allowed it to stand for 10 min at room temperature. From there on 0.5 ml of Folin-Ciocalteu reagent was added and mixed properly. Later, incubated it at room temperature in dark for 30 min. At last, absorbance was taken at 660 nm against blank using a UV-visible spectrophotometer. The amount of the protein in the sample was assumed after plotting the standard graph.

Total Amino Acid

Total free amino acids were extracted and assessed according to the method described earlier by (Moore *et al.*, 1948). The 0.5 gm of leaf sample homogenized in 80% of alcohol using a pinch of sand in mortar and pestle. The homogenate was centrifuged at 4000-5000 rpm for 15 min and the supernatant was taken. The extraction was repeated two to three times with 5 ml of ethanol and supernatants were combined to make a total 20 ml volume of ethanolic extract. An appropriate volume of it was taken as an aliquot and mixed with 1 ml of ninhydrin solution (0.2 M acetate buffer and 4% ninhydrin in methyl cellosolve). The final volume was made up to 5 ml with distilled water. Each tube was boiled for 15 min and cooled at room temperature. The intensity was read at 570 nm against blank in a colorimeter. The amount of total free amino acids were presumed from the standard plot prepared against leucine (10-100 µg).

Proline Estimation

The leaf sample (0.5 gm) was extracted from control and As treated plants by homogenizing in 10 ml of 3% aqueous sulphosalicylic acid. Homogenate was filtered through Whatman No.2 filter paper. The 2 ml of filtrate was collected in a test tube and to this added 2 ml of acid-ninhydrin and 2ml of glacial acetic acid. The reaction mixture was heated in a boiling water bath for 1 h. The reaction was terminated by placing the test tubes in an ice bath. Thereafter, 4ml of toluene was added to the mixture and stirred for 20-30 sec. It was allowed to settle down. Biphase appeared in the

mixture. Thus, the toluene layer separated and warmed at room temperature. Lastly, absorbance was measured at 520 nm against a blank. The amount of proline was calculated from a standard plot prepared against L-Proline. (Bates *et al.*, 1973)

Proline quantity can be calculated by the formula as follows:

[µmoles of proline / g tissue = (µg proline per ml × ml toluene)/115.5 × (5 /g of sample)]

where 115.5 is the molecular mass of proline.

Phenol Estimation

The total content of phenol was estimated by the following procedure described by Swain and Hillis (1959). 0.5 to 1 g of leaf sample was homogenized in 10 ml of 80% ethanol. Centrifuged it at 10,000 rpm for 20 min. Re-extracted the residue with 5 ml of 80% ethanol and allowed it to evaporate at room temperature. Then the residue was diluted with 5 ml distilled water. This reaction mixture was taken as diverse aliquots and total volume made up to 3 ml. 0.2 ml of FCR reagent added to each tube and incubated at room temperature for 3 min. Later, each one was mixed with 2 ml of saturated 20% Na_2CO_3 and heated by placing it in a boiling water bath for 1 min. The readings were measured at 560 nm in a UV-visible spectrophotometer. Here, the amount of total phenol was obtained from the standard curve prepared against catechol.

Reducing Sugar

Amount of reducing sugar estimated by the DNS method given by Miller (1959). 0.1 g of leaf sample homogenized in hot 80% ethanol and centrifuged. The residue was extracted twice with 5 ml of ethanol each time. Supernatants were combined to make a total 20 ml volume and allowed to evaporate by placing them in a boiling water bath at 80 °C. Sugar was dissolved by adding 10 ml of distilled water. 1ml of aliquot was taken and mixed with 1 ml DNS reagent. The mixture was heated in a boiling water bath for 10 min. 8 ml of distilled water added to make a final volume of 10ml which resulted in a red coloured solution and it was measured at 540 nm in a spectrophotometer. Total reducing sugar content was assessed by a standard curve prepared against glucose (0-500 µg).

Catalase

The catalase activity was assayed using the method of Braber (1980). A smooth pulp of leaf sample (1.0 g) was prepared with 0.1 M phosphate buffer (pH 7.0) in a prechilled mortar and pestle. The sample was centrifuged at 15,000 rpm for 30 min at 4 °C. The collected supernatant was used as an enzyme source. Then, 1 ml of enzyme extract, 2ml of H_2O_2, and 3 ml of phosphate buffer were taken in a test tube. Mixed it well and incubated at 20 °C for 1 min. Thereafter, the reaction was terminated by adding a 10ml of 0.7N H_2SO_4. At last, it was titrated with 0.01N $KMnO_4$ until a faded purple colour lasts for at least 15sec. Blank was prepared by adding the enzyme extract to an acidic solution of the reaction mixture at zero time.

Peroxidase

Peroxidase activity was analysed according to the method described by Braber (1980). It was assayed at 25 °C. Initially, 3.0 g of leaf sample was taken in 10ml of 0.1mM pre-chilled phosphate buffer to homogenized using mortar and pestle. The mixture was sieved using the muslin cloth (2 folds). Centrifuged it at 8000 rpm for 20 min at 4°C. The obtained supernatant was used for the enzyme activity. The well-diluted leaf extract (0.1ml) was mixed with 1 ml of 0.1 M guaiacol and 0.2 ml of 1% H_2O_2. Hydrogen peroxide was neglected for blank. To initiate the reaction, enzyme extract was added, and to terminate the reaction, 1 ml of 2N H_2SO_4 was added. The absorbance was measured at 420 nm.

Atomic Absorption Spectroscopy (AAS)

Heavy metal analysis in leaf was obtained by atomic absorption spectroscopy (AAS). For that, each sample as arsenic10 mg/L, arsenic 20 mg/L, and arsenic 30 mg/L treatment along with control of all the three varieties was

planted for 30 d and then 10 g of leaves samples of each one were analyzed in AAS. Here in this study, AAS analysis was carried out in Gujarat Lab, Ahmedabad.

Statistical Analysis

The data were interpreted by one-way and two-way analysis of variance (ANOVA) followed by Duncan multiple comparisons ($P < 0.05$) (Duncan, 1955) based on SPSS software (SPSS for Windows 20.0, SPSS Inc., USA).

RESULTS AND DISCUSSION

The plants are prone to stress and react accordingly. The growth of the plant was expressed in terms of height. Poor growth was observed in arsenic metal stressed plants compared to control. The significant difference over control was recorded in all growth parameters of black gram seedlings. Decreased in shoot length, root length, fresh weight, and dry weight of seedling of all black gram cultivars. It may be due to the deposition of arsenic in seeds. Hartley (2001) reported that the root and shoot length of plants decreases when plants get associated with higher arsenic concentration. Previous studies showed that arsenic in higher concentrations severely affected the germination, growth, and yield of many plants such as black gram (Chidambaram *et al.*, 2006), tomato (Purohit *et al.*, 2003). Likewise, with high concentrations of copper, the root and shoot of the bean plant has shown poor elongation with a concomitant decrease in root and shoot length (Bouazizi *et al.*, 2008; Ahsan *et al.*, 2007).

Germination Percentage

Arsenic exposure has significantly affected the normal growth and development of black gram plants. Germination percentage decreased with increasing heavy metal concentrations in these two cultivars. Seed germination rate under heavy metal sodium arsenate was found lowest at the range of 30 mg/L (64.66 % and 62 %) in T9 and AV88 varieties of black gram respectively. It was decreased with sequence of 10 mg/L < 20 mg/L < 30 mg/L concentration in sodium arsenate. The untreated seeds showed a germination rate after 30 days which was better as compared to all the sodium arsenate treatments in both cultivars (Table 1). Similar results have been observed in *Triticum aestivum* and *Cucumis sativus* (Munzuroglu and Geckil, 2002), *Nigella sativa,* and *Triticum aestivum* (Shri *et al.*, 2009) where the seed germination has been delayed. The reason could be the ionic toxicity, osmotic effect, and the alterations of selective permeability properties of the cell membrane as shown in the seed germination process in *Parkinsonia aculeate* L., *Pennisetum americanum*, and *Vigna mungo* (Shaukat *et al.*, 1999).

Seedling Length, Fresh and Dry Weight

In the case of black gram seedling length, fresh and dry weight results showing that the high concentrations of arsenic affect the germination, growth, and yield of black gram plants. As compared to AV88, T9 cultivar affected more with the arsenic concentration in context to seedling length, fresh weight, and dry weight. It was gradually decreased with increasing the concentration of arsenic 10 mg/L < 20 mg/L < 30 mg/L (Table 1). Germination is a complex phenomenon, which involves several physiological and biochemical changes leading to the activation of embryonic tissue that includes various physiological and morphological events such as imbibitions and absorption of water, hydration of tissue, O_2 absorption, enzymes activation and digestion, transport of hydrolyzed molecules of embryo axis, increase in respiration and assimilation, initiation of cell division, elongation emergence of the embryo (Wierzbicka and Obidzinska, 1998). The number of plants that show reduced root and shoot length in exposure to heavy metal is mung bean (Nag *et al.*, 1989), *Oryza sativa* (Zhang *et al.*, 2009), *Brassica juncea* (John *et al.*, 2009). Oxidative stress, low water potential that hampers nutrient uptake and leads to the reduction in seedling growth. (John *et al.*, 2009).

Seedling Vigour Index (SVI)

This method has been to evaluate the phytotoxicity index to evaluate the effect of heavy metal toxicity on seedling growth. Since both the germination percentage and seedling length were drastically decreased as the concentration

of sodium arsenate increased, the SVI also followed the same trend (Table 1). The value of SVI ascertained that Avani 88 was more affected compare with T9. These results reflected its response towards the toxicity level of sodium arsenate towards its seeds and later on seedlings.

Protein Estimation

The total protein content depends on the building blocks of amino acid binding. Once the seed germination leads to the seedling stage and further develops into plantlets the plants require proteins. In the case of external stress i.e. metal stress gives an impact on protein synthesis. It is indicated in the results of sodium arsenate treated plants. The exposure of sodium arsenate i.e. 10 mg/L, 20 mg/L, and 30 mg/L on both the cultivars reduced the level of proteins. Among them, cv. T9 produced a better protein content than the AV88 although it was not better than the control plants. The control plants contributed the best 0.59 µg/ml protein after 30days in T9 as compared to AV88 with a value of 0.58 µg/ml protein (Table 2). This indicates the impact of the metal stress on black gram. These values are significant at $P<0.05$ level (Table 3). Such type of protein damages have already been observed in *Pisum sativa* (Singh *et al.,* 2015), *Oryza sativa* (Sanglard *et al.,* 2016) and *Brassica juncea* (Kanwar and Bhardwaj, 2015) etc. by the inoculation of arsenic.

Total Amino Acid Estimation

The estimated total amino acids in both the control and treated plants gradually decrease. The assimilate partitioning process initiates as the number of days progresses in the plants and is converted into proteins. The total amino acids content obtained after 90 days in the untreated plants (640 µg/g and 637 µg/g) were more as compared to the 10 mg/L sodium arsenate treated black gram plants (607 µg/g and 590 µg/g) in cv. T9 and AV88 respectively (Table 2). These values further down in the 20 mg/L and 30 mg/L sodium arsenate treated both the cultivars of black gram plants. The two-way ANOVA also confirms these results with a significance level of $P<0.05$ (Table 3). Even individual amino acids such as drastically fall in the levels of Val, Trp, Thr, Met, Lys and Pro with the impact of arsenic in *Cicer arietinum* (Malik *et al.,* 2011). The same is the case in *Oryza sativa* when arsenic has shown its toxic fetaures (Dwivedi *et al.,* 2012).

Proline Estimation

Proline is a heterocyclic amino acid found abundantly in basic proteins. Free proline in plants is said to play an important role under induced, cold, drought, salt, and pathological stress conditions. Once the black grams were treated with the sodium arsenate, is reflected in the results of proline. A gradual increase in the amount of proline noticed in all three metal treated plants. The maximum value of proline was observed in 30 mg/L (i.e. 2.44 µg/g) followed by 20 mg/L, 10 mg/L, and the controlled T9 and AV88 cultivars of black gram plants (Table 2). Similar level of proline increment has been observed while 100 µM arsenate applied on blac gram (Srivastava and Sharma 2013). The enhancement in proline content has also been found in rice (Begum *et al.,* 2016) , brinjal (Pandey and Gupta, 2015), wheat (Hasanuzzaman and Fujita, 2013) etc. The two-way ANOVA table (Table 3) gives an indication of significant value at $P<0.05$ while considering the sodium arsenate and day combination. It also ascertained that cv. T9 is better adopted as compared to the AV88 cultivar of black gram.

Phenol

Phenol is an important aromatic compound that plays a crucial role in plant defense systems. The appearance of phenol in the plants is a secondary goal. Plants prefer to produce phenol in response to any stress provided to plants. In this study, stress came from the three different concentrations of sodium arsenate. This was revealed in its results since the highest value of 4.84 mg phenols/100g material in T9 while in AV88 it was 4.79 mg phenols/100g material with the exposure of 30 mg/L of sodium arsenate to the black gram plants. At the same time, a less concentration of the same metal i.e. 10 mg/L produces 3.78 mg phenols/100g material in T9 (Table 2). Moreover, the control showed the least amount of phenol (0.59 and 0.58 mg phenols/100g material respectively in cv. T9 and cv. AV88) in contrast

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to other sodium arsenate toxicity. This confirms that metal toxicity is not acceptable by the plant rather reject by the production of phenols. These results are concomitantly visualized significance value at P<0.05 (Table 3).

Reducing Sugar

Black gram is enriched with both reducing and non-reducing sugars. Here we had been focused to find out the effect of arsenate exposure on reducing sugar concentration in plants. What we find out is that as the concentration of sodium arsenate increased from 10 mg/L, 20 mg/L, and 30 mg/L, the amount of reducing sugar decreased as displayed in (Table 2). Among these three concentrations of metal, 10 mg/L was the least hampered. The reducing sugar amount in it was 1190 mg/100ml in cv. T9 while it was 1145 mg/100ml in cv. AV88 black gram (Table 2). Reducing sugars are mostly monosaccharides such as glucose, fructose, galactose along with a few disaccharides maltose, lactose, and cellobiose. Plants need more reducing sugars for their rapid use and also try to make certain defense products during stress conditions. Thus, with the onset of the metal toxicity, the reducing sugar levels down and it is being utilized by the plants. That's why the untreated plants did not show less reducing sugar as compared to the treated plants. The F values in Table 3 gives an indication of significance in both the cultivars at P<0.05. Under arsenic toxicity, the level of reducing sugar drastically reduces in rice seedlings (Jha and Dubey, 2004).

Catalase Activity

The catalase activity is important when we are looking for the toxicity effect of heavy metal on plants, as we know that number of metals is associated with the enzymes and impact on their activity. As the concentration of sodium arsenate increased from 10 mg/L to 30 mg/L the catalase activity started showing its effect as observed in Table 2. The highest catalase activity was shown by 30 mg/L sodium arsenate treated cultivars (4.41 and 4.39 nmoles of H_2O_2 used/min/g weight of sample respectively in cv T9 and AV88 respectively) i.e. it was facing the highest toxicity level. The enzyme present in cotyledons and endosperm is reduced during exposure to heavy metals. Hydrolysis of food reserves takes place during seedling growth which is carried out by hydrolytic enzymes. So, the activities of hydrolytic enzymes might be affected. Food did not reach the radical and plumule leading to the reduction in seedling growth in pea (Mihoub *et al.*, 2005), rice (Ahsan *et al.*, 2007). Thus here, the entire two legume seedling shows the lower seedling length and dry weight accumulation under heavy metal stress. Table 3 justifies the above results at P<0.05.

Peroxidase Activity

As discuss the role and the impact of catalase activity in black gram plants, similar things more or less occur in the case of peroxidase activity under the exposure of sodium arsenate 10 mg/L, 20 mg/L, and 30 mg/L respectively, as described in Table 2 the trends shows that when we increased the concentration of arsenate peroxidase activity gradually increases. Since the control plants did not face the toxicity level, it shows less peroxidase activity i.e. 2.36 and 2.34 units/min/mg protein respectively in cv T9 and cv AV88 (Table 2). But, the highest activity of peroxidase (6.59 and 6.49 units/min/mg protein in cv T9 and cv AV88 respectively) was observed in 30 mg/L sodium arsenate treated black gram. Earlier study of Srivastava and Sharma (2013) in black gram also reveals the higher level of peroxidase activity by the introduction of arsenic toxicity.

Atomic Absorption Spectroscopy (AAS)

The technique makes use of the atomic absorption spectrum of a sample to assess the concentration of specific analytes within it. Here we have checked the concentration of arsenic in black gram plants of two cultivars (Avani 88 and T9). The concentration of arsenic obtained in control versus T1, T2 and T3 in Avani 88 and T9 was 0.15 mg/Kg 0.19 mg/Kg 0.28 mg/Kg 0.38 mg/Kg and 0.16 mg/Kg, 0.25 mg/Kg 0.42 mg/Kg 0.65 mg/Kg respectively (Table 4). Since, after the treatment of sodium arsenate in black gram, this must enter into the plants and show its toxicity level. As the highest value was observed by the 30 mg/L concentration, definitely it gives an impact on both morphological and physiological parameters, and the same happened in both the cultivars of black gram.

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The present study reveals that the presence of heavy metal impacts seeds germination in these two varieties of black gram (T9 and Avani 88). Seed germination is of vital importance for the continuation of plant life and at this early stage, heavy metal toxicity to seed directly or indirectly affects crop stand and ultimately production. In these experiments, the concentration of sodium arsenate increases from 10 mg/L to 30 mg/L which increases both the catalase and peroxidase activities as compared to control. In context to protein content, proline content, phenol content, and reducing sugar the amount decreases as the concentration of sodium arsenate increases. But, overall both the cultivars showing a tendency of survival during these arsenate toxicity levels. That's a good sign for these two cultivars. Therefore, it can be recommended for these two cultivars of a black gram to the farmers where arsenate toxicity level is higher in soil.

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Abbreviations
ANOVA- Analysis of Variance; cv – cultivar; $HgCl_2$- Mercuric chloride

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Table 1. One-way ANOVA of different morphological parameters in mean ± standard deviation (Seedling length, Seedling fresh weight, Seedling dry weight, Seedling Vigour and Germination percentage). The different alphabets after mean ± standard deviation are significantly different at $P<0.05$ according to Duncan's multiple range test (Duncan 1955)

Treatmnt (Sodium Arsenat)	Seedling Length (cm)		Seedling Fresh weight (g)		Seedling Dry weight (g)		Seedling Vigour Index (SVI)		Germination (%)	
	T9	**AV88**	**T9**	**AV88**	**T9**	**AV88**	**T9**	**AV88**	**T9**	**AV88**
Control	12.2±0.008a	12.16±0.005a	0.29±0.005a	0.28±0.005ab	0.07±0.005a	0.057±0.003b	919.6±0.88a	900±1.15b	96.66±1.76a	96.00±2.3a
10 mg/L	11.95±0.008b	11.8±0.057c	0.28±0.005ab	0.26±0.005cd	0.073±0.005a	0.041±0.0005	895±0.57c	865±0.57	77.33±1.76c	84.33±1.76b
20 mg/L	11.7±0.011cd	11.6±0.057d	0.27±0.005bc	0.25±0.005d	0.063±0.001b	0.040±0.001c	784.3±1.2d	785±0.57d	70.00±2.3d	73.00±1.15cd
30 mg/L	11.4±0.011 e	10.9±0.057 f	0.25±0.005d	0.23±0.005e	0.041±0.0005c	0.039±0.0008c	765.6±1.2e	696±0.57f	64.66±2.02e	62.00±1.73e

Table 2. One-way ANOVA of different biochemical parameters [Protein (µg/ml), Total amino acid (µg/g), Proline (µg/g), Phenol (mg phenols/100g material), Reducing sugar (mg/100ml), Catalase (nmoles of H_2O_2 used/min/g weight of sample) and Peroxidase (units/min/mg protein)]. The different alphabets after mean ± standard deviation are significantly different at $P<0.05$ according to Duncan's multiple range test (Duncan 1955).

Sodium arsenate	Days	Protein		Total amino acid		Proline	
		T9	**AV88**	**T9**	**AV88**	**T9**	**AV88**
0 mg/L	0	0.55±0.008ij	0.54±0.11j	655±2.88no	654±1.2mn	0.61±0.005p	0.65±0.008nop
	30	0.56±0.095k	0.55±0.005ij	651±2.08o	650±1.52n	0.62±0.003op	0.66±0.005no
	60	0.58±0.005hij	0.57±0.005ij	649±2.88m	647±1.15n	0.65±0.005nop	0.62±0.012op
	90	0.59±0.005hij	0.58±0.005hij	640±1.150	637±1.45m	0.69±0.005n	0.65±0.005nop
10 mg/L	30	0.43±0.014ghi	0.41±0.008fgh	621±5.04l	601±0.88j	1.09±0.011m	1.03±0.003l
	60	0.46±0.005efgh	0.44±0.005defg	617±1.15k	598±0.57i	1.2±0.012l	1.12±0.057k
	90	0.49±0.005cdefg	0.48±0.003cdefg	607±2.88i	590±0.57h	1.27±0.017jk	1.22±0.008jk
20 mg/L	30	0.38±0.015cdefg	0.37±0.003cdefg	557±1.15g	552±1.45d	1.36±0.008i	1.25±0.008h
	60	0.39±0.003cdefg	0.38±0.005cdefg	549±0.57f	547±0.57e	1.45±0.005h	1.36±0.017g
	90	0.47±0.008bcde	0.45±0.003abcd	546±0.88e	541±0.57f	1.48±0.005h	1.38±0.005g
30 mg/L	30	0.37±0.005abcd	0.31±0.003	539±2.08c	529±2.9b	2.20±0.008f	2.11±0.005e
	60	0.39±0.005abc	0.34±0.005abcd	532±1.2b	517±2.18a	2.34±0.005d	2.29±0.015c
	90	0.41±0.005ab	0.46±0.005a	529±0.88a	509±0.57b	2.44±0.012b	2.38±0.015a

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Sodium arsenate	Days	Phenol		Reducing sugar		Catalase		Peroxidase	
		T9	AV88	T9	AV88	T9	AV88	T9	AV88
0 mg/L	0	2.95±0.017kl	2.92±0.005k	1208±5.77cd	1200±3.17bcd	3.55±0.008fg	3.49±0.005gh	2.14±0.051p	2.11±0.011q
	30	2.97±0.008k	2.95±0.017kl	1216±4.4cd	1201±3.05bc	3.52±0.011def	3.51±0.005hij	2.17±0.012q	2.13±0.003q
	60	3.07±0.003k	2.99±0.095l	1260±5.77ab	1250±2.88a	3.79±0.008b	3.70±0.008a	2.28±0.005n	2.26±0.005pq
	90	3.15±0.008k	3.07±0.005k	1276±6.0a	1273±1.76a	3.89±0.02cde	3.80±0.015bc	2.36±0.008o	2.34±0.005o
10 mg/L	30	3.74±0.008hi	3.66±0.011fg	1170±2.88f	1145±0.88def	4.40±0.017hij	4.30±0.005cd	3.55±0.005l	3.47±0.005m
	60	3.75±0.005ghi	3.70±0.005fg	1180.3±1.85ef	1151±0.88cdef	4.52±0.02cd	4.45±0.005b	4.55±0.005i	4.45±0.013k
	90	3.78±0.005fgh	3.73±0.005f	1190±2.08def	1169±1.15cde	4.71±0.055ijk	4.60±0.014de	4.59±0.008j	4.51±0.008jk
20 mg/L	30	4.12±0.015d	4.02±0.017c	918±7.85jk	915±7.26jk	4.41±0.021n	4.30±0.005e	5.13±0.012h	5.01±0.005g
	60	4.21±0.014c	4.12±0.012b	980±11.93g	972±1.15h	4.56±0.008jkl	4.44±0.02ef	5.32±0.008e	5.22±0.005
	90	4.32±0.015ab	4.27±0.017a	1062±3.5g	1053±3.05g	4.61±0.011hi	4.55±0.005fg	5.42±0.008f	5.30±0.005e
30 mg/L	30	4.65±0.005e	4.58±0.017i	870±2.88l	855±1.15l	4.21±0.008o	4.20±0.005o	6.26±0.012b	6.13±0.008d
	60	4.76±0.008	4.73±0.005fg	940±6.73kl	883±1.15ij	4.32±0.011n	4.28±0.008lm	6.46±0.00a8	6.33±0.008c
	90	4.84±0.008j	4.78±0.012e	970±2.08h	961±0.88h	4.41±0.012lm	4.39±0.005klm	6.59±0.02b	6.45±0.005b

Table 3. Two-way ANOVA showing different biochemical parameters (Protein, Total amino acid, Proline, Phenol, Reducing sugar, Catalase and Peroxidase) with the treatment of sodium arsenate. *Significant at P<0.05

Source	df	Protein				Total Amino Acid				Proline				Phenol			
		Mean Square	F	Mean Square	F	Mean Square	F	Mean Square	F	Mean Square	F	Mean Square	F	Mean Square	F	Mean Square	F
		T9		Avani 88		T9		Avani 88		T9		Avani 88		T9		Avani 88	
Corrected Model	12	0.021	9.107	0.015	134.678	15660.231	1021.31	14943.000	2590.12	1.166	4593.955	1.247	1166.547	0.681	1995.649	0.786	314.550
Sodium Arsenate	3	0.060	26.322	0.042	372.962	54478.991	3552.97	51458.889	8919.541	4.101	16155.290	4.441	4153.051	2.177	6383.641	2.634	1053.603
Time Period	3	0.010	4.456*	0.005	42.045*	554.241	36.14*	34.278	5.941*	0.055	215.270*	0.029	26.904*	0.001	2.704*	0.031	12.524*
Sodium Arsenate * Time Period	6	0.002	1.005*	0.000	3.176*	228.935	14.93*	201.806	34.980*	0.007	25.694*	0.009	8.203*	0.044	129.859*	0.007	2.825*
Error	26	0.002		0.000		15.333		5.769		0.000		0.001		0.000		0.002	
Total	39																

Source	df	Reducing Sugar				Catalase				Peroxidase			
		Mean Square	F	Mean Square	F	Mean Square	F	Mean Square	F	Mean Square	F	Mean Square	F
		T9		Avani 88		T9		Avani 88		T9		Avani 88	
Corrected Model	12	61752.368	54.59	61370.786	2641.789	0.063	49.34	0.079	269.317	8.781	9433.68	8.611	47299.20
Sodium Arsenate	3	212749.407	188.08	213788.481	9202.815	0.174	136.83	0.156	527.762	28.913	31064.05	28.342	155680.87
Time Period	3	15771.324	13.94*	14578.093	627.534*	0.036	28.63*	0.170	577.972	0.453	487.05*	0.478	2624.77*
Sodium Arsenate * Time Period	6	2503.269	2.21*	2300.843	99.043*	0.015	12.11*	0.005	17.720*	0.158	169.44*	0.169	926.560
Error	26	1131.128		23.231		0.001		0.001		0.001		0.000	
Total	39												

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Table 4. Atomic Absorption Spectroscopy analysis confirms the presence of heavy metal Sodium Arsenate ($Na_2HAsO_4.7H_2O$) in leaf of black gram cultivars.

Sr. No.	Varieties	Treatment $Na_2HAsO_4.7H_2O$ (mg/L)	Results (mg/Kg fresh wt)
1	Avani-88	Control	0.15
	Avani-88	T1	0.19
	Avani-88	T2	0.28
	Avani-88	T3	0.38
2	T_9	Control	0.16
	T_9	T1	0.25
	T_9	T2	0.42
	T_9	T3	0.65
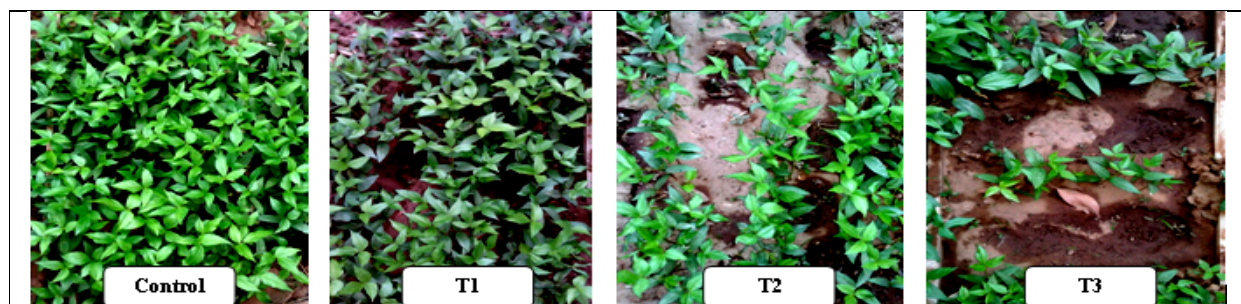
Figure 1. Black gram (cv AV 88) after 30 days of seedling germination, where control (without external exposure of arsenic) and with sodium arsenate treatments
T1 (10mg/L), T2 (20mg/L), and T3 (30mg/L).
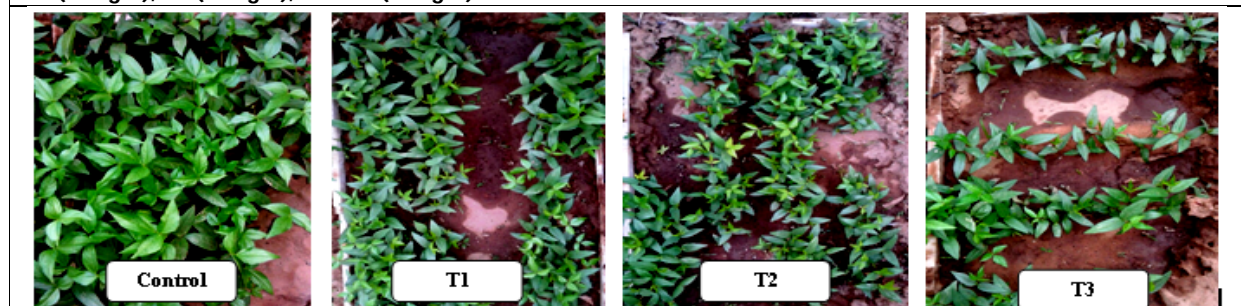
Figure 2. Black gram (cv T9) after 30th days of seedling germination where control (without external exposure of arsenic) and with sodium arsenate treatments
T1 (10mg/L), T2 (20mg/L), and T3 (30mg/L).

RESEARCH ARTICLE

Assessment of an Industrial Effluents and Heavy Metals Present in and Around Dindigul District

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ABSTRACT

The natural aquatic systems may comprehensively be polluted with heavy metals unrestricted from domestic, industrial and other man-made activities. Heavy metal contagion may have demoralizing effects on the ecological steadiness of the receiver environment and a diversity of aquatic organisms. Among animal species, fishes are the inhabitants that cannot escape from the detrimental effects of these pollutants. Industrial effluents came out from the industries in and around the Dindigul district contains the heavy metals such as Iron (Fe),Arsenic (As), Aluminum (Al),Lead (Pb), Cadmium (Cd), Mercury (Hg), Copper(Cu), etc., which in higher amount may contaminate ground water and other resources. These may enter in the consumption and the excess intake of these harmful heavy metals enters into the human body either directly or through our food and other things cause hazardous effects such as many characteristic diseases according to the metals. Now we must improve the methods of filtering these harmful effluents containing heavy metals which are disease carriers from the industries to protect the people and environment. Even the minimal amount of heavy metals may consideration harmless but in future the effluents left in the soil affects ground water and contaminate soil. The agricultural yields from these heavy metal contaminated soil may cause serious health hazards. So the proper recovery and effluent management should follow to protect environment.

Keywords: Heavy metal, Industrial Effluents, hazards

INTRODUCTION

Heavy metals from industrial processes are of special concern because they produce water or chronic poisoning in aquatic animals[1]. Heavy metals are not biodegradable and tend to be accumulated in organisms and cause numerous diseases and disorders[2]. Industrial development results in the generation of industrial effluents, and if untreated results in water, sediment and soil pollution[3]. The presence of any toxic substance in water that degrades the quality to constitute a hazard or impair its usefulness[4]. Once the groundwater is contaminated, its quality cannot be restored by stopping the pollutants from the source.[5] It therefore becomes imperative to regularly monitor the quality of groundwater and to device ways and means to protect it.[6] Water quality index is one of the most effective tools [7,8]. Human health is threatened by most of the agricultural development activities particularly in relation to excessive application of fertilizers. In the face of increasing food demand of the burgeoning population, efficient fertilizer use in crops and the prevention of ground water pollution are critical [9]. Water is not only a vital environmental factor to all form of life, but also it has a great role to play in socio-economic development of human population [10].

The metals associated with particulate material are also available for biological uptake[11]. Out of 17 most important heavy metals Fe, Cu, Mo, Mn are classified to have low toxicity , Zn, Ni, V, Co, W, Cr are categorized to have average toxicity, while As, Ag, Sb, Cd, Hg, Pd, U are grouped in highly toxic heavy metals [12]. Among the pollutants which are discharged in to water bodies, heavy metals are of most concern because other pollutant may be degraded by some microorganisms but metals cannot be degraded. Some heavy metals are purely toxic with no known role [13]. Toxic pollutants may percolate down via soil profile and reach in groundwater, which ultimately cause the health hazards among human being and livestock after consumption as daily drinking requirements[14]. Ground water contaminated by textile effluents, has impact on agriculture irrigation, drinking utilities, soil and agricultural systems [15].Heavy metal contamination may have devastating effects on the ecological balance of the recipient environment and a diversity of aquatic organisms[16].The treated and untreated waste effluents from different industries contain toxic metals as well as chelates [17].

 Heavy metals normally occurring in nature are not harmful to our environment because they are only present in very small amounts[18]. Human beings can be exposed to heavy metal ions through direct and indirect sources like food, drinking water, exposure to industrial activities and traffic [19]. Contaminants such as bacteria, viruses, heavy metals, nitrates and salt have found their way into water supplies due to inadequate treatment and disposal of waste (human and livestock), industrial discharges, and over-use of limited water resources[20].

Scope of Study
The study of industrial effluents and heavy metals present in and around the Dindigul district helps us to protect our lives by analyzing the hazardous effects caused by these substances. This may improve the interest on progressing knowledge about the industrial effluents and paves the path for developing proper management methods for reducing the harmful effects of heavy metals came out from industries. Formation of new diseases by heavy metals such as mina matai,.etc. were prevented by proper analysis and management methods. Due to increasing population and increased growth of industries cause more amount of effluents which contains more hazardous heavy metals may affect environment and human health. Therefore, Now a days the study of industrial effluents and heavy metals present is very essential for protecting environment.

Effect of Heavy Metals
The presence of heavy metals such as Iron (Fe),Arsenic (As), Aluminum (Al),Lead (Pb), Mercury (Hg),Copper(Cu) may cause following effects.

MATERIALS AND METHODS

Collection of Samples
Industrial effluent samples were collected from in and around Dindigul district, in sterile bottles from five different sites . Samples were transfer aseptically and processed immediately in laboratories.

Atomic Absorption Spectroscopy (AAS)
In 1954 Alan walsh constructed this method spectroscopy who was the CSIRO Scientist.

Principle
In atomic absorption spectroscopy the free atoms present in the ground state absorbs light of certain wavelength and these absorption of wavelength is specific ,therefore no other elements absorb this wavelength. The industrial effluents samples in and around the Dindigul district were taken and then analyzed the types of heavy metals present in the samples and the amount of heavy metal level were analyzed with the help of atomic absorption spectroscopy.

Procedure
The samples of industrial effluents which collected from various areas of Dindigul district are taken and then prepared well for analysis. The hallow cathode lamp is taken and coated with selective analyzing metal in cathode and the tungsten wire act as anode. The hallow cathode lamp is filled with inert gases. When the potential of about 500-1000V is applied ,the positively charged atoms move towards cathode and the fast moving ions strike the cathode surface and remove the metal atoms is called sputtering .The element coated in cathode gets ionized and excited with emission of radiation at particular intensity and that passes through the chopper. The intensity reaches the flame which formed by the oxidants and fuel.

The sample of industrial effluents made into small droplets by the nebulizer and these droplets passed into the atomizer. The atomizer made droplets into vaporized atoms and ions by graphite furnace. These atoms and ions absorbs the intensity of radiation came from the hallow cathode lamp and this decreases the intensity of emitting radiation. This intensity noted shows the amount of elements present in sample. The concentration can be determined by the amount of absorption. These atoms either absorbs visible or ultraviolet light and make the transitions into higher electronic energy states. Then the radiation of decreased intensity passed into the monochromator for selection of specific light. Then the light passes through slits or focusing lens to form fine beam and reached the photo multiplier tube. The photomultiplier which converts the light signals and radiations into the electrical intensity. Then the observed electrical intensity is proportional to the light intensity. Amplifier helps to observe the electrical signals to detect the intensity of light. These signals are noted with data in the data station. Every element contains certain characteristic sensitivity limits. Plot the graph of concentration against the absorbance reading to find out the concentration of the elements such as heavy metals present in the industrial effluent samples.

The intensity of this emitted radiation or light is proportional to the concentration of the elements such as heavy metals present in the industrial effluent samples. The following processes involved in the atomic absorption spectroscopy:
➢ Hallow cathode tube coated with the metal which we want to detect and tungsten act as anode and tube filled with inert gas.
➢ When 500-1000V electricity applied sputtering process occurs and emit radiation after excitation of atoms occurred.
➢ Desolvation is the process of drying the effluent samplesolution and the metals in sample are dehydrated by heat of flame and solvent is evaporated on heating.

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➤ Vaporization involves in evaporation of solvent to dehydrate metal particles in sample.
➤ Atomization involves in separation of chemical substances and convert the solid particles into atoms and ions.
➤ Excitation of atoms and ions with absorption of particular amount of energy from ground state to excited state.
➤ Emission of energy in the form of radiation when excited atom in the comes to ground state energy level due to unstable excited state energy level.
➤ Radiation intensity is decreased with the absorption radiation by characteristic metals to be calculated .
➤ The intensity of light is detected by the help of photomultiplier and it converts into electrical signals.

The intensity of radiation is calculated and the wavelength also recorded and analyzed the elements in the form of electrical signals. By this method the heavy metals in the industrial effluents is analyzed from samples collected in and around the Dindigul district.

RESULTS AND DISCUSSION

The amount of heavy metals that present in the industrial effluent in the Dindigul district is observed and by the qualitative analysis the metals such as Iron (Fe),Arsenic (As), Aluminum (Al),Lead (Pb), Mercury (Hg),Copper(Cu) are observed and quantitatively the amount of heavy metals in industrial effluents were observed which differs in different areas of analysis. Even though the heavy metals in these effluent samples are minimal in amount , these affect pure water and may cause hazardous effects to environment also. So the heavy metals from these effluents should be prevented from mingling in the environment by using the sedimentation , ultra filtration method ,chemical precipitation method or coagulation method. These may selectively separate the heavy metals and some impurities present in the Industrial effluents in and around Dindigul district.

Chemical Precipitation Method

In removal of heavy metals from the industrial effluents, Chemical precipitation helps to convert the materials such as ions, heavy metals and other substances into the solid precipitate and removed from water. Both the anionic impurities such as fluoride, phosphate, etc., and the cationic metal impurities present in the industrial effluents are removed by chemical precipitation method in the formation of solid precipitates by adding the reagents. This method also helps in the precipitation of organic molecules.

 The heavy metals were removed by formation of precipitates from the soluble salts of Iron (Fe),Arsenic (As), Aluminum (Al),Lead (Pb), Mercury (Hg),Copper(Cu),cadmium(Cd) and then recovered by filtration process. There are many types of precipitations involved in anionic and cationic substances removing process from industrial effluents. These are sulphide precipitation, cyanide precipitation, carbonate precipitation, hydroxide precipitation methods. Therefore the heavy metals such asIron (Fe),Arsenic (As), Aluminum (Al),Lead (Pb), Mercury (Hg),Copper(Cu) were removed by this method to protect environment from the pollution caused by these heavy metals before the industrial effluents come out from the industry to the ground surface area or under the ground.

CONCLUSION

Industrial effluents came out from the industries in and around the Dindigul district contains the heavy metals such as Iron (Fe),Arsenic (As), Aluminum (Al),Lead (Pb), Mercury (Hg),Copper(Cu),.etc. which in higher amount may contaminate ground water and the other resources .These may enter in the consumption and the excess intake of these harmful heavy metals enters into the human body either directly or through our food and other things cause hazardous effects such as many characteristic diseases according to the metals .Such diseases where mentioned earlier in this journal in above table 2.1 and these metals are present in the industrial effluents samples collected in and around the Dindigul district.

Now we must improve the methods of filtering these harmful effluents containing heavy metals which are disease carriers from the industries to protect the people and environment. Even the minimal amount of heavy metals may thought harmless but in future the effluents left in the soil affects ground water and contaminates soil.The agricultural yields from these heavy metal contaminated soil may cause serious health hazards. So,the proper recovery and effluent management should follow to protect environment.

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Table 1.Diseases caused by excess intake of metals

S.No.	METALS PRESENT IN INDUSTRIAL EFFLUENTS	DISEASES CAUSED BY METALS
1	Iron (Fe)	Hemochromatosis,Arthritis
2	Arsenic (As)	Gastroenteritis,Hyperpigmentation,ExfoliativeDermatitiscardio Myopathy,Intestinal Hemorrhage
3	Aluminum (Al)	Parkinson's Disease, Alzheimer's Disease, Multiple Sclerosis
4	Lead (Pb)	Lethargic,Dysarthia,Hyperproteinemia, Encephalopathy
5	Mercury (Hg)	Minamata Disease, Pulmonary Edema,Ataxia,Gingivitis
6	Copper(Cu)	Wilson's Disease

Table 2.,Wavelength of heavy metals

S.No.	METALS PRESENT IN SAMPLE	WAVELENGTH (nm)
1	Iron (Fe)	248
2	Arsenic (As)	193
3	Aluminum (Al)	309
4	Lead (Pb)	217
5	Mercury (Hg)	253
6	Copper(Cu)	324

Table 3. Metals and the sensitivity limits.

S.No.	METALS PRESENT IN SAMPLE	SENSITIVITY LIMITS (ppm)
1	Iron (Fe)	0.1
2	Arsenic (As)	2.0
3	Aluminum (Al)	1.0
4	Lead (Pb)	0.01
5	Mercury (Hg)	1.0
6	Copper(Cu)	0.1
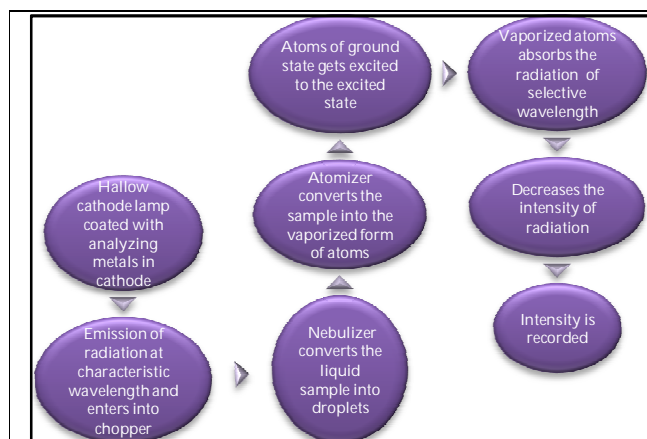
Figure 1. Process involved in Atomic absorption spectroscopy.
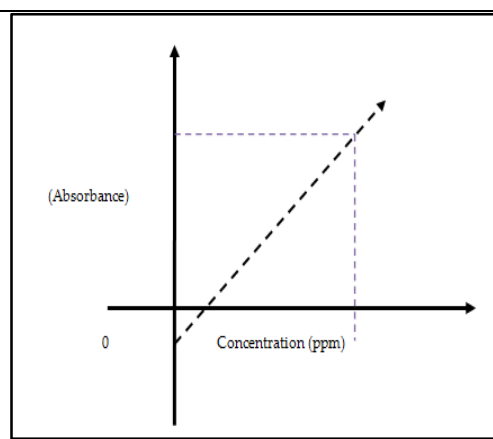
Figure 2. concentration against the absorbance

RESEARCH ARTICLE

Treatment for the Effective Removal of Heavy Metals from the Tannery Effluent by using Fly Ash from Thermal Power Plant

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ABSTRACT

In this paper we clearly discuss about the maximum adsorption of heavy metals like Cr (II), Cu (II) and Zn (II). It was observed at the pH value of 8.0. The equilibrium time for the adsorption of Cr (II), Cu (II) and Zn (II) on the CFA, TA and 50:50 mixture ranges from is 45 to 90 minutes. The percentage removal of Cr (II), Cu (II) and Zn (II) increases with increase in the adsorbent amount. Optimum dose found in this study for various adsorbents ranges from 30 to 50 g/L. The equilibrium data obtained for the adsorption of Cr (II), Cu (II) and Zn (II) can be described by Freundlich Adsorption Isotherm model. Adsorption follows and obeys second order rate equation. Comparing the various adsorbents, TA (*Triticum aestivum*) proves that as a food material has negligible cost and has also been proved to be an efficient and an effective alternative to commercial activated carbon.

Keywords: adsorption, water treatment, fly ash, isotherm, heavy metal.

INTRODUCTION

Removal techniques such as chemical precipitation, ion exchange, electrochemical precipitation, solvent extraction, reverse osmosis etc. are cost intensive for large scale treatment of waste water that is rich in Cr (II), Cu (II), Zn (II) especially in developing countries like India (Rao *et al*, 2001). Adsorption using activated carbon is a best method for

the treatment of tannery effluents contaminated with Cr (II), Cu (II) and Zn (II). Tanning is the chemical process that converts animal hides and skin into stable and imputrescible products called leather [1]. The release of effluents directly from tanneries into bodies of water has become a growing environmental challenge as it is one of the major sources of pollution [2]. Most of these effluents are complex mixtures containing inorganic compounds [3]. Tannery effluent treatment is a multi-stage process to purify wastewater before it is discharge into the body of natural water, to the land, or it is reused [4] Most of the heavy metals discharged into the wastewater are found toxic and carcinogenic and cause a serious threat to the human health[5]. The metal toxicity depends on duration of exposure, route of exposure and adsorbed concentration of metal [6]. The long term exposure to heavy metals leads to disfunctioning and degenerative muscular, physical and neurological diseases like Parkinson's and Alzheimer's [7]. Tertiary treatment normally includes media filtration followed by carbon adsorption and sometimes physico-chemical treatment [8]. Tannery effluents contain several pollutants, including Cr (III), NaS, NaCl, and the aftermath of the discharge of these effluents can cause a serious problem for living organisms [9]. The discharge of tannery effluent, municipal sewage, farm and urban wastes carried by drains to rivers worsens and broadens water pollution [10] .Effluent treatment methods are classified into three (3); physical, chemical and biological processes [11]. Coagulation-flocculation process is employed in separating suspended solids materials in tannery effluent [12]. The presence of high concentrations of dissolved solids, mainly chlorides, from soak yard makes the tannery effluent particularly amenable for electrochemical treatment [13]. Electro coagulation is based on dis-solution of the electrode material used as an anode (sacrificial anode) which produces metal ions that act as coagulant agents in the tannery effluent [14]. The textile effluent had consisting high concentration of trace heavy metals and through its accumulation in different trophic levels of ecosystem ultimately cause the health hazards among livestock and human beings [15]. Ground water contaminated by textile effluents, has impact on agriculture irrigation, drinking utilities, soil and agricultural systems [16]. The toxic metals cause physical discomfort and sometimes life threatening illness and irreversible damage to vital body system [17]. The condition of drinking water may be polluted with pathogen, toxic metal, chemical compounds such as pesticides, herbicides and other industrial waste becomes waterborne outbreaks [18]. Wastewater production varies in wide range (10–100 m3 per ton hide) depending on the raw material, the finishing product and the production processes [19]. The wastewater from neutralization, retaining, dyeing and fat liquoring sections contribute little pollution load [20]. Food crop namely *Triticum aestivum* is used as an adsorbent for the removal of Cr (II), Cu (II) and Zn (II) from waste water. Batch experiments are carried out for kinetic studies on the removal of chromium, copper and zinc from aqueous solution. The effects of various influencing parameters such as initial pH, contact time, dose of adsorbent and initial concentration of adsorbate are studied. The equilibrium isotherm data and kinetic data are tested with various isotherm models and kinetic models.

Characterization of Adsorbents

The physico-chemical characteristics like moisture content, particle density, ash content and water soluble components of adsorbents such as activated coal fly ash and activated *Triticum aestivum* were determined and given in Table-1. The bulk density and particle density affect the adsorption of metal ions. The decrease in the bulk density enhances the adsorption of metal ions. Finer the size of the adsorbent, greater will be the adsorption. The bulk density value less than 1.2 indicates the adsorbent materials are of fine nature. When this value falls within the range of 1.2-2 the materials are medium and the value more than 2 indicates that the materials are coarse in nature. The particle density value less than 2.2, which indicates the materials are finer, the value between 2.2-4 are medium and more than 4 indicates materials are coarse in nature. In the present study, the bulk density and particle density values obtained are closer to fine in nature.

Other Chemicals

All other chemicals used are analytical reagent grade and were obtained from Loba / Glaxo / BDH, Buffer solutions of pH equal to 4,7 and 9 for calibration of the pH meter, conc. Nitric acid. Individual standard solution for Cr (II)

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ion, individual standard solution for Cu (II) ion, individual standard solution for Zn (II) ion, sodium hydroxide pellets, sodium nitrate and 0.5N Hydrochloric acid were prepared as per the procedures.

Heavy Metal Analysis of Heavy Metals Using Atomic Adsorption Spectro Photometer (AAS)

The test methods cover the determination of dissolved and total recoverable chromium, copper and nickel in water and waste water by atomic-adsorption spectrophotometer. The reason to choose AAS is the results produced are reproducible and accurate and moreover applicable to industrial discharges, which may contain less than 6 mg/l of any heavy metal. In atomic adsorption a sample is aspired into a flame and atomized. A light beam is directed through the flame into a monochromator and onto a detector that measures the amount of light absorbed by the atomized element in the flame. For some metals, atomic absorption exhibits superior sensitivity over flame emission. Because each element has its own characteristic absorption wavelength, a source lamp composed of that element is used, which is called the Hollow Cathode lamp. This makes the method relatively free from spectral or radiation interference. The amount of energy at the characteristic wavelength absorbed in the flame is proportional to the concentration of the element in the sample over a limited concentration range. The instrument used in determination of heavy metals is the Atomic Adsorption spectrophotometer. Perkin-Elmer Model 403 equipped with a Honeywell Electronic 193 strip chart recorder. The method used for the determination of heavy metals was Direct Air Acetylene flame method. In the case of chromium (II) ion, the absorption of the color complex is measured at a wavelength of 283.3 nm, the copper (II) ion the adsorption of the color complex measured at a wavelength of 228.8 nm.

Batch Experiments

The batch experiments are carried out in 250 ml borosil shaker bottles by shaking a pre weighed amount of the CFA, TA and 50:50 mixtures of CFA and TA with 100 ml of the aqueous Solutions for a pre-determined period (found out from kinetic studies) at 30°C with an initial adsorb ate concentration of 10g/l. The effect of adsorbent amount is studied by varying it in the range of 10-50 g/l with the adsorbate concentration range of 5-25 mg/l at 30°C. The effect of pH of adsorbate on adsorption is studied by varying it in the range of acidic 2 to alkaline 12. Moreover the effect of contact time between adsorb ate and adsorbent is studied by varying it in the range of 15 to 180 minutes. The various experimental parameters, which influence the process, are as follows:

   i.   Effect of varying concentrations
   ii.   Effect of varying pH of solution.
   iii. Effect of varying the amount of photo catalyst.
   iv.   Effect of varying the contact time.

Study of Varying Concentrations

The effect of initial concentration of Cr (II), Cu (II) on the amount of CFA, TA and 50:50 mixtures was studied with a fixed dose of adsorbent (10 g/l) and constant contact time (60 min) by varying the initial concentration of the above adsorbate. From the experimental results, it is found that the amount of adsorbate adsorbed exponentially increases while the percentage removal decreases with the increase in the initial concentration of adsorbate. This indicates that there exists a reduction in immediate solute adsorption due to the lack of available active sites required for the high initial concentration of adsorb ate. The effect of concentration on the percentage removal of adsorbate is represented graphically. The relative adsorption capacity of CFA, TA and 50:50 mixtures reveals that under identical conditions, compared to CAC, the adsorptive capacities of CFA, TA and 50:50 mixtures are less. This may be due to the porous textural nature of the surface of AC. These low cost adsorbents possess nearly 50% adsorptive capacities compared to that of AC. The percentage removal of adsorbate by above mentioned adsorbent is found toexponentially decrease with increase in initial concentration of heavy metal, which may be due to the lack of available active sites on the surface of the adsorbent. The amount of adsorbate adsorbed on an adsorbent increases with increase in initial concentration of heavy metal. The optimum concentration of heavy metals found to be 15-20 ppm

Study of Dosage of Adsorbent

To study the influence of the adsorbent dosage on the removal of heavy metal ions, different values have been taken by varying the adsorbent concentration ranging from 10-50 g/l by keeping the volume of the effluent solution constant under optimum temperature and contact time. Fig 3,4,5 shows the effect of adsorbent dosage on the removal of chromium, copper and Zinc by CFA, TA and 50:50 ratio of CFC: TA at optimum temperature of 296 K and time 60 mins. In case of TA, chromium removal 46% to 64% was achieved with respect to dose of 10-50 g/l, Copper removal of 42-56% was achieved with respect to dose of 10-50 g/l and Zinc removal of 42-60 % is achieved with respect to a dose of 1050 g/l. In case of CFA, chromium removal 40%-47% achieved with respect to dose of 10-50 g/l, copper removal of 36-42% achieved with respect to dose of 10-50g/l and zinc removal of 36- 50% is achieved with respect to dose of 10-50g/l. But in case of 50:50 mixture, chromium removal of 40-55% achieved with respect to dose of 10-50 g/l, copper removal of 40-50 % achieved with respect to a dose of 10-50 g/l and zinc removal of 40-50% is achieved with respect to dose of 10-50g/l. The observation made in this study promotes the extent of removal of heavy metal ions from the tanning industries increases with increase in adsorbent dosage. This can be explained by the availability of the exchangeable sites or surface area on the adsorbents. In the minimum adsorbent dosage level (10 g/l) there will be low availability of exchangeable sites, ultimately removal of metal ions at low adsorbent dosage is minimum. But at the maximum adsorbent dosage level (50 g/l) there will be a greater availability of exchangeable sites or surface area, hence the removal of metal ions at maximum adsorbent dosage is also maximum. Success removal of heavy metal ions with the effect of adsorbent dosage has been evaluated through the study of the percentage ratio, before and after individual adsorbent dose.

Dose of adsorbent scale: x-axis- dose of adsorbent (g/l)

Effect of pH

The effect of pH on the removal of heavy metal ions was studied by varying the pH ranging from 2-12 and keeping the concentration of the individual solution and dose of adsorbent at constant under optimum condition of temperature 296K and time 60 min. The removal of heavy metals is found to be highly pH dependent. The figures 6,7,8 shows that the percentage removal of chromium is 18-66% for the pH range 2-10, the percentage removal of copper ions varies from 12-58% for the pH range of 2-10 respectively. It was observed that the adsorption capacity of adsorbents increased when pH of heavy metal solution increased. As pH value increases, the extent of removal increases reaches a maximum value and then decreases further increased up to optimum pH. The optimum pH for CFA, TA and 50:50 mixture, removal of chromium is fixed as 9.0, for copper is fixed as 8.2 and for the removal of zinc ions is fixed as 8.3 respectively. A slight alkaline pH is found to be favorable. The pH value slightly decreases and change in pH (ΔpH = Initial pH -final pH) values after adsorption are found to decrease in the order of 0.2-0.5 units. This suggests that during the adsorption of heavy metal species, protons are released from the surface functional groups like phenolic, carboxylic and enolic groups present on the carbons. These adsorption data suggest that the alternatives could be used as low cost adsorbent alternative to any other adsorbent, which is used currently for the cost effective treatment of effluents, especially for the removal of metal ions

Effect of pH Scale: X-axis- pH values

Adsorption Isotherm

In the present study, as the new adsorbent is developed, it is needed to test the equilibrium data obtained for heavy metal ions removal using activated tamarind seeds with different isotherm models. In the present study Freundlich isotherm model is tested with the experimentally obtained equilibrium data.

Freundlich Isotherm

The adsorption data are fitted with the linearized form of Freundlich adsorption isotherm.

Log (x/m) = logK + (1/n) logCe

Where (x/m) is the amount of adsorb ate adsorbed per unit mass of the adsorbent, Ce is the equilibrium concentration and K and 1/n are the Freundlich constants, which are the measure of the adsorptive capacity and adsorption intensity, respectively. The log (x/m) values are found to be linearly correlated to the log Ce values in the case of all the adsorbents. The computed values, which are very close to unity, conclude that the Freundlich model is applicable to the experimental data. The observed high values (2 -4) of 1/n in the case of all the adsorbents indicate an adsorption mechanism with an intraparticle diffusion or mass transfer as the rate limiting step. The increasing order of the adsorptive capacities of these adsorbents as indicated by the K values (log k values) for CFA, TA and 50:50 mixtures.

Adsorption Kinetics

In order to understand the kinetics of removal chromium, copper and zinc using CFA, TA
Al ne and 50:50 mixture as an adsorbent, pseudo first order, second order kinetics are tested with the experimental data. As per the application of second order kinetics, it obeys better than any other.

Pollution Index

The pollution index was used in this study to evaluate the degree of heavy metal contamination. The tolerable level of the element concentration in the water considered safe for human consumption. The BIS for drinking water standards (2009) were used as tolerable level for water and the pollution index can be calculated by the formula below

Heavy metal concentration in water/Tolerable level PI

Number of heavy metals

The   PI among all sites varied from 0.01 -1.5 and 0.106-5.0 for highly polluted and less polluted sites respectively. Concentrations of chromium, copper in most of the water samples were comparatively high than the tolerable levels while in few water samples showed lower concentration. PI was below 0.1 at 4 and 6 sample representing (27.2% and 37.5%) of the total samples, between 0.1 to 0.3 at 6 and 8 samples (37.5% and 50%) and greater than 0.3 at 5 and 2 samples (33.3% and 12.5%) for least industries, respectively.

CONCLUSION

The following conclusions could be drawn from the present study, for the removal of Chromium, Copper and Zinc from the tannery effluent.

➢ The maximum adsorption of heavy metals namely Cr (II), Cu (II) and Zn (II) was observed at the pH value of 8.0.

➢ The equilibrium time for the adsorption of Cr (II), Cu (II) and Zn (II) on the CFA, TA and 50:50 mixture ranges from is 45 to 90 minutes.

➢ The percentage removal of Cr (II), Cu (II) and Zn (II) increases with increase in the adsorbent amount. Optimum dose found in this study for various adsorbents ranges from 30 to 50 g/L.

➢ The equilibrium data obtained for the adsorption of Cr (II),Cu (II) and Zn (II) can be described by Freundlich Adsorption Isotherm model.

➢ Adsorption follows and obeys second order rate equation.

➢ Comparing the various adsorbents, TA (*Triticum aestivum*) proves that as a food material has negligible cost and has also been proved to be an efficient and an effective alternative to commercial activated carbon.

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Table-1 : The physico-chemical characteristics like moisture content, particle density, ash content and water soluble components of adsorbents such as activated coal fly ash and activated *Triticum aestivum*

PARAMETERS	CFA	TA
pH	6.1	5.9
Bulk density(g/cc)	0.96	0.97
Moisture (%)	26	8
Ash (%)	70	24

Table-2 : The optimum concentration of heavy metals

Adsorbent	Experimental condition	
	Identical	Optimum
CFA	48	60
TA	58	70
50:50 (CFA:TA) mixture	52	64

Fig. 1. Y-axis, Chromium removal (%)

Fig.2. Y-axis- Copper removal (%)

Fig. 3. Y-axis- Chromium removal (%)
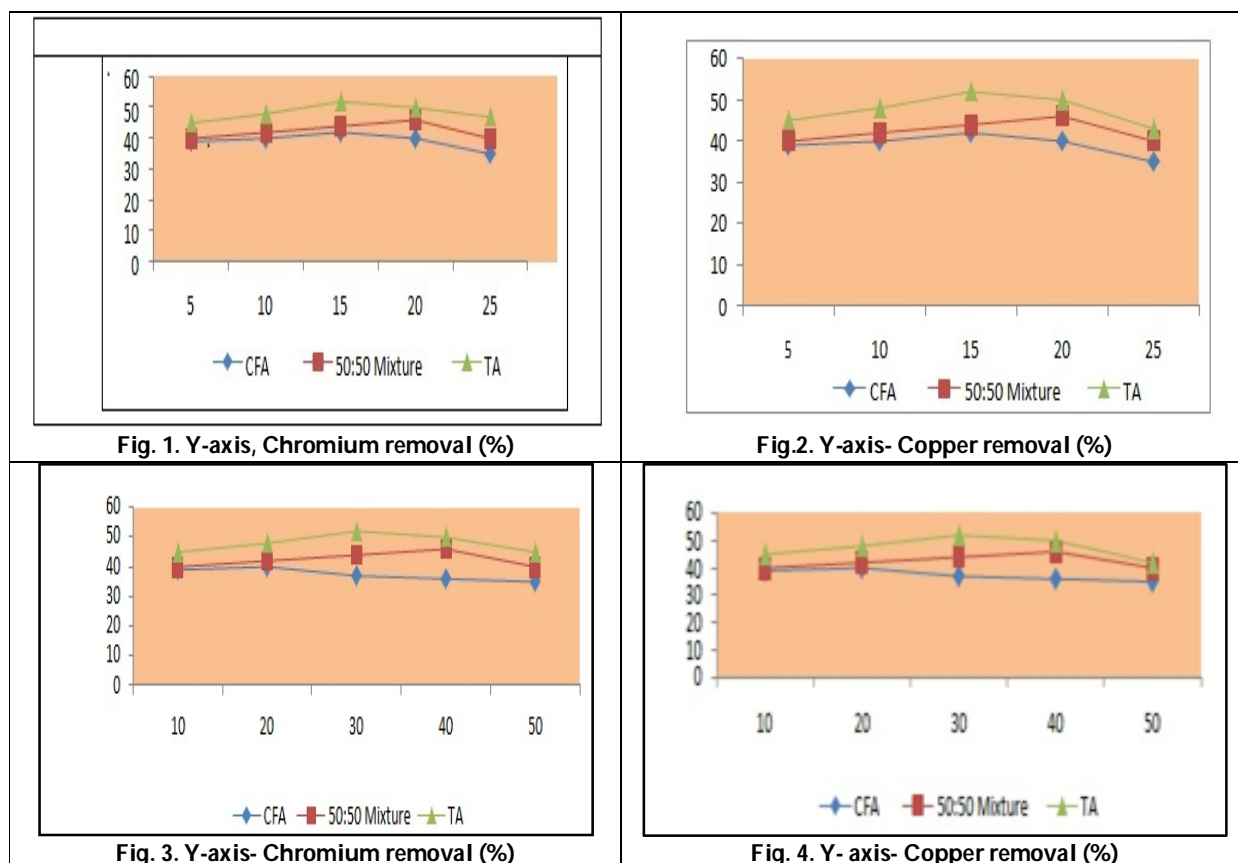
Fig. 4. Y- axis- Copper removal (%)
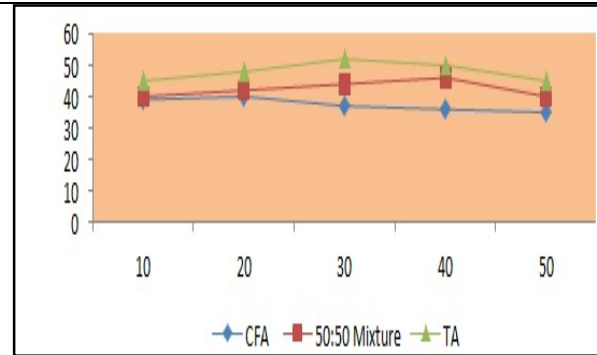
Fig. 5. Y-axis: Zinc removal (%)
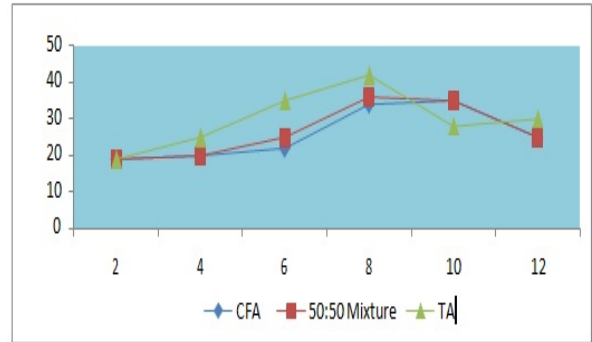
Fig. 6. Y-axis- Chromium removal values (%)
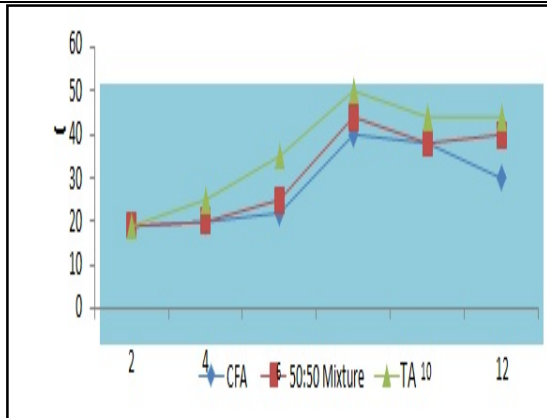
Fig. 7. y-axis-Copper removal values (%)
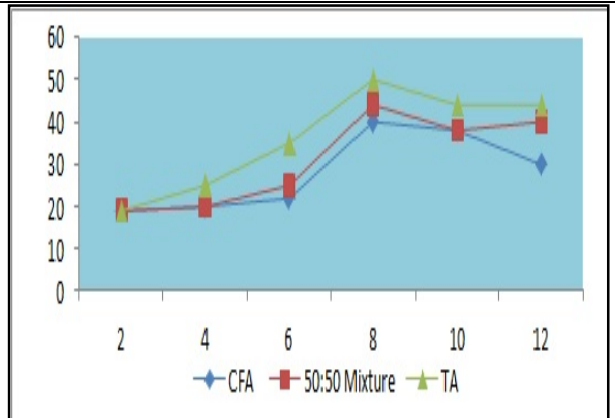
Fig. 8. y-axis-Zn removal values (%)

RESEARCH ARTICLE

Performance Evaluation of Activated *Saccharum officinarum* (Sugarcane Bagasse) as Natural Adsorbent used for Elimination of Pollutants in Automobile Service Station Waste Water

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ABSTRACT

Water pollution is a worldwide task because of non-point source of automobile station wash wastewater consists of poisonous contaminants with less possible treatments. Among diverse technologies of membrane application, oil separator and else, activated carbon is more reliable. Studies has been centered in the direction of converting the low cost agricultural wastes of sugarcane bagasse (*saccharum officinarum*) into precious outcome from activated carbon, because of adsorption properties. The approach of these activated carbons has been taken into consideration also a chief unit operation in the industries discharges toxic effluent. In this paper, adsorption is a cheap and productive remedy treatment method because of excessive utilizability of herbal adsorbents. From this factor of outlook, this paper accents the usage of herbal adsorbents for automobile station effluent treatment and an overall performance study of sugarcane bagasse to find out the percentage removal of oil & grease, chemical oxygen demand (COD), total dissolved solids (TDS) and electrical conductivity (EC). The purpose of these findings is to evaluate the performance of sugar cane bagasse to take off the toxic and poisonous contaminations from automobile station waste water by way of using the adsorption process. This study additionally focuses upon developing the car wastewater treatment approach to make the water reusable for washing reason. These findings show that the activated sugarcane bagasse (ASB) is an attractive opportunity adsorbent material for the elimination of toxic contaminants in automobile station wastewater. The present findings also proven that it can be a appropriate, cheap and environmentally feasible opportunity as a best and less expensive root of adsorbent for automobile effluent treatment due to its outlet and excessive

convenience, gives outcomes in most of the environmental advantages. The surface morphology images of activated sugarcane bagasse (ASB) as natural bio-adsorbents before and after adsorption treatment were investigated by Scanning Electron Microscope (SEM) of JEOL (JSM 6490 LV) at 10 kV with magnification of 200x 500x, 1000x, 2000x and 5000x and IR spectra of the Activated Sugarcane Bagasse (ASB) as natural bio- adsorbents before and after adsorption were examine by FTIR spectrometer (Fourier Transform Infra-Red Spectrometer (FTIR) of Thermo-Scientific (Nicole 6700) using a 4,000–400 cm^{-1} range.

Keywords: Adsorption; Sugarcane Bagasse; Sustainable; Automobile Garage Wastewater Treatment.

INTRODUCTION

The untreated discarded automobile waste water raises the water pollution levels to the municipal sewage. Due to non-stop growth in pollution level, moderate capability of natural water bodies is notably decreasing and inflicting nuisance to human and natural eco-system. Respectively the environmental regulatory authorities are preceding actions to lower the pollutants strength of wastewater earlier than disposal into municipal sewerage or some other direct disposal. Automobile station waste water are an important constituent of the service sector industry (Moorthi, et al., 2008) due to the fact it plays important function for maintaining the vehicle in the premier condition. Due to fast economic and infrastructure development, the quantity of various classes of vehicles in the world has increased substantially which make contributions to growth in quantity of automobile stations. But, the discharges of this automobile statin wastewater to nearby municipal sewer or surroundings have the capacity to cause enormous environmental harm through the discharge of contaminants to the surroundings. This is because, the contamination of oil and grease in wastewater covers the surface of water and reduces oxygen diffusion from air to water (Kadarwati and Herlina, 2008) and contribute to Biochemical oxygen demand (BOD) and chemical oxygen demand for (COD) in effluents water (Yasin, et al., 2012). In general, the automobile service station grey water includes (wash water from vehicle washing, tools and equipment elements and vehicle engine etc.). Contaminants in wash wastewater contain oil and grease (O&G), detergents, phosphates, hydrofluoric acid, ammonium bi-fluoride merchandise (ABF) and so on. Oil and grease and detergents, which include biodegradable detergents, can be toxic to aquatic life. However, phosphates, which can be plant nutrients, can cause excessive boom of nuisance plants. However, the drainage of the automobile washed wastewater directly into nearby municipal sewerage might adverse effect on the efficiency of the treatment system of sewage because of presence of many heavy metals or at the least constitutes a burden on the sewage treatment plant. Therefore, it's far necessary to consider low cost and good alternate technologies for automobile station waste water management. According to the study, a domestic automobile wash consumes 300 to 500 liters of water, while a wash at one of the garages will take approximately (250 to 400 litres). Fakhru'lRazi et.al.(2009) have given an overview of physical, chemical, biological and membrane treatment for waste water treatment.

Huge kind of low-cost adsorbents have been explored for their potential to eliminate color and other toxic contaminants from wastewater, which includes peat, bentonite, china clay, maize cob, steel-plant slag, fly ash, silica etc. But, these low-cost adsorbents have usually low adsorption potential and they require in large quantities for the treatment purposes. Consequently, there is a requirement to discover unique, low-cost, handy, and more reactive adsorbents [6]. Sugarcane bagasse (SCB) is the left of product of the sugar cane industry; it is one of the massive important agricultural left of product in the earth. It is far a fibrous left of product of sugarcane left over after crushing and extracting sugarcane [8]. About fifty four million tons of dry sugarcane bagasse is generated yearly in the world and massive quantities of sugarcane bagasse are incenerate in the agricultural fields, resulting in extreme pollutants hassle. Moreover, sugarcane bagasse is an considerable, cheap, and reliable kind of commercial lavish with a lignin cellulose and polymeric shape (50% cellulose, 25% hemicellulose, and 25% lignin) [9]. Thus, usage of

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this cheap herbal waste as adsorbent offers many advantages in view of environmental pollution. Firstly, the quantity of bi-products can be in minimized, and then the cheap adsorbent reduces the pollution of wastewaters at effective price [10]. Confirms the provision of sugarcane bagasse product and its properties, as well as the requirement for alternate treatment system, this study focuses to evaluate the minimisation of toxic contaminations from vehicle station waste water by means of the adsorption system using sugarcane bagasse as a cheap adsorbent.

MATERIALS AND METHODS

Collection and Preparation of Wastewater Sample
The wastewater is predominantly initiated from washing of various types of vehicle. In the existing service, 2 to 3 vehicles are serviced on turning basis and an average 25 vehicles wash per day. The washing is done by sprinkling pressurized water jets with the help of hose pipe lead by compressor motor assembly. Typically 300-400L of water is used per day for washing of a vehicle. The washed wastewater is then left out to municipal sewerage system by the washing bay. The washing bay is made of cement concrete platform. The spent water containing dirts, oils and other solids is drained through drainage and then collected in a pit. The study was conveying by grab sampling from the vehicle wastewater collection pit of washing area of the garages. The Supernatant wash was stored in a 1 litres plastic bottle after settling for one hour. Another one litres sample was stored in the other bottle from the next automobile station. The process was carry on for six consecutive vehicle washing working in the same day and all the samples were stored in one litre of container.

Collection and Preparation of sugarcane bagasse
Sugarcane Bagasse was collected from a temporary local juice shop at Tedhi Pulia, Lucknow. Collected Sugarcane Bagasse was cut into small pieces and washed with distilled water. After that, sugarcane bagasse was soaked in 0.1 M HCl solution for 24 hours in order to ensure the complete removal of dirt, lignin and coloring components. Then, the Bagasse was dried in the oven at 120~130°C for 24 hours and further SB soaked with $ZnCl_2$ solution in ratio of 1:1 at room temperature then dried for 24hrs. In physical carbonization step- the SB sample was heated in muffle furnace at 500ºC for 15 min. Finally the activated sugarcane bagasse was separated in four different mess sizes according to their particle size distribution: 250um, 300um, 500um and 1.0mm sizes respectively and then stored in an air tight container according to their particle sizes for further use.

Sieve Analysis of Adsorbents
For the determination of optimum particle size removal rate, activated sugarcane bagasse (ASB) was collected in four different particle sizes of 250μm, 300μm, 500μm and 1.0mm sizes respectively and then stored in an air tight container according to their particle sizes for further use.

Scanning Electron Microscope (SEM) analysis
The surface morphology images of Activated Sugarcane Bagasse (ASB) as natural bio- adsorbents before and after adsorption treatment process in automobile garage wastewater were examined by Scanning Electron Microscope (SEM) of JEOL (JSM 6490 LV) at 10 kV with magnification of 200x, 500x, 1000x, 2000x and 5000x.

Characterization and morphology of modified bagasse
To assess the effect of treatment on the morphological surface of bagasse fibers, the samples had been studied the usage of Scanning Electron Microscope (SEM) of JEOL (JSM 6490 LV) at 10 kV with magnification of 200x, 500x, 1000x, 2000x and 5000x. Morphological characteristics of fibers before and after treatment have been microscopically observed. Figure shows SEM micrographs of sugarcane fibers, providing the simple fibrils and bundles are cemented by lignin and pectin intercellular substances. It indicates that cellulose fibers are in one piece and intact due to the presence of lignin. The fiber received from sugarcane bagasse changed into shown by using parallel stripes and is

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partly protected with residual material (pith). As a result, when observing the SEM micrograph sample of ASB (as shown in figure) it is straight forward to notice two distinct groups: large particles, known as fibers, and smaller particles, referred to as pith. Fibers are compact, hard, and have a thick-walled fiber cells interlinked with the pith. Fibers are constituted with the aid of parallel stripes and are superficially included with extractives. This continuous covering layer might be composed of hemicellulose and lignin. Pores of various size and distinct shape can be determined. As shown in figure, ASB has heterogeneous structure that could prefer the biosorption of toxic contaminants on different parts of the biosorbent. Sugarcane fiber treated with automobile station waste water has been able to remove most of the lignin and minor hemicellulose. The surface micrograph in figure shows a cleaner structure of the fiber in comparison to untreated one as in figure. As the treatment time grows that will increase the surface adsorption on the bagasse. That surface adsorption is evidenced with the aid of a definitive alter the morphological structure passed off after treatment which the cellulose fibers observed inside the micrographs as in figure are in part decomposed. The SBAC characterized via having two regions, one being darker and the alternative being white. The white region is in pure form which do no longer have contained any impurities whereas the dark portion is prosperous in impurities and crammed the pores of adsorbents.

Fourier Transform Infrared (FTIR) Spectroscopy

The IR spectra of the Activated Sugarcane Bagasse (ASB) as natural bio- adsorbents before and after adsorption were analyzed by FTIR spectrometer-Fourier Transform Infra-Red Spectrometer (FTIR) of Thermo-Scientific (Nicole 6700) using a 4,000–400 cm^{-1} range. Bagasse is a lignocellulosic material consisting of cellulose 43.8 %, hemicellulose 28.6 %, lignin 23.5 %, ash 1.3 %, and other components 2.8 % [19]. Studies performed with different varieties of sugarcane bagasse reported that their main chemical composition does not differ significantly [22]. The major effect of treatment is the removal of lignin from the bagasse. FTIR spectroscopy was used to obtain information about the chemical structure of the bagasse before and after treatment. The FTIR spectra for bagasse after both treatments are shown in Figure. The spectra for untreated fibers were also shown for a comparative study to identify considerable changes in the chemical composition of the bagasse as a consequence of modification due to the treatments. The similarity of the FTIR spectra between untreated and treated bagasse fibers was presented in the 4 000 cm^{-1} to 400 cm^{-1} region where the OH and CH stretching vibrations existed. Figure showed a broad band at 3380.60 cm^{-1} indicated the presence of hydroxyl group, O-H in cellulose, hemicellulose and pectin. At 2923.70 cm^{-1} peak showed stretching correspond to asymmetric and symmetric vibrations of -CH2 group respectively. The presence of peaks at 1704.30 and 1607.30 cm^{-1} indicated carbonyl group, C=O and alkene group, C=C stretching vibration. The vivid absorption band of carboxylic acid group, C-OH stretch at 765.80 cm^{-1} might be presented in cellulose.

EXPERIMENTAL PROCESS

Primary Treatment Process of Automobile Garage Waste Water Sample

Screening: It is the primary treatment process. It is the first unit operation used for the removing of coarse floating particles of the effluent. Screening removes objects such as pebbles, stones, nut-bolts, paper pieces from garage effluent to prevent damage and clogging in filter. The purpose of screening process also restricts the entry of suspended solids.

Sedimentation: It is also called settling tank or clarifier, component of modern system of waste water treatment. It allows suspended particles to settle out of water. It is the purpose of removing entrained solids. It is the process for 30 minutes. In this treatment process, the effluent was allowed to settle down for 30 minutes in the first chamber so that the suspended particles could be settled down.

Settling: It is the final treatment process. It allows the water to settle in certain times to removes the finer particles and also remove the coarse dispersed phase. To remove precipitated impurities after chemical treatment through the tank thereby providing the some degree of purification.

Aeration: It is the secondary treatment process. It is based on pumping air into a tank, which promotes the microbial growth in the waste water; the microbes feed on the organic material which can be easily settled out. It is solves odour. In this system, fish tank aeration bowl is used to effectively break down pollutants in to less harmful components. Waste water aeration provides the appropriate oxygen level so that aerobic bacteria can thrive in degrading pollutants such as iron and manganese as part of the waste water treatment process. The oil free automobile wash water is allowed to sediment for 30 minutes and then the aeration process is done for 30 minutes with the help of fish tank aeration motor.

Filtration: It is often part of the tertiary treatment process. Colloidal suspension of fine solids may removes by filtration through fine physical barriers distinguished from coarser screens or sieve by the ability to remove particles smaller than the opening through which the water passes. Some types of filter can removes the impurities by chemical or biological process that involves the final removal of suspended particles from water that has passed through both the primary and secondary treatment phases and immediately precedes disinfection. The latter is called water reclamation and implies avoidance of disposal by use of treated waste water effluent for the various purposes. In this filtration tank, the filtration tank consists of Sand and aggregate stones. The effluent coming out from sedimentation and aeration process was then passes form this sand filter. Thereafter, the effluent was treated with activated sugarcane bagasse (ASB) as natural adsorbent for further treatment.

Tertiary Treatment of Effluent with Activated Sugarcane Bagasse (ASB)

Adsorption Experiment: Adsorption experiments were scaled to a laboratory setup. All laboratory scale batch adsorption experiments were carried out in a 250 cm^3 flasks. The adsorbent dosages (1.0–5.0 g) were added in 100 ml automobile garage waste water filtered from sand filter. The residual concentration of the sample was taken at equilibrium. The initial and residual concentrations of sample were analyzed. The percent adsorption and adsorption capacity at equilibrium were calculated using equations (1) and (2), respectively.

$$\% \text{ adsorption} = \frac{(C_0 - C_e) \times 100}{C_0} \quad \ldots\ldots\ldots\ldots (1)$$

$$q_{e,\,exp} = \frac{(C_0 - C_e) \times V}{W} \quad \ldots\ldots\ldots\ldots\ldots\ldots (2)$$

Where, C_0 is the initial concentration and C_e is the equilibrium concentration of the automobile garage wastewater (mg/L). $q_{e,exp}$ is the experimental adsorption capacity at equilibrium (mg/g), V is the volume of the automobile garage wastewater (L),and W is the weight of the adsorbent (g).

Batch adsorption experiments
Optimization of amount of Activated Sugarcane Bagasse (ASB)

The optimization of amount of activated sugarcane bagasse (ASB) as adsorbent was carried out by adding 0.1g, 0.2g, 0.3g, 0.4g, 0.5g of adsorbents in 100 ml of grey water samples. The contents were shaken for a 15 min time period at 25ºC. Then the samples were filtered and the absorbance was analyzed by SEM and FTIR.

Optimization of contact time with Activated Sugarcane Bagasse (ASB)

For the determination of optimum contact time, the optimized amount of activated sugarcane bagasse (ASB) as adsorbent was placed in shaking flasks. Then 100ml of grey water sample was added in each flask and shaken for 5, 15, 25, and 30 minutes respectively. After respective shaking time samples were filtered and their respective

absorbance were measured. The adsorption capacity X/m (mol/g) was calculated using the mass balance relationship as follows:

X/m= (C$_o$-C$_t$) (V/W)

Where, Co is the initial concentration, C$_t$ is the concentration after treatment, V is the volume of the solution (ml), and W is the mass of the dry adsorbent used (g).

Optimization of Particle Sizes of Activated Sugarcane Bagasse (ASB)

Preliminary adsorption experiments were performed to optimize the activated sugarcane Bagasse (ASB) as adsorbent particle size. These experiments were conducted batch-wise, varying the particle size 250 micron, 300 micron, 500 micron and 1.00 mm respectively sieves with 100 mL of grey water effluent samples at 25℃, in a beaker and after varying time, samples were withdrawn and the remaining treated effluent sample were determined.

RESULT AND DISCUSSION

Batch adsorption experiments with activated sugarcane bagasse (ASB)

Effect of adsorbent dose on the removal of Total Dissolved Solids (TDS)

The effect of the ASB adsorbent dose on the removal of total dissolved solids (TDS) was studied by varying the dose from 0.1g/100ml to 0.5g/100ml. The results were presented, where it could be seen that maximum removal of total dissolved solids (TDS) was about 62.22% is found at an adsorbent dose of 0.5 g/100ml and thereafter the percent removal became approximately constant.
Here figure shows the graphical representation of percentage removal of total dissolved solids.

Effect of adsorbent dose on the electrical conductivity (EC)

The effect of the ASB adsorbent dose on the removal of electrical conductivity (EC) was studied by varying the dose from 0.1g/100ml to 0.5g/100ml. The results were presented, where it could be seen that maximum removal of electrical conductivity (EC) was about 84.81% is found at an adsorbent dose of 0.3 g/100ml and thereafter the percent removal became more or less constant.
Here figure shows the graphical representation of percentage removal of electrical conductivity (EC).

Effect of contact time on the removal of total dissolved solids (TDS)

The effect of the contact time with the ASB adsorbent and waste water on the removal of total dissolved solids (TDS) was studied by varying the time from 5 minutes to 30 minutes. The results were presented, where it could be seen that maximum removal of total suspended solids (TDS) was about 60.13% is found with an adsorbent dose of 0.5 g/100ml at contact time of 30 minutes and thereafter the percent removal became approximately constant.
Here figure shows the graphical representation of percentage removal of total dissolved solids.

Effect of contact time on the electrical conductivity (EC)

The effect of contact time with the ASB adsorbent and waste water on the removal of electrical conductivity (EC) was studied by varying the time from 5 minutes to 30 minutes. The results were presented, where it could be seen that maximum removal of electrical conductivity (EC) was about 75.66% is found at an adsorbent dose of 0.5 g/100ml at contact time of 15 minutes and thereafter the percent removal became more or less constant.
Here figure shows the graphical representation of percentage removal of electrical conductivity (EC).

Effect of pH on the removal of Total Dissolved Solids (TDS)

The effect of the Ph with the ASB adsorbent and waste water on the removal of total dissolved solids (TDS) was studied by varying the dose from 4 to 8. The results were presented, where it could be seen that maximum removal

of total dissolved solids (TDS) was about 72.05% is found at 4 pH and thereafter the percent removal became approximately constant.

Here figure shows the graphical representation of percentage removal of total dissolved solids.

Effect of pH on the electrical conductivity (EC)

The effect of the pH with the ASB adsorbent and waste water on the removal of electrical conductivity (EC) was studied by varying the dose from 4 to 8. The results were presented, where it could be seen that maximum removal of electrical conductivity (EC) was about 77.59% is found at 4pH and thereafter the percent removal became more or less constant.

Here figure shows the graphical representation of percentage removal of electrical conductivity (EC).

Effect of particle size on the removal of Total Dissolved Solids (TDS)

The effect of the particle size of ASB adsorbent on the removal of total dissolved solids (TDS) was studied by varying the particle sizes of 250µm, 300µm, 500µm and 1.0mm sizes. The results were presented, where it could be seen that maximum removal of total dissolved solids (TDS) was about 62.22% is found at particle size of 1.00mm and thereafter the percent removal became approximately constant.

Here figure shows the graphical representation of percentage removal of total dissolved solids.

Effect of particle size on the electrical conductivity (EC)

The effect of the particle size of ASB adsorbent dose on the removal of electrical conductivity (EC) was studied by varying the particle sizes of 250µm, 300µm, 500µm and 1.0mm sizes. The results were presented, where it could be seen that maximum removal of electrical conductivity (EC) was about 84.81% is found at particle size of 1.00mm and thereafter the percent removal became more or less constant.

Here figure shows the graphical representation of percentage removal of electrical conductivity (EC).

Comparison of environmental parameters of wastewater before treatment and after treatment

Here the table representing a comparison among different environmental parameters of raw water, after sedimentation and after treatment.

CONCLUSION

It was demonstrated that the utilization of ASB as biosorbent is an eco-friendly technique, as it is a way of minimization of agricultural waste and it also proved to be a promising biosorbent for treating automobile garage waste water. The batch study parameters—doses, contact time, pH and particle size—were found to be important parameters in the biosorption processes. It was proven that the ASB had performed well. The following points are concluded from this work:

i. The maximum removal of total dissolved solids (TDS), turbidity and electrical conductivity was about 62.22%, 88.23% and 84.81% is found at an adsorbent dose of 0.5 g/100ml, 0.5 g/100ml and 0.3 g/100ml respectively.

ii. The maximum removal of total dissolved solids (TDS), turbidity and electrical conductivity was about 60.13%, 87.89% and 75.66% is found at an adsorbent dose of is found with an adsorbent dose of 0.5 g/100ml at contact time of 30 minutes, 20 minutes and 15 minutes respectively.

iii. The maximum removal of total dissolved solids (TDS), turbidity and electrical conductivity was about 72.05%, 88.12% and 77.59% is found with an adsorbent dose of 0.5 g/100ml at 4pH, 3pH and 4pH respectively.

iv. The maximum removal of total dissolved solids (TDS), turbidity and electrical conductivity was about 62.25%, 88.23% and 76.14% is found with an adsorbent dose of 0.5 g/100ml at particle size of 1.00mm, 1.00mm and 1.00mm respectively.

It was also conclude that SCB has no commercial value and the present study showed that it could be a suitable and economically viable alternative as a good and inexpensive source of biosorbent for automobile wastewater treatment due to its production and high availability, resulting in several environmental benefits.

Declarations
Author contribution statement

Islamuddin: Performed the experiments; Analyzed and interpreted the data; Wrote the paper.
Monowar Alam Khalid: Analyzed and interpreted the data.
Syed Aqeel Ahmed: Analysis tools or data; contributed reagents, materials.
Mehtab Ahmad: Contributed reagents, materials, analysis tools or data.

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Competing Interest Statement

The authors declare no conflict of interest.

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Table 1: Environmental parameters of raw water sample before treatment and after treatment

S. No.	Parameters	Before Treatment	After Treatment	BIS-2296 (E)
1.	pH	6.9	6.9	5.5-9.0
2.	COLOUR	Dark Grey	Very Light Grey	Remove as far as practicable
3.	ODOUR	Yes	No	Remove as far as practicable
4.	TEMPERATURE	29.7	27.4	--
5.	TDS (mg/l)	755	211	2100
6.	Oil & Grease (mg/l)	165	8	10
7.	DO (mg/l)	5.4	6..5	--
8.	Electrical Conductivity (EC) (µs/cm)	415	63	2250
9.	BOD_5	18.5	7.8	30
10.	COD	73.6	21.7	150
11.	SULPHATE (mg/l)	93.3	53.7	500
12.	LEAD (Pb)	0.04	0.03	0.10
13.	IRON (Fe)	57.7	13.6	2
14.	CHROMIUM (Cr)	0.01	ND	0.50
15.	CADMIUM (Cd)	0.03	ND	0.05

Fig.1:Composition of sugarcane bagasse (mean value of 60 samples) (De Moraes Rocha et al. 2015)	**Fig.2: Sugarcane Bagasse**

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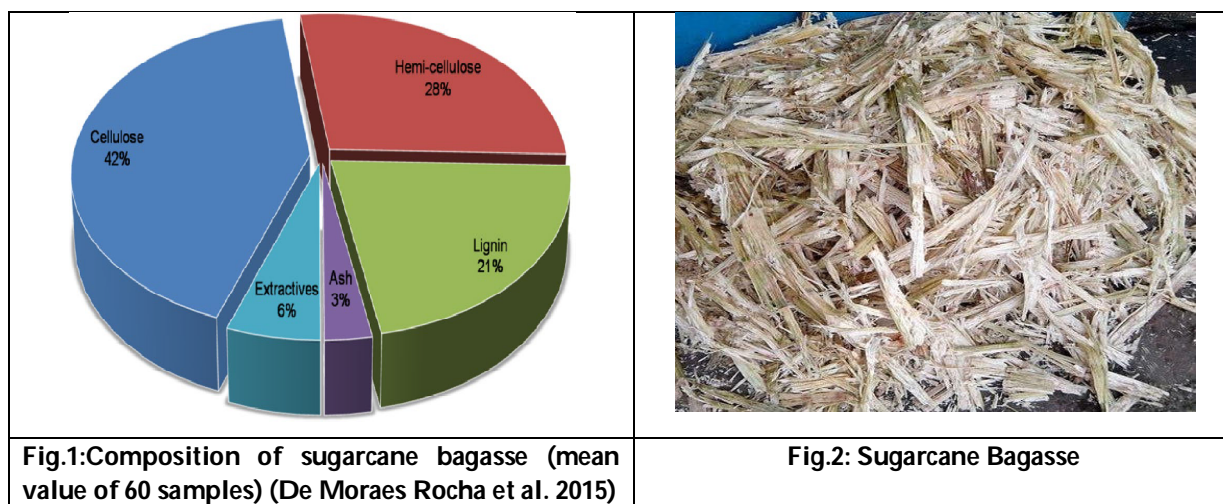
Fig.3: Waste water samples of different automobile stations.

Fig.4: Crushed and Activated Sugarcane Bagasse

Fig.5: Sieve analysis using sieves of 250μm, 300μm, 500μm and 1.0mm sizes respectively.
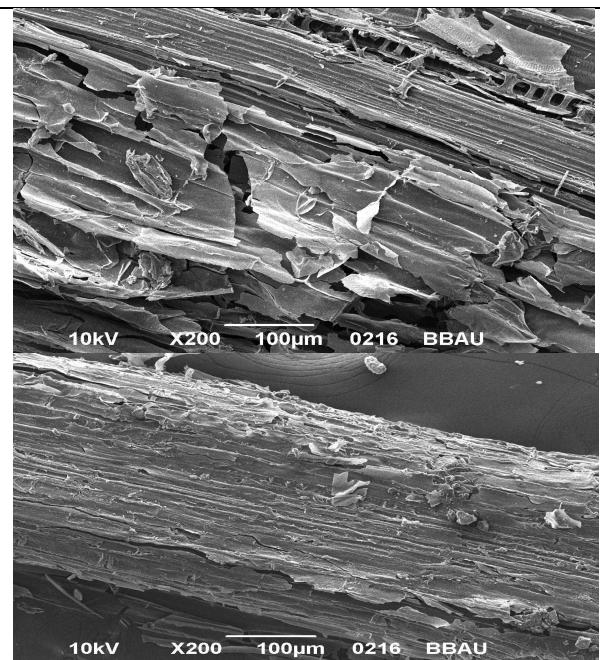
Fig. 6: SEM micrograph of general view of the sample of sugarcane bagasse (ASB), showing fiber and residues with 200× magnification. a) Before treatment, b) After treatment.
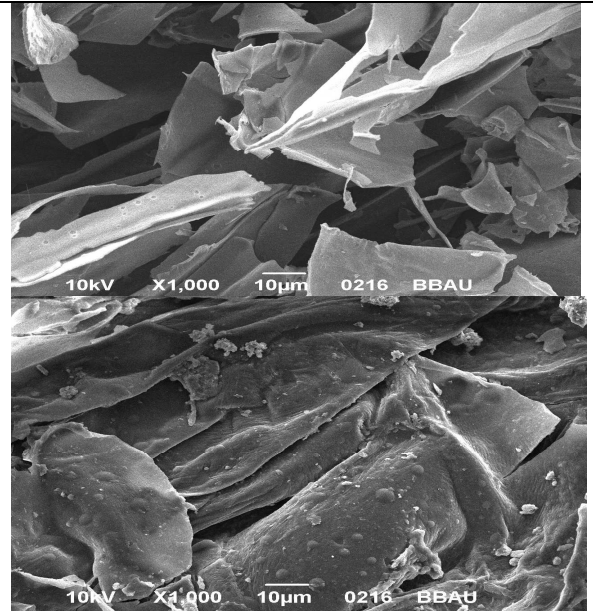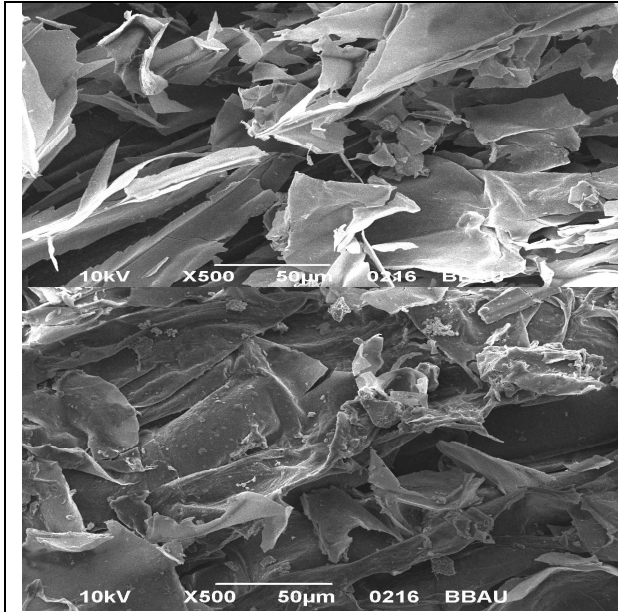
Fig. 7: SEM micrograph of general view of the sample of sugarcane bagasse (ASB), showing fiber and residues with 500× magnification. a) Before treatment, b) After treatment.

Fig. 8: SEM micrograph of general view of the sample of sugarcane bagasse (ASB), showing fiber and residues with 200× magnification. a) Before treatment, b) After treatment.
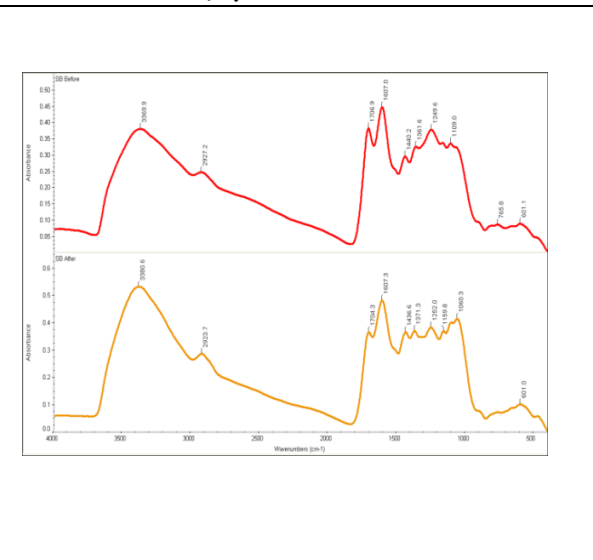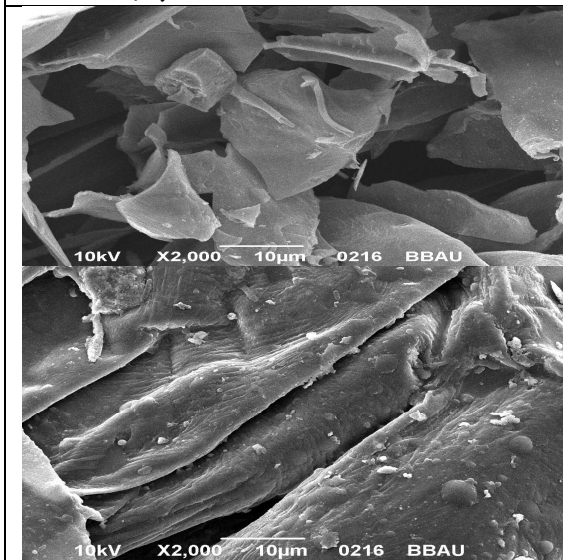
Fig. 9: SEM micrograph of general view of the sample of sugarcane bagasse (ASB), showing fiber and residues with 200× magnification. a) Before treatment, b) After treatment.

Fig. 10: FTIR spectra of untreated and treated bagasse fibers in the region between 500 cm⁻¹ to 4 000 cm⁻¹

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Fig. 11: Experimental Setup of filter model	Fig. 12: ASB as Adsorbent in grey water
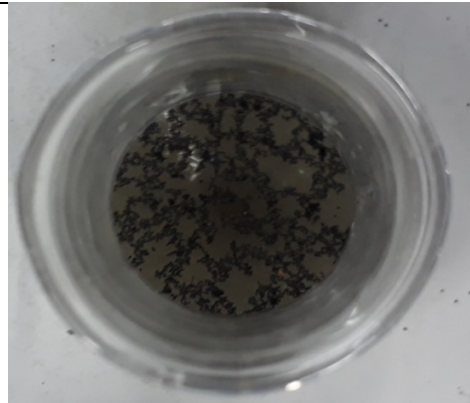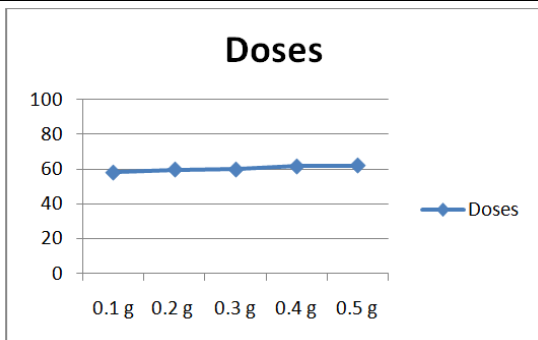
Fig.13: Amount of adsorbent vs. percentage (%) removal of total dissolved solids	Fig.14: Amount of adsorbent vs. percentage (%) removal of Electrical Conductivity.
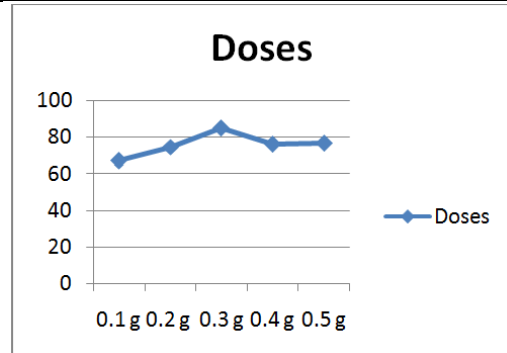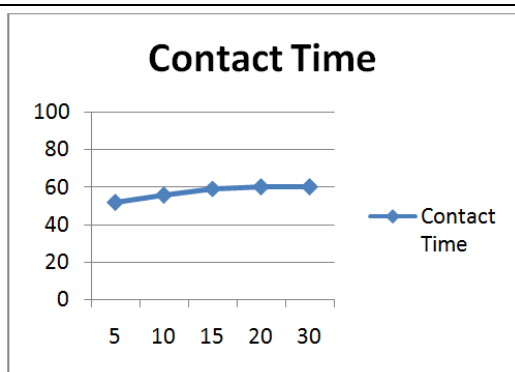
Fig.15: Adsorbent contact time vs. percentage (%) removal of total dissolved solids	Fig.16: Adsorbent contact time vs. percentage (%) removal of Electrical Conductivity.
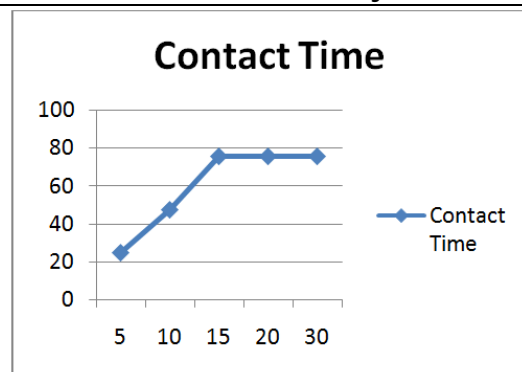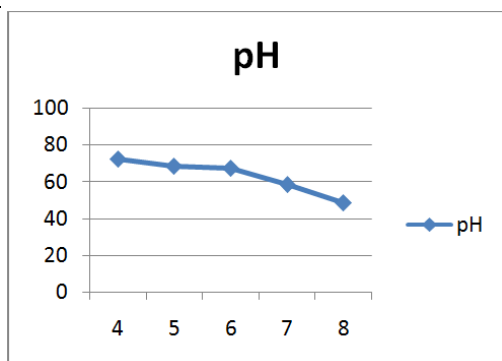
Fig.17: pH vs. percentage (%) removal of total dissolved solids
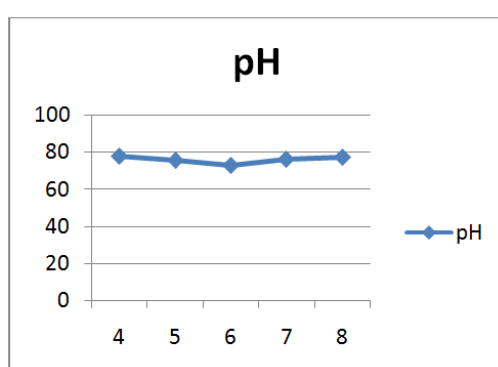
Fig.18: pH vs. percentage (%) removal of Electrical Conductivity
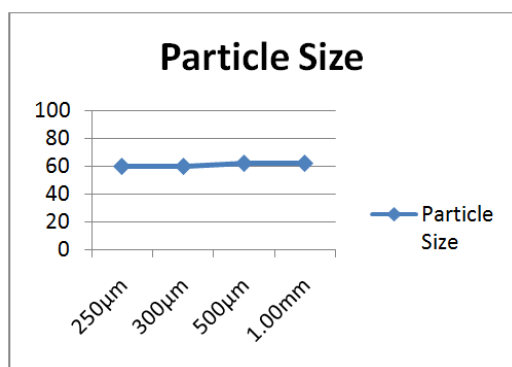
Fig.19: Amount of adsorbent vs. percentage (%) removal of total dissolved solids
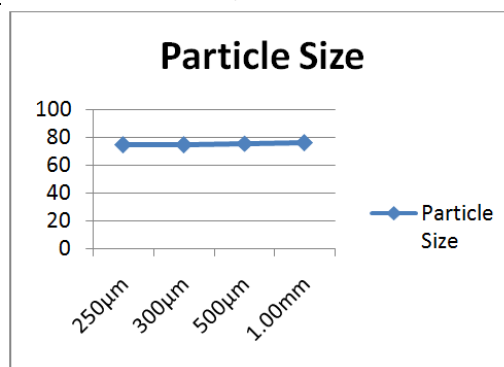
Fig.20: Amount of adsorbent vs. percentage (%) removal of Electrical Conductivity.

RESEARCH ARTICLE

An Approach for Secure Software Development Life Cycle in Small Software Firms

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ABSTRACT

Developing secure software is really a challenge now for all types of software industry like small or big industry. Security is an essential part of any type of software development. There is a number of drawbacks to our existing system of software development. Starting from Conceptualization to the last phase of an SDLC. Software security does not depend on maintaining security in each step of software development but also it depends on the technology we are using for maintaining the security of the software. In this paper, we did a literature review to identify the basic security challenges during development of a software and also pointing out research gap. Here around sixty research articles are reviewed related to software issues or software security.

Keywords: Software security, SDLC, Agile method, Information security

INTRODUCTION

The country like India is one of the quickest developing economies of the existence where the monetary development has consistently speed up and stable. IT area has arisen as a profoundly energetic and dynamic area of the Indian economy. Developing secure software is really a challenge now for all types of software industry like small or big industry. Security is an essential part of any type of software development. There are number of drawbacks to our existing system of software development. Starting from Conceptualization to the last phase of an SDLC, Software security does not depend on maintaining security in each step of software development but also it depends on the technology we are using for maintaining the security of the software. In the present Scenario, effective usage of data

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innovation projects is a basic key and serious need for firms in every single mechanical area. Because of cost invades, plan delays, unfilled necessities and low quality, IT projects are not effectively encouraging norm. There are a few practices and achievement factors for keeping up the norm of activities however extends still keep on fizzling. Sustaining quality of IT projects is a critical task. IT projects have not successfully facilitated standard due to cost involved in project completion, required resources along with inefficient risk & stakeholder. Few customer-oriented approaches enhance the efficiency of software development process along with elimination of waste and improvement of flow of productivity during software development & maintenance and get acknowledged positively by the IT organizations during project development. A Software Development is a list of interrelated steps for the developing a software or system. It is also a flow of interrelated steps where each step depends on its previous steps output completely. Each step follows a list of predefined activity as their stage role. Like beginning from requirement analysis to the last step of software maintenance. There are many models are available for the development of software like the waterfall model, iterative model, spiral model, agile and lean.

Meaning of Software Security

Software security is an idea to protect the software or the system from malicious attack or from hackers, so that software can work properly without any problem till the software existence in the system. Secure software means it maintains security goal of a software like integrity, confidentiality and availability.

➢ **Confidentiality**: Protect the entrance control and exposure limitations on data and ensure that no one will disrupt the guidelines of individual security and restrictive data
➢ **Integrity**: Maintaining a strategic distance from unapproved data adjustment.
➢ **Availability**: It implies all the data must accessible at whatever point required.

A protected programming consistently gives a quality item which must have accessibility, uprightness, interoperability, rightness, viability, execution, dependability, reusability, adaptability, security, testability and ease of use.

Software Security in SDLC

The best way to maintain software is sure means, maintain security in each and every stages of software development. The only secure methods to ensure that software is developed in secure is by maintaining a security in the all stages of software development life cycle (SDLC). Before software developer are not serious in development phase, so problems are identifying easily in the next stage of the development. Software security begins from requirement stage and carries forward till the maintenance phase. A good software application is one that is composed to accomplish its proposed reason and to guarantee that it gives a lovely client involvement with a totally sheltered condition. Intermittently, it is exceptionally testing to compose applications that meet all the achievement measures characterized. The critical request is how should, an item will be flexible to security flaws? Architects are frequently less mindful of security approaches prompting practical software, yet exceptionally helpless against security dangers toward the finish of the undertaking. Due to various blemishes in the improvement approach/measure, security issues are presumably going to happen when complement is put on the down to earth part of the item, while various security concerns are disregarded during the cycle. Various Engineers attempt to improve security perspectives by getting back to the work after the progression cycle has been done [2]. The research has distinguished different significant components as security approaches, measures being polished, and instruments used inside the SDLC through the study of the composition and the context oriented investigation investigated. The evidence collected from the field exhibits the shortfall of clear methodology and decides that are set up at the endeavor the chief level inside every time of the SDLC. Generally speaking, thought of present cycles, measure techniques, and standards recognizes the distinctive four SDLC secure programming improvement models.

Security Engineering Activities

Security planning practices join practices expected to assemble an ensured arrangement. Models join security necessities elicitation and definition; secure course of action subject to plan standards for security, utilization of static assessment instruments, secure outlines and reviews, and secure testing

Security Assurance Activities

Confirmation rehearses wire to check, underwriting, expert audit, relic study, and assessments.

Security Organizational and Project Management Activities
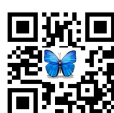
Different leveled rehearses combine genuine plans, senior association sponsorship and oversight, setting up reformist positions, and other authoritative exercises that help security. Undertaking the board rehearses combine task engineering and following asset task and utilization to guarantee that the security building, security attestation, and hazard indisputable affirmation rehearses are coordinated, managed, and followed.

Security Risk Identification and Management Activities

There is broad comprehension in the association that perceiving and overseeing security chances is perhaps the primary exercises in a safe SDLC and in conviction is the driver for following exercises. Security risks likewise drive the other security building works out, the undertaking the bosses work out, and the security confirmation works out. Hazard is besides canvassed in different zones of the Build Security in site [3]

Survey from 2008 to 2020

In the year 2018, the author Hasal Assal and Sonia chaiasson, have written a paper on, "Security in the Software Development Lifecycle", [1] In this article author explore different software security such as security knowledge, operational strategies. Division of labour, company culture, external pressure, and experiencing a security incident are factor need to address for maintain more secure in development of software. In the year 2016, the author Sanjay Kumar have written a paper on," Security Enhancement in Software Development Life Cycle" [11] in this paper creator said that the outcome acquired by secure programming is of very significance in light of the fact that numerous significant capacities are altogether subject to the product. With least expense and time to form the product into the market, numerous engineers begin thinking security after that. In the year 2017, the author Syed Mohd. Shahe Alam1, Prof.(Dr.) Sanjay Kumar Singh2, Dr. Suhel Ahmad Khan3, publish a paper on "Security Estimation Framework for Development of Secure Software and Cyber Attacks",[16] in this paper as indicated by authors to configuration, assemble and convey secure programming implies it must apply security in SDLC and follow the ongoing new advancement innovation identified with programming security during improvement procedure, for example, spry and others. In the year 2012, the author Ruchi Dabey, Vishnu Kumar, Suresh, publish a paper on, "Improve Security in a Software Development Life Cycle", [6] in this paper author said Effective software security management means it must apply new technique which is simple to apply and maintain and easy to understand. Software security means all the new methodology used for secure development must understand all security issue of development process or SDLC. In the year 2012, the author Dejan Baca, publish a paper on, "Developing Secure Software - in an Agile Process", [9]in this paper author said software security can be maintaining more if the company follow the agile process because to create secure programming, numerous organizations use security designing procedures that are plan substantial and inflexible and all the things are effectively feasible in agile procedure. In the year 2019, the author moutasm tamimi1, Fatimah alghamdi 2 & ahid yaseen 3, publish a paper on, "A systematic snapshot review of custom-made software enterprises from the development perspectives",[20] in this paper author made a review around 102 research paper from different source and made a study furthermore, this study exhibited that there was a higher research enthusiasm for their own made programming. In the year 2017, the author Sabbir M Saleh, M Ashikur Rahman, K Ali Asgor, publish a paper on, "Comparative Study on the Software Methodologies for Effective Software Development", [21] in this paper author made a comparative study on waterfall model, XP model, the objective of the study is to find out different

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functionality of each model and going through thoroughly. In the year 2013, the authors Srikrishnan Sundararajan, Bhasi M., Pramod K.V, have written a paper on , "An Empirical Study of Industry Practice in Software Development Risk Management",[23] in this paper authors propose a model for chance organization appropriate to non-in-house adventures and moreover explain the unquestionable features of our model in assessment with the current composition on programming peril, in that model the key community zones of programming danger the board in reallocated endeavors to achieve the best outcome. In the year 2017,the authors, Malek Al-Zewairi1, Mariam Biltawi1, Wael Etaiwi1, Adnan Shaout, have written a paper on, "Agile Software Development Methodologies: Survey of Surveys",[25] in this paper author made a comparative study on various tools used by different author on agile process, they made study by comparer and review method (CR) and the proposed agile methods that have not been tended to till now in some other writing survey were looked into and thought about as far as where the progressions that they proposed lay on the SDLC. In the year 2014, the authors, Haneen Hijazi, Msc, Shihadeh Alqrainy, Hasan Muaidi, Thair Khdour, have written a paper on, "RISK FACTORS IN SOFTWARE DEVELOPMENT PHASES", [27] in this paper authors made a comparative study of many major risk factor associated with software development in SDLC. Around 100 risk factors were addressed in the paper which are mostly common risk factors in all software development and in all software industry. In the year 2014, the author, Kavita Sahu, Rajshree, Rajeev Kumar, have written a paper on, "Risk Management Perspective in SDLC", [28] in this paper authors have tried to combine between software security and software risk in a solitary string. It is a finished procedure that will assist a designer with choosing most suitable risk the board plan for giving software greater security and build up a real existence cycle is proposed which will assist with recognizing and moderate dangers at the beginning phase of development. In the year 2018, the author, Shams Tabrez Siddiqui, have written a paper on, "Significance of Security Metrics in Secure Software Development", [30] in this paper authors make an investigation on security measurements of programming improvement stages and some normalized models for approval. In the investigation each phase of measurements and contrasted with one another and the end result are noted. The product got from the proposed security measurements of the product will be secure and more qualityiable In the year 2014, the authors, Nikhat Praveen, Md. Rizwan Beg, M. H. Khan, have published a paper on," Software Security Issues: Requirement Perspectives", [31] in this paper the author examine 21 issues identified with security with separate to prerequisite which can evacuate the all the security threats in start of improvement life cycle. By remembering these issues, working individuals in the zone of software security can ready to assemble increasingly secure software and furthermore the objectives of security can without much of a stretch be distinguished. In the year 2015, the authors, Manoj1, Shabnam Sangwan2, have written a paper on, "Information Security requirement in Project Development Life Cycle",[33] in this paper the author discovers how data security could be increment and build up another system and new philosophy that can help coordinate data security in venture improvement life cycle procedures and Information Security contribution in Software Project Development Life Cycle. In the year 2017, the author, Dr Rajesh Kapur, have written a research paper on, "A stochastic model to enhance information security in software development through risk management", [37] in this paper author develop a model to identify different threats in overall information security management. In the year 2015, the authors, Usman Rafi, Tasleem Mustafa, Nayyar Iqbal, Waseeq-Ul-Islam Zafar, have written a research paper on," US-Scrum: A Methodology for Developing Software with Enhanced Correctness", [38] in this paper authors develop a model on FDD and scrum principle to improve quality and security of a software and also this model provide more quality production using the concept verification and validation process. In the year 2016, the authors, Ruchi Sharma, Priyanka Mehta, have written a research paper on, "Implementation of Fuzzy Logic for Introducing Security at Process Level in Agile Development", [40]in this paper the authors highlight different concern of security requirement of the project using agile process using fuzzy logic technique which use java language and GUI.

Observation from Literature Review

After reviewing above article published by different author, here are list of some secure software development approach.

1. Security Knowledge and training to developer
2. Security goal should be clear to all development team.

3.   Requirement analysis from security.
4.   Formal risk assessment at each stage of development
5.   Thirty party verification of software related to security level after development.
6.   Identifying & Handling Sensitive Data
7.   Implement centralize security in both client and server side.
8.   Object reuse or code reuse should utilize.
9.   Adopting new methodologies for more secure in development like agile or lean

Research Finding

1. **Security measures in SDLC checkpoints:** Security rules are remembered for each SDLC stage's entrance and leave checkpoints.

2.**Secure software standards and practices:** All improvement measures and their ancient rarities adjust to make sure about engineering, plan, coding and reconciliation, and testing standards and practices, for example, those depicted in later areas of this report.

3. **Adequate necessities:** Elicitation, inference, and determination of prerequisites incorporates satisfactory, complete necessities for imperatives on the product's usefulness and conduct ("negative" prerequisites) just as non-utilitarian necessities relating to improvement and assessment measures, operational limitations, and so forth., to guarantee the product's steadfastness, reliability, and versatility.

4. **Secure coding:** Includes both coding and reconciliation of programming parts.
Coding follows secure coding practices and clings to make sure about coding principles. Static security investigation of code is performed iteratively all through the coding cycle, to guarantee that security issues are found and wiped out before code is delivered for unit testing and reconciliation.

5. **Secure programming incorporation:** Software units/modules/parts are coordinated in light of the accompanying contemplations: Guaranteeing that all automatic interfaces and technique calls are naturally secure or that security systems are added to make sure about them

6. Security testing: Appropriate security-arranged audits and tests are performed all through the SDLC. Tests plans incorporate situations incorporate strange and antagonistic conditions among "foreseen conditions" under which the product may work, and test standards incorporate those that empower the analyzer to decide if the product fulfills its prerequisites for constancy, dependability, and survivability under totally foreseen conditions. The survey and test system incorporates a wide enough assortment and mix of tests to empower the analyzer to decide if the product fulfills its prerequisites for constancy, dependability, and survivability under conditions.

7. **Secure circulation and organization**: Distribution and sending follows secure practices, which include:

a. Completely "cleaning" the product executable(s) to eliminate hazardous coding builds and installed delicate information, engineer indirect accesses, and so on., before move to download site(s).

b. Dispersion on media or through interchanges channels that satisfactorily shield the product from altering when it is in transit to its buyer or installer this may incorporate use of advanced marks or computerized rights the executives' systems to forestall altering or unapproved/unlicensed establishment

c. Default arrangement settings that are maximally prohibitive, with the design direct adequately instructive and nitty gritty that it empowers the installer to settle on educated danger based choices about reconfiguring the product with less-prohibitive settings if vital

d. Comprehensible, exact client, director, and installer documentation that unmistakably clarifies every necessary requirement and security highlights of the product.

8. **Secure sustainment:** Maintenance, weakness the executives, and fix issuance and dissemination adjust to make sure about sustainment standards and practices. Programming clients are urged to apply fixes and keep programming refreshed, to limit pointless presentation of weaknesses.

9. **Supportive advancement instruments:** Development, testing, and organization apparatuses and stages that upgrade security of created relics and backing secure improvement rehearses are utilized all through the SDLC.

10.Secure design the board frameworks and cycles: Secure programming arrangement the executives and form/change control of the advancement ancient rarities as a countermeasure against disruption of those curios by malignant engineers, analyzers, or other SDLC "insiders"

11. Security-learned designers: The security the information the engineer needs will explain the immediate connection between security standards and programming building rehearses. Security instruction and preparing of designers needs to go past basically clarifying what security ideas and standards are significant. It needs to address the useful manners by which those ideas and standards straightforwardly apply to the designing practices by Which programming is imagined, executed, and supported. The instruction/preparing ought to be adequate to empower the designer to recognize security-upgrading and security-compromising programming rehearses, and to certainly and skilfully grasp the previous.

Problem Statement

After studying and exiting propose model and research on security in software development process, in all big software industry are following different methodology for developing secure software, but in case small software industry it quite difficult to adopt new technology or tools for developing secure software.

1. Is the agile procedure will assist with improving security in software development in small software firm?
2. Is the Hybrid model of waterfall and agile will assist with improving security in software development?
3. Would Agile-Lean model be appreciated and adopted by the small software firm to develop

Objectives of the Research

- To Understand the strengths, weakness and opportunities of existing security architectures for SDLC
- To Conduct a Primary Survey for IT SME's for exploring the need of secured software development
- To develop a model for secured software development
- To carry out a comparative study after implementation of model in selected SME's

Research Methodology

- For carrying out the first objective, a rigorous review of literature will be carried out by referring indexed journals in Computer science and Engineering field.
- For carrying out the second objective, we carry out questionnaire survey; a well-structured questionnaire will be prepared and analysed using IBM SPSS tool.
- For carrying out the third objective, a mathematical model using machine learning techniques will be developed and tested in selected SME's
- A comparative study using quality control tools will be carried out.

CONCLUSION

Development of secure software is a challenge to all types of industries like big or small software firms, so small software firms may face different type of attack during the development process or after the development of the software which will leads to many expanses so developing secure software is an integral part for small software industry. Our future research to develop a secure model for small firm which will help social and economic growth.

Future Research and Research Gap

All the research on software security enhancement in the software development process is based on research methodology, research development process, and risk factor identification, but till now there is no such type of research is there for enhancing security level during software development life cycle in small software farm.

1. All the research is based on process of secure software development but no one address Cost factor.
2. All the research is on the overall development process but there is no research on "How to enhance software security in software development in small scale software company".

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3.   There is no such research to identify different issues in secure software development for small industry.

Future Work on My Research

Finalizing my research problem, questioner formation for my research topics. Developing one model for small software industry.

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REVIEW ARTICLE

A Literature Review of Recent Generative Adversarial Network Architectures

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ABSTRACT

Generative adversarial networks (GANs) are network architectures consisting of two or more neural networks, generator networks that aim to convert random noise into meaningful data, and discriminator networks that aim to identify the data perceived as real or fake. This paper brings together research on recently proposed GAN architectures, for image generation, image-to-image translation, and image super-resolution. A total of 16 recent architectures that the authors found promising are reviewed, with a brief analysis of each architecture. The overall progress and potential of GANs are discussed.

Keywords: generative adversarial networks, gan applications, image generation, image-to-image translation, super-resolution

INTRODUCTION

Generative adversarial networks (GANs) are a type of multi-network artificial neural network architecture, wherein one or more "generator" networks attempt to replicate or imitate a data distribution, while one or more "discriminator" networks attempt to distinguish the original data distribution from the generated data distribution. GANs were first introduced in 2014 in [1], where the authors proposed a simple architecture consisting of fully connected layers, with rectified linear unit (ReLU) activations [2]. for the generator network and maxout activations for the discriminator network. This original GAN performed well on low-resolution images. Since then, there have been several improvements and variations in GAN architectures, generator and discriminator architectures, training methodologies and loss functions that have contributed to the rapid development of GANs as one of the

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most powerful neural networks. Several GANs have received attention for their significant contribution to the field, and either measurable improvement in image generation performance or the development of additional functionality or capability for GANs. A brief discussion of key GAN research papers follows:

Deep Convolutional GAN (DCGAN): In 2016, the authors of [3]. presented an architecture that employed convolutional layers with strides, which were better at spatial up-sampling and down-sampling. This method proved to significantly improve the image generation capabilities.

Wasserstein GAN (WGAN): The Wasserstein GAN (WGAN) [4]. applies the Wasserstein distance function to measure the differences between the original and imitation data distributions. Also, the discriminator is trained far more than the generator, and its weights are clipped to between -0.01 and 0.01. This architecture leads to greater model stability, and possibly the avoidance of the mode collapse problem.

Cycle-Consistent GAN (Cycle-GAN): The unpaired approach to image-to-image translation proposed in [5]. was an important step in improving the capabilities of GANs in mapping image features across image styles. This paper was able to use style transfer generative networks with discriminators using a cyclic-loss function to replicate image styles and features in the target images.

The key sections of this paper are as follows. Section 2 provides the criteria for the selection of literature and its analysis. In section 3, a summary of GAN literature is provided. GANs specializing in image generation are reviewed in section 4, GANs handling image-to-image translation are reviewed in section 5, and GANs for super-resolution are reviewed in section 6. Section 7 discusses the various architectures reviews and presents use cases for different GAN types. A look at the limitations of this literature review is in section 8. Finally, the conclusion for this paper and possible future research is detailed.

METHODS OF LITERATURE REVIEW

In this section, the literature selection approaches and criteria are laid out.

Criteria for Architecture Selection

The research papers considered for this review are based on the following criteria:
- Title of the paper and its year of publication – Only papers that have been published since 2018 are considered and selected based on their title.
- Abstract and initial overview of the paper – The abstracts were reviewed for the premise and the authors' summary. A brief scan of each paper helped narrow the scope of this review further.
- Understanding and reported results of the paper – Papers were filtered based on the architectures, methodology, and reported results.

Bases for the Analysis of Literature

The literature reviewed here are analysed based on:
- Reference Type – the original publication source of the paper
- The objective of the research – the authors' primary objective in developing the GAN architecture.
- Datasets used in the research – which notable datasets were used to test the GAN architecture.

- Type of GAN – broadly classifying GANs into one of two categories, either image generation or image super-resolution.
- Evaluation metrics – reported performances and results for the proposed architecture.

OVERVIEW OF LITERATURE

For this review, 16 papers were identified from recent research, and Table 1 shows the distribution of considered research by year. Most of the research papers were taken from conference publications, but a few were also from journals. The sources considered and the papers from each source are highlighted in Table 2. The following sections will examine GAN architectures by their type, and Table 3 shows the distribution papers by the type of GAN. The research papers often use a variety of datasets to test the models they propose. Table 4 looks at the most mentioned datasets.

IMAGE GENERATION GANs

Image generation is the original domain of GANs; here GANs are used to generate fake images (also called synthetic images) which resemble the real images that they are trained on.

ProGAN

In 2018, the authors of [6] presented their method for the progressive growing of GANs (ProGAN) which is a GAN with a dynamic structure. Both the generator and discriminator are mirrored and are initially trained on low-resolution images, and then have layers added to them to work on higher resolutions. Additionally, the architecture uses pixel feature vector normalization [7], and equalized learning rate, which involves modifying learning rate while training.

SPGAN

The Sparse GAN (SPGAN) proposed in [8] takes images and divides them into 'patches', and then trains the generator to produce sparse representations of features found in these patches. The architecture also includes a discriminator network and a reconstructor (encoder) network – whose role is to reverse map the generated images to their latent vectors. SPGAN achieves a higher Inception score [9] on the CIFAR-10 dataset [10] than notable GAN architectures like BEGAN [11] and WGAN [4].

DRGAN

While most GANs focus on regular images, the Deep Residual GAN (DRGAN) model from [12] is used on Positron Emission Tomography (PET) images. This designed and used residual deep connections with pixel shuffle (RDPS) blocks for their generator network to produce fake residual PET maps (RPMs). The production is judged by two discriminator networks – one for classifying PET images as real or fake, while the other compares the generator's RPMs against actual RPMs. The DRGAN is used by the authors to successfully reduce streaking artefacts and noise from PET maps.

EvolGAN

The Evolutionary GAN (EvolGAN) proposed in [13] uses standard generator and discriminator models, but changes how the latent vector is generated by using a quality estimator that is based on evolutionary strategy. An important change by the authors is a modification to local and global searches, by changing the maximum mutation rate (α in the paper), which helps increase the diversity of the generated images. EvolGAN aims to bring more powerful generation capabilities when dealing with datasets containing a small number of training samples, difficult training samples, or both. The authors' results show that they have managed to create an architecture that creates more realistic images (based on a human evaluation).

R3-CGAN

The authors of [14] identify the issue of insufficient labelled data hindering supervised learning GANs and propose a semi-supervised GAN (based on Triangle-GAN [15]) that uses Random Regional Replacement (R3) regularization using CutMix to create real-fake instances and cross-category instances which supplement the available labelled data. The architecture consists of a generator, a classifier (for instance-label pair generation), and two discriminators. R3-CGAN is tested on CIFAR-10 (4k), SVHN (1k), CIFAR-100 (10k) and FaceScrub-100 (2k) datasets and has lower test error rates than previous state-of-the-art GAN architectures.

Spectral Regularization of GAN

While most GANs are powerful enough to create realistic-looking fake or synthetic data, the authors of [16] found that many fail to replicate the spectral distributions of real training data. This makes the identification of fake images simpler. To tackle this discrepancy, the paper presents a method for regularizing the spectral distribution of the generated images to closely resemble real images by adding a spectral loss term to the generator loss. This makes for more stable models and improved visual quality of fake images. The tests of spectral regularization on existing GAN architectures showed an improvement in the stability of the models during training as shown by low FID scores [17].

YLG-SAGAN

Based on the SAGAN architecture [18], the Your Local GAN (YLG-SAGAN) from [19] replaces the dense attention layer in the original architecture with a local sparse attention layer. The sparse attention layers provide a significant improvement over the SAGAN model with an FID score improvement of 14.53% and a 40% reduction in training time. The authors also show the inversion of their attention model which allows them to visualize the areas of attention for the model in every image.

SinGAN-GIF

While most other GAN models reviewed focus on image generation, the SinGAN-GIF model [20] goes a step further to generate short videos. The original SinGAN architecture [21], uses a series of multi-scale patch generators and discriminators to generate fake images that closely resemble the original image. The new architecture proposed in this paper aims to work on short videos, and includes, at each scale, the addition of a 3D Convolutional Neural Network (CNN) used to generate residuals, and an additional discriminator used to perform frame-wise discrimination. SinGAN-GIF can use a single GIF to generate realistic video samples and do so at different resolutions and frame rates.

IMAGE-TO-IMAGE TRANSLATION GANs

Image translation is where a GAN is used to convert images of one variety (or domain) to images of another variety and vice versa.

CFAGAN

As discussed, CycleGAN [5] made it possible to use unpaired image data to translate images from one domain to another. The authors of [22] apply CycleGAN to the problem of facial ageing. Using the trained CFAGAN, the authors apply image translation to transform images between two age groups created by the authors – 20-35 years (or young) and 55-70 years (or old).

StyleGAN

StyleGAN is perhaps the best-known architectures in this literature review. Proposed in [23] the architecture breaks the traditional generator into two networks – a mapping network that converts the latent space input into an intermediate latent space, and a synthesis network that is controlled by the generated latent space using adaptive

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instance normalization. This leads to StyleGAN being able to not only generate realistic images with fine details but also learn to apply the "style" of an image when generating images, which the authors call style mixing. Additionally, the original authors and others have proposed an improvement to StyleGAN, referred to as StyleGAN2 [24], where they address the issue of image artefacts. They propose changes to the synthesis network to tackle the artefacts and make changes to the progressive growth of the network. They also use path length regularization to improve generator smoothness. The changes make for faster training and more traceable attribution of image styles.

CIT-GAN

The Cyclic Image Translation GAN (CIT-GAN) [25] is a three-network GAN, with a generator that translated images from one domain to another, using inputs from the styling network, and a discriminator which handles domain-wise classification of images into real or fake. The authors of the paper use CIT-GAN to generate fake images of iris presentation attacks for iris scanners. The fake images generators by the GAN are used for data augmentation for training the classifier in those domains where samples are limited and outperform StarGAN v2 [26].

DGGAN

Hand Pose Estimation (HPE) using images is generally done using images paired with the corresponding 3D depth images. However, Depth-image Guided GAN (DGGAN) [27] translates images to 3D depth-images and vice versa using unpaired data. This is achieved by using two modules – the first is a GAN network that uses unpaired images to reconstruct the depth-maps of images, the second is a multi-network HPE module that uses a depth regularizer to reconstructs depth-images from 3D joint locations (from the images) and the corresponding generated depth-map. This architecture more accurately predicts the 3D HPE compared to other methods.

CuGAN

Taking into consideration the difficulty to train GANs from scratch, the authors of [28] propose three curriculum learning strategies. First, they suggest scoring images by their difficulty to learn and then training the GAN from simple to complex images (batches-strategy). Second, the authors present a curriculum loss function to be used to weight images based on difficulty (weighting-strategy). Finally, they suggest ensuring the distribution of samples favour 'easy' images during the early stages of training and then progressing towards a uniform distribution in later stages (sampling-strategy). Using SNGAN [29] as a baseline, the authors test their three strategies and find that all approaches score better on Inception and FID scores than other GAN architectures for both generation and translation tasks.

GAN Compression

GAN architectures are growing as high-resolution and style-transference features become common. In [30] the authors propose a technique for the compression of generator architectures, using a three-step approach – first, a pre-trained generator is used to create a student generator using weight sharing, then a set of sub-generators with diverse channel numbers are extracted from the student generator, and then based on the performance target and compression ratio one of the sub-generators is chosen. This compression technique is tested on the CycleGAN, the Pix2pix [31] and the GauGAN [32] architectures and compresses the models by 5-33x in terms of size and 9-21x in terms of Multiply-Accumulate Operations (MACs).

IMAGE SUPER-RESOLUTION GANs

Image super-resolution (SR) is the application of GANs (or other networks) in the approximation of a high-resolution (HR) version of a sample of low-resolution (LR) images.

Hierarchical GAN

Single image super-resolution (SISR) is a task where a model is trained to super-resolve a single image given its LR and HR versions. The hierarchical GAN introduced in [33] uses a dual-module approach to this task. First, the

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hierarchical feature extraction module (HFEM) is a combination of a multi-branch network that extracts features at various scales parallelly and a future fusion network to combine the features in terms of their hierarchy. Second, the hierarchical guided reconstruction module (HGRM) is a multi-branch network wherein each branch attempts to super-resolve the image to a specific resolution, and one branch aims for the target HR; the outputs of all branches contribute to the loss calculation and feedback. Finally, a discriminator network handles classification. The method presented in this paper performs better than multiple other state-of-the-art SR models.

PULSE

Photo Upsampling via Latent Space Exploration (PULSE) is an SR method proposed in [34], where instead of training on LR-HR paired image datasets, the authors use latent space exploration to find HR images that can be scaled down to the given LR images using a 'down-scaling loss'. This allows the method to create HR images from the LR images, instead of trying to fit generated HR images to the real paired HR images. PULSE produces higher resolution and more detailed images than other SR models.

DISCUSSION

Since the original GAN architecture was proposed, there have been several improvements to the power, functionality and diversity of GANs. While image generation has been a focus for GANs, their applicability to image translation and image super-resolution are growing. In this paper, we have seen that image generation GANs are now capable of producing high-resolution images with the right architecture and training approach. Also, as image translation techniques gain traction, the ability to create images that can reflect the features, styles or other attributes of a completely different domain of images is now commonplace. Finally, the challenge of image super-resolution is also being tackled by GANs to a noticeable degree of success.

Limitations of this Literature Review

We would like to highlight some of the limitations of this literature review:

- Firstly, we had limited access to subscriber-access or pay-walled research papers, and relied on the availability of papers through open access journals and conference publications. This limited the scope of this review as several GAN architectures were inaccessible.
- Secondly, GAN architectures are reliant on a variety of complex internal networks and diverse loss functions. This limits the depth of this review, as there is no scope for in-depth coverage of architectures.
- Finally, the high GPU-intensive computing requirements, complex architectures and time-consuming training of models limit the possibility of implementing and evaluating architectures for a fair comparison.

CONCLUSION AND FUTURE WORK

This literature review looks at 16 GAN architectures published between 2018 and early 2021. The models presented herein show GANs are suitable for image generation, translation and super-resolution. Training time, Inception scores and FID scores are used to evaluate model performance.

We present this review as a basis for identifying unique models, applications and loss functions for GANs, and hope it will aid researchers in developing their architectures through identifying a baseline approach or will otherwise contribute to their understanding of the field.

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Table 2: Papers by publication year

Year	#
2018	2
2019	2
2020	10
2021	2
	16

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Table 3: Papers by publication source C: Conference, J: Journal

Publication	Type	#
Asian Conference on Computer Vision	C	1
IEEE Computer Society Conference on Computer Vision and Pattern Recognition (CVPR)	C	1
IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR)	C	5
IEEE/CVF Winter Conference on Applications of Computer Vision (WACV)	C	5
IET Image Processing	J	1
International Conference on Computer Vision Workshop (ICCVW)	C	1
International Conference on Industrial and Information Systems (ICIIS)	C	1
International Conference on Learning Representations (ICLR)	C	1
		16

Table 4: Papers by type of GAN architectures

Type	#
Image Generation	8
Image Translation	6
Image Super-resolution	2
	16

Table 5: Most used datasets

Dataset	# of uses
CIFAR-10	4
CelebA	3
CelebA-HQ	2
Horse2zebra	2

REVIEW ARTICLE

A Review of Techniques for Extracting Knowledge to Develop Semantic Web of Things Applications

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ABSTRACT

Internet of Things (IoT) is a rapidly growing interactive network of computers, automobiles, industrial networks, and a variety of consumer electronic devices. However, the lack of interoperability in the IoT leads to a significant challenge to the predicted financial advantage. Interoperability, efficient data access, resource discovery, knowledge extraction can be assisted by applying semantic techniques to IoT. In a cyber-physical system, the Semantic Web of Things (SWoT) enables the exploration and interoperability of IoT devices. As IoT becomes an interesting research topic, several methods have been explored to encourage the growth and popularity of IoT from multiple perspectives. One trend is to view IoT as SWoT, where data sharing and system interoperation are facilitated by open Web standards. The objective of the proposed review is to discuss the recent developments in semantic web. In this study, the recent research articles related to semantic web and IoT with its applications are summarized. In addition, comparisons of multiple approaches in SWoTare made to present the insight of growth and future direction of SWoT. Finally, some open challenges in the development of SWoT are also presented.

Keywords: Semantic Web of Things; Internet of Things; Semantic Web; Web Ontologies; Semantic Reasoning

INTRODUCTION

The Internet of Things (IoT) is represented by the widespread existence of intelligent collaborative devices that perform tasks in very different application domains [1]. The development of using the Internet with actual art effects has contributed to the formation of the IoT. IoT is described by the International Telecommunication Union as a

global information society infrastructure that allows advanced services to link (physical and virtual) items based on existing and emerging interoperable information and communication technologies [1],[2]. Moreover, the IoT enables a path between human and technology and reduce the complexities in the communication medium [3], [4]. In fact, intelligent devices and node sensors have the ability to sense, communicate and share information and information about their surroundings.

The semantic web does not share the text of a website but shares data and information. Sir Tim Berners-Lee introduced the concept of the Semantic Web in 2001. The Semantic Web aims to create a technology stack to support a 'web data' instead of a 'web document'[6]. The ultimate purpose of the web data is to provide the machine with the ability to perform tasks that are more practical and to develop structures that can support trustworthy network interactions. The Semantic Web of Things (SWoT) includes the implementation of the semantic web standard in its vision [11], an initiative that was developed to reinvent the web as a data repository that can be interpreted as a machine. A collection of standards to define resources to encode information and to attach a definition to all elements of information. Due to the enormous amount of heterogeneous artifacts, sensing data, and services, the continuous evolution of the IoT has led to a degree of complexity [7],[8].The lack of a cohesive and standard model of IoT devices and data and services presents such challenges. The definition of semantics plays a central role in the IoT, because of its versatility to address complexity, interoperability and data interpretation problems. Semantic interoperability often refers to the ability to access and interpret explicit data for various entities, provided that linked objects are capable of sharing data online with each user [9].

In order to express semantic objects and their data, SWoT intervention in the IoT field is a simple, explicit and comprehensive representation [10]. Semantics also accept the concept of collaboration that allows for data sharing, reuse, integration and probing [11]. This data, extracted from various objects and domains related to each other, ensures that the linked objects work together, encourage the communication between them to underline their intelligence aspects [13]. It also ensures data interpretation and reasoning which explains why synchronization of data with various vocabulary and frameworks is needed [14].

The application of SWoT in the IoT domain is considered a suitable and rational solution for this purpose [15]. The use of semantic technology in IoT facilitates interoperability between its tools, data models, data providers and consumers. It also facilitates efficient data access and integration, exploration of tools, semantic reasoning, and extraction of information [16]. SWoT is a new vision that blends the semantic websites with the Internet of Things. Leveraging SWoT includes creating an ontology that governs web-based relationships and hence their distinction based on their shared connections [17],[18].

Through a taxonomy of the existing approaches, we detail, identify, compare, and discuss the most recent realized semantic modelling approaches in the IoT/SWoT domain [19]. We assume that both researchers and developers will be supported by this study to concentrate on the blending between SWT and the IoT domain that will lead them towards recent advances.
We assume that both researchers and developers will be helped by this survey to concentrate on the amalgamation of SWT and these domains, as it will direct them into new potential areas of study.
The major contributions to our research are described as follows:

- We present a comprehensive analysis of the up-to-date framework of the study on the role of semantic web and IoT
- We suggest a systematic classification that leads to a detailed study of a detailed process of literature.
- We include in-depth comparisons and discussions of different approaches, the key role of which is to ensure IoT and SWoT semantic interoperability.

The structure of this study is as follows: We include a summary of relevant IoT semantics survey papers in Section 2. Section 3 outlines our survey's methodology. The summary of the reviewed papers for the representation of semantics will be presented in Section 4. Section 5 offers a brief discussion about the extracted research articles. In

Section 6, potential future research opportunities are defined in detail based on the systematic analysis in the previous parts. Finally, Section 7 concludes the study.

Related Works

We analyze all the relevant surveys on the semantic web and its appropriate resource in this section, and finally, define how our survey differs from current surveys. The arrival of web semantics in the field of tourism data systems enables the management and interoperability of semantically diverse data and provides reliable and versatile information. Many researches have been instrumental in the field of the semantic web[20]. The versatile representation of information is provided by semantic Internet technologies such as RDF, ontologies, and OWL. These technologies are used for the search and classification of features in geographical information systems. For the earthquake recommendation framework, some researchers employed the idea of semantic web technologies. Abaalkhai *et al.* [1] addressed 18 ontologies focused on various human behavioral states such as mood, emotion, needs, and so forth. In their opinion, ontology, in such a format that a machine can easily process, reflects real-world information. Ontology is a concept that enables improved machine processing since there are organized documents on the web in such a way that machines can understand them.

Bajaj *et al.* [2] studied, examined, and analyzed different ontologies that are reused by taking sensors, time, place, and context awareness into account. The above methods have been categorized into generic and field-specific ontologies. Furthermore, the authors outlined the current IoT ontologies to ensure semantic interoperability among heterogeneous IoT systems. They concentrated mainly on a generic ontology that was used on IoT platforms and domains (security and logistic fields). Ahlem Rhayem *et.al.*[3] discussed the semantic technologies for IoT. They classified the research articles based on IoT, WoT, and sensors. They analyzed the role of SWoT in the implementation of IoT. The authors have formulated a set of research questions and provided solutions using their survey. Archana Patel and SarikaJain [4] presented a review on semantic web technologies. They examined the semantic web research articles using 10 different domains. They analysed the area which has increased the usage of the semantic web. In addition, the authors presented the application of semantic web technologies in constructing an effective information retrieval system. The proposed review presents the recent researches on the semantic web and IoT. The existing review articles focused only on semantic web technologies and not on knowledge extraction. Therefore, we analyze the role of the semantic web and its application in IoT and classifies the articles based on it.

Survey Methodology and Data Extraction

We focused on a systematic literature review (SLR)[5] to examine and evaluate relevant SWoT and knowledge extraction technologies for IoT. According to the study [5], the proposed review consists of two phases such as keyword construction based on Research Question (RQ) and Article extraction and screening.
Based on the review of literature, we constructed the RQs as follows:
RQ1 – How semantic web supports IoT in extracting knowledge?
RQ2 – What are the existing techniques in SWoT and its applications?
RQ3 – How to classify the SWoT techniques?

Keyword Construction

The construction of keywords for extracting research articles is a vital process in a systematic literature review [5]. Multiple portals are available for exploring scientific articles.   Thus, an effective set of keywords are required to extract relevant research that matches the RQs and objective of the research. The proposed review aims to discuss the extraction techniques for developing SWoT applications.   The following combination of keywords is defined for retrieving the research studies from the digital libraries.
(("Knowledge Extraction") AND ("Semantics in IoT" OR "Semantic Web of Things" OR "IoT" OR "Web of Things" OR "Internet of Things) AND ("Issues" OR "Problems" OR "Solutions")) We combined "Semantic Web",

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"Knowledge Extraction", and "Internet of Things" for retrieving the most relevant researches based on SWoT and IoT with knowledge extraction.

Article Extraction and Screening
In this study, we utilized IEEE Explore, Springer, Science Direct, and ACM digital libraries for extracting the research studies in the field of semantic web and IoT. Figure 1 represents the steps involved in the extraction process. In the first step, we framed the filter criteria for each library. For context, Springer publishes research articles for the upcoming year 2021 in the present year. Therefore, the criteria of publication year for Springer and Science Direct is selected between March 2017 and March 2021. As specified in the following figure, the conditions are applied and appropriate research articles from the respective digital libraries are retrieved. The second step indicates the number of articles that were retrieved from the digital libraries. We collected 753 articles from ACM, 89 from IEEE Explore, 657 from Springer link, and 213 from Science Direct, respectively. It is evident from the outcome that IEEE Explore has published few articles related to SWOT and IoT. In the third step, duplicate or redundant articles were removed from the set of extracted articles. Due to the time constraint, we minimized the number of research articles to 100 and filtered the articles using title and abstract. The fourth and the final step shows the total number of articles i.e., 15 articles at the end of the extraction process.

RESULTS

The following table presents the information about the research articles collected through the previous phases. It provides the features and type of the selected research studies. The studies are related to SWoT is in infancy stage. Thus, the number of studies in the field of IoT and semantic web are limited rather than other fields. It is evident from the table 1 that the author of the extracted studies was implemented either an application or a framework using semantic ontologies. Table 2 presents the classification of studies and their limitations. The limitations of studies are addressed by studying its objective and contributions. Most of the studies were implemented as a framework to provide a solution for semantic interoperability. Based on the analysis of the research studies and their contributions, we classified the articles into two major classifications include Ontology – based framework and Middleware application with interoperability. Data heterogeneity or Interoperability is one of the major challenges of SWoT. However, the emergence of AI based technologies and machine learning concepts will overcome the interoperability issue.

DISCUSSION

RQ1 focuses on the studies that address the role of the semantic web in IoT. To provide a suitable solution for RQ1, through this review, we found that semantic web technologies are widely used to model and integrate data from various Web sources and can be used to mitigate these challenges by extending them to the IoT domain[4],[5],[7]. The semantic annotation of IoT data represents a key step in the development of intelligent and interoperable IoT applications. A lot of computational resources are needed in this type of process, particularly when scenarios are expected to involve a large number of sensors like intelligent cities [8],10]. The RDF(Resource Development Framework) triples are the concepts of RDF, which is an ontology to describe a web of thing. RDFS (RDF Scheme) and the OWL (Web Ontology Languages) are used to define specific domain schemes and ontologies. Semantic ontology and schemes are the key concepts of the semantic web [9]. An ontology is a formal characteristic of a shared conceptualization. Several projects that employ ontologies and vocabulary are available on the web. Schema.org provides one of the schemes which is most widely used on the web and defines it as a 'collaborative community activities aimed at creating, maintaining, and promoting schemes for structured data on the web, web pages, emails etc.,'[11]. The scheme is used on more than 10 million websites and consists of 642 different types, 992 properties and 210 counts [12].

RQ2 is to find the existing SWoT techniques and its applications. The existing SWoT approaches were presented in Table 1. SWoTis based on the sensor and wireless hardware. Thus, most of the studies applied use case for evaluating their methods / frameworks. Some of the studies. Were employed the existing ontologies and vocabularies to test the performance of the methods. RQ3 concentrates on the classification of research studies. Table 2 discussed the classification and limitation of the studies. Ontological – based framework and application for semantic interoperability are the major classifications of SWoT and IoT [5]. Based on the classification, the studies were classified. Business strategy and logic are represented by business rules. Ontologies have a structured semantic knowledge model to capture enterprise objects as principles and rules behind the business objects defined. Properties, constraints, and relationships are described to describe high - level business rules[11],[14]. Semantic web is evolving with the growth of IoT and web. Many research studies are in-progress and we can expect more successful findings in this field.

Potential Research Directions

Ontology development, scalability, multilingualization, and security are the major challenges in semantic web [6],[8],[10].In order to convey the semantics of the Semantic Web material, ontologies will become a key component. Multi-lingual is a major challenge to build standard, widely accepted ontologies for the Semantic Web, to provide adequate ontology development infrastructure, organisational change and visualisation and to adequately monitor and control the progress of the ontology and its annotations. While English is considered the predominant web content-language, important documents written in other languages are still available on the web. At the level of ontology and annotations and user interface, this plays an important part. The development of a native ontology method, ontology mapping, and interpretation in different languages, as well as culture and national ontology integration are the future necessities of internationalization. Other Semantic Web concerns include cultural and linguistic integration [15]. Control of its contents in a scalable fashion is another problem for the Semantic Web [16], [17]. A critical effort should be made to store Semantic Web contents to face these challenges and to include an instrument through which the contents can be found to be scalable. Protection should be regarded as another challenge for Semantic Web [6], [8],[9]. Solutions should be offered when Semantical Web is entirely created. Web 2.0 includes particular security vulnerabilities not yet fixed. These problems can be included in Web 3.0 applications as Web 3.0 is known as the Web 2.0 extension and thus Semantic Web as part of Web 3.0 can face the same problems. Security issues in this context such as data credibility, metadata control and data mash-up protection remain accessible in web 3.0. Semantic Web and its layers will be vulnerable to security issues.

CONCLUSION

Semantic web presents more flexibility for knowledge extraction and supports IoT to become platform independent. In this study, we discussed the recent developments in the semantic web, IoT, and knowledge extraction. In addition, limitations of the research studies were discussed. A systematic approach is followed for collecting the articles related to SWoT and IoT. Most of the research papers are associated with the ontology-based framework. It is evident from the analysis that the existing approaches are not sufficient to overcome the issues in implementing SWoT. Thus, there is a demand for practical strategies to handle issues such as security, scalability, and ontology development. The future direction of this study is to develop an ontology to present information in a secured manner to users.

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Table 1: Studies and its type

Research article	Year of Publication	Utilized / Employed Dataset	Type of research
NouraM *et. al.* [6]	2019	4500 full – text conference / Journal	Application - Knowledge extraction for WoT (Smart city, Smart home, and Smart weather based IoT application)
Cristyan *et. al.* [7]	2018	Employed real – world scenario for evaluating the system	Application – Information Retrieval using Semantic Web
Mazayev A *et.al.*[8]	2018	Use case examples are employed	Framework for object profiling
Noura M *et.al.*[9]	2018	Utilized 20 most popular ontology concepts,	Identification of ontologies to achieve semantic interoperability
Iglesias-Urkia, M[10]	2020	No dataset utilized	Application - To enable the generation of WoTservients in programming language
G. Hatzivasilis *et al*[11]	2018	Analyzed the features of existing IoT projects	A framework for semantic interoperability
I. P. Žarko *et al.,*[12]	2020	Analyzed the features of the open source Middleware for IoT	Presented the concepts of the SymbIoTe middleware application
Son N. Han and Noel Crespi[13]	2017	Utilized use cases	Presented an algorithm to develop a service provisioning architecture
Guang Chen *et.al.* [14]	2020	Applied reasoning rules of semantic ontology with Pellet reasoning engine	A framework of IoT with the dimension of semantic ontology for real - time systems
BehailuNegash *et.al.* [15]	2019	Analyzed the multiple level of interoperability.	Presented a virtual server for web semantic
Victor Charpenay *et.al.*[16]	2018	Employed of WoT standards based on the Open Mobile Alliance, the Open Connectivity Foundation, and the oneM2M foundation.	Presented a method to integrate data from actuators and sensors
Noura M *et.al.* [17]	2019	A testbed with multiple sensors and actuators	Application- WoTDL2API
A.Khattab *et.al.*[18]	2018	No dataset utilized	A semantic solution for IoT Mashup Tools
Hussain A *et.al.*[19]	2017	No dataset utilized, however, Application Programming Interface (API) is employed	Presented a framework for semantic interoperability
F. Antoniazzi and F. Viola [20]	2019	No dataset utilized	A practical Application of WoT ontology

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Table 2 : Classification of studies

Studies / Classification	Research contributions		Limitations
	Ontology – based framework	Middleware	
NouraM *et. al.* [6]	✓	✓	No Performance analysis and threats to validity
Cristyan *et. al.* [7]	✗	✓	Few real - world scenarios were applied to test the system.
Mazayev A *et.al.*[8]	✓	✗	Only use cases were applied.
Noura M *et.al.*[9]	✓	✗	Tested only existing ontologies
Iglesias-Urkia, M[10]	✗	✓	Case studies were related to specific domain
G. Hatzivasilis *et al*[11]	✓	✗	Tested only the existing ontological framework
I. P. Žarko *et al.,*[12]	✗	✓	Tested only the middleware in the specific domain
Son N. Han and Noel Crespi[13]	✓	✗	Only few use cases were employed to evaluate the performance
Guang Chen *et.al.* [14]	✓	✗	Only specific case studies were applied and no exclusive limitation about the reasoning engine
BehailuNegash *et.al.* [15]	✓	✓	Only tested the multiple level of interoperability
Victor Charpenay *et.al.*[16]	✗	✓	Tested the method in the particular domain
Noura M *et.al.* [17]	✗	✓	Developed a testbed for testing the application
A. Khattab *et.al.*[18]	✗	✓	No evaluation metrics were applied to evaluate the system
Hussain A *et.al.*[19]	✓	✗	The framework was evaluated with specific API
F. Antoniazzi and F. Viola [20]	✗	✓	No performance analysis for the application
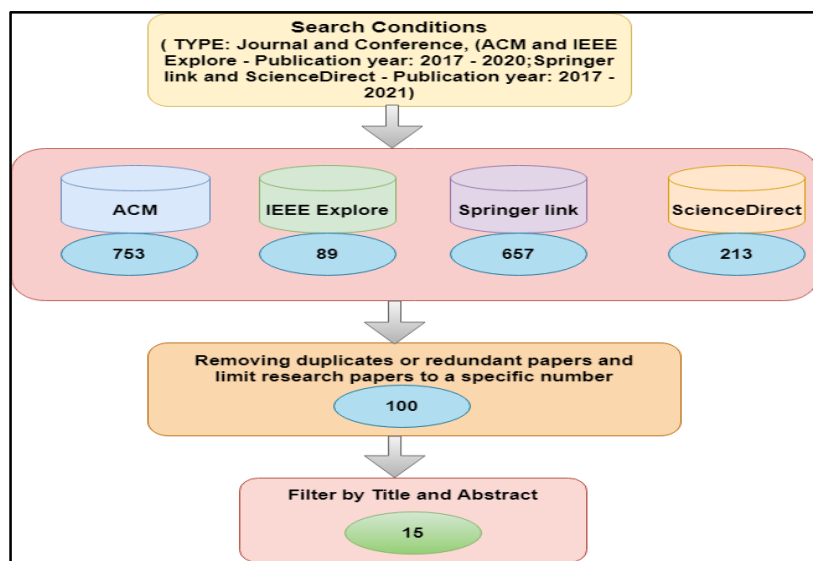
Figure 1 : Process of extraction of research articles

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RESEARCH ARTICLE

Lean Six Sigma in IT SME's for Software Process Optimization and Minimization of Wastes

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ABSTRACT

Six sigma is a collection of data and information-driven administration perspectives that use explicit mechanisms to speed up the process of achieving a guaranteed complex judgment for optimization. Lean is a persistent paradigm for improving implementation with an emphasis on waste elimination. In this paper, discusses about the various Six Sigma techniques in the perpetuation of IT firms at SMEs, which could address the fundamental issue of decreasing client revealed defects during the client acceptance testing phase of the product advancement lifecycle. This analysis study will help us to identify and evaluate their maintenance programs and models used on reducing duplication and increasing efficiency through software process optimization during software development and maintenance in Small and Medium Scale IT Enterprises.

Keywords: Six Sigma, Lean, Waste, SME, Process Optimization

INTRODUCTION

A Methodology which centers around persistent improvement of cycles so as to diminish the expense because of low quality and to cause enhancements in results to make an incentive for the clients is known as Lean Six Sigma. Lean practice continuously reduces the waste using rapid experimentation process. The general root causes for project failure are as follows: [35].
- Insufficient planning finally ends with a project failure.
- Ineffective stakeholder management, inexperienced user and their involvement
- Unrealistic estimated time

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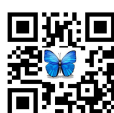
- Budget, project goal along with change in technology
- Elimination of quality assurance mechanism
- Unqualified resource and environment and Underutilization of employee
- Poor and ineffective communication between stakeholders
- Planning and Managing Risk
- Poor project management and managing changes in control
- Undefined project development process
- Waste during Software development and Time Pressure to increase productivity

Lean Six Sigma Approach focuses on eliminating waste and improving flow of productivity with software process improvement during software development & maintenance and to be acknowledged positively by the IT organizations in SME's during project development.

Six Sigma
Six Sigma is an information driven procedure which uses certain mechanism to increase productivity and benefit inorganization. Six Sigma diminishes on process variety and improves process control. Lean eliminates the wastes(Non-Value-Added process and procedure) and advances normalized work and flow of production. Lean Six Sigmaesteems the imperfection counteraction over deformity recognition which drives consumer loyalty and results bydecreasing variation, waste and process duration while advancing normalized work and flow of production. The SixSigma procedures can be actualized in two different ways. First Implementation of Six Sigma Program or Initiativeand Second making of Six Sigma Infrastructure. Six Sigma can be adopted in three levels [38].

Metric: A scale for quality termed as sigma is used in Six Sigma such as DMPO value is 3.4.

Methodology: It is a business improvement methodology such as; DMAIC (extended to DMAICT) and DMADV.
DMAIC: It is used for improving existing business process
(Define) Defining the problem and project goal
(Measure) Measuring current processes in details
(Analyze) Analyzing the data and generating the root cause of defects in process
(Improve)Process improvement
(Control) Controlling the process for future maintenance
(Transfer) Transferring best practice to other areas of organization (DMAICT)

DMADV: It is basically used to create new processes and new product or services.
(Define) Defining the project goal
(Measure) Measuring the critical mechanism of process and product potentialities
(Analyze) Analyzing the data along with the development of various designs for process
(Design) Designing and testing the process details
(Verify) Verifying the design using simulator along with a pilot program and hand over to client

Management System: It drives clearness around the business technique and measurements which reflects accomplishment with that procedure. It gives the structure to organize assets for ventures which improves the measurements. It additionally leverages decision makers who deal with the endeavors for fast, reasonable and improved business result.

Lean Practice
Lean software development approach helps in optimizing the software development process by eliminating the waste which means removing not essential things from the final product and helps deliver a product in refined

quality. The lean improvement group centers around learning and conveying the item as quick as conceivable to expand productivity. Lean spotlights on client and their fulfillment. It targets interfacing with client as often as possible, understanding their worth and spotlights on its key procedures to improve it which actually focuses on two major concepts that are eliminating waste and improving flow of production. The principles of lean are: [36].

Eliminating Waste
It means eliminating the things which are not useful for the customers, termed as waste. These wastes must be eliminated to reduce the unnecessary complications, developing the wrongly featured product to reduce stress or workload.

Amplify Learning
The ways through which work can be improved and not on adding more and more features. It promotes continuous learning in each iteration which involves discovering newer ways/ideas to write a code or build a product in an optimal manner. In most of the cases, user feedback is also taken to understand their perspective and requirements.

Decide As Late As Could Reasonably Be Expected
This rule defers the decision until we get especially portrayed fact which is the greater delay in decisions and duties. This alters more forward-thinking changes which can be costly.

Deliver As Fast As Possible
This also helps in delaying the decision so that customer gets enough time to discover their requirements properly. This helps in getting the product as fast as possible which further helps in improving the product in the next iteration. This also leads a complete product which satisfies customer's requirement.

Empower the Team
In this, manager helps the team member in taking any decision, assigning tasks to them, providing them with the decision, suggestion and also help in removing the obstacle.

Build Integrity
It can be further classified into two terms; perceived integrity which is related to the overall experience of the customer with the production and how the product is useful; Completed integrity focuses on how separate component of the system are integrated to make it more efficient, maintainable and flexible product cane be designed.

See the Whole
Most of the defect in the software system can be eliminated by developing the system into subsystem and developing them separately using well defined standards. The larger the system or the larger the organization involved in the development which results in the development of complex, efficient and powerful system. But using lean, the defects can be identified in each stage of software designing.

Category of Waste
There are eight categories of wastes. [37].
Overproduction
Production in huge scope in limited capacity to focus time, brings about poor progression of data or merchandise and utilization of overabundance stock.
Defects
Frequent blunders in material/item prompts adjust to create the quality just as poor conveyance execution.
Unnecessary Stock
Delay of data or items lead overabundance expenses and poor client support.

Inappropriate Preparing
Using an inappropriate arrangement of instruments, methodology or frameworks, the efficiency can be diminished.
Excessive Transportation
Excessive development of individuals, data or merchandise, results wastage of lead time along with cost.
Waiting
Waiting time for individuals, data or merchandise, results poor stream and long lead times.
Work Environment
Poor work environment association lead ineffectual development of the association and its partners.
Underutilization of Worker
Employee's innovativeness and aptitudes ought to be improved for the procedures and practices which alludes to squandering of accessible information, experience or expertise of the staff/workforce.

SMEs in India

India is one of the quickest developing economies of the existence where the monetary development has consistently quickened and stable. SME gives huge business opportunity at similarly lower capital expense which helps in industrialization growth. It is an integral to huge industry unit which contributes gigantically to financial improvement of nation [40].. Small and Medium Enterprises (SME) part mushrooming in a horde of segments the nation over comprising farming, assembling or administration industry along these lines creating new business people by giving information, preparing and expertise improvement. Disregarding its commitment to the financial development of India, SMEs face various difficulties:

• Lack of capital because of lacking admittance to finance and credit
• Inability to draw in skilled and well-informed labor
• Poor framework and utilities bringing about low production limit
• Lack of advancement
• Technology and computerized information hole
• Lack of promoting Needs

Survey from 2008 to 2020

Abdullah *el at.* [1]. set up the current situation of worldwide comprehension relation of SME and Lean along with analyzing the Lean's fundamental classes execution with regards to SMEs. Next, a comprehensive conversation of related to Lean's CSF execution can be used for Business Owner. Narishah *et al.* [2]. addressed to the arrangements and activities to guarantee constant improvement in delivering quality programming along with the advantages along with the procedure of standards converged at businesses to increase profitability successfully, Waste elimination and improving the quality level. Folorunso *et al.* [3]. talked about different lean six sigma procedure devices embraced by little and Small and Medium scale ventures for improving the quality effectively. They featured how this investigation would help any sort of assembling industry to discover an answer on the most proficient method to contend well in a serious business condition with a powerful market framework. Sedano, Ralph and Peraire [4]. conducted in depth study on software development waste and wasteful practices. They also described different types of waste and different process for eliminating those. Ayon *et al.* [5]. edified the quality improvement practice can be strengthened in SME of one particular region. The author determined quality administration practices to support the business growth. Jha *et al.* [6]. investigated different basic achievement factors for fruitful usage of six sigma in Manufacture SME. They further determined the interrelationship among them utilizing ISM technique. Pearce, Pons and Neitzert [7]. saw that the genuine issue with making lean progress is information issue. They gave new experiences as information could be a casual factor in Lean implemented SME. Patel and Desai [8]. talked about the combined approach of six sigma and Total Quality Management can be useful for Small and Medium Scale industry. Deshmukh and Mukti [9]. talked about similar outline of level of usage of Lean Six Sigma and impact on development rate. They determined that "development rate" is a solid capacity of basic achievement components of Lean Six Sigma execution in e-administration based association. Panteha *et al.* [10]. presented the views on benefits of using Agile and Lean Six Sigma together and also discussed that how combination of the disciplines may be taken as
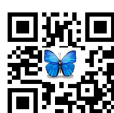
a step to further enhance the competitiveness of an organization. They concluded with a model of integration of Agile and Lean Six Sigma, based upon a relationship matrix. Sodhi, Singh and Singh [11]. investigated different critical achievement and disappointment elements of LSS approach in different SME's groups of India. Prakash *et al.* [12]. determined the overall quality can be improved using six sigma technique which is a technique that pointed toward expanding consumer loyalty and productivity by improving the quality of product and services. Romdhane, Ahmed and Manel [13]. proposed another model to improve the security of the process using fuzzy framework. Soumya *et al.* [14]. evaluated contextual analysis on standards related Six Sigma Implementation along with DMIAC measures. Dharmendra, Soni and Khare [15]. endeavored to catch the issues derived during the usage followed by understanding the process of resolving those issues during Six Sigma implementation. Matt and Rauch [16]. broke down a fundamental report on existing lean strategies for the application in SME. They performed modern contextual analysis to distinguish the challenges in the usage stage alongside the critical factors and delineated hidden potential in SME along with productivity improvement.

Punitha *et al.* [17]. featured that using Six Sigma strategy, the defects related to maintenance software projects can be minimized and the quality of product improved. Raghunath *et al.* [18]. gave an overall diagram of boundaries for usage of Six Sigma by the SME. The author produced a plan to change the basic misperception of the SMEs around Six Sigma and helping them to beat the boundaries for its execution. Mamata *et al.* [19]. depicted to improve the product advancement process and existing improvement models. They additionally examined models like CMM have a few constraints where these models give the means of programming measure improvement techniques and models so that to get comprehend the ideas of progress and its methods. Sunil *et al.* [20]. focused on use of the Six Sigma theory in the advancement of SMEs just as to archive improvement of practices through an efficient literature review. Rajeshkumar *et al.* [21]. looked into dependent on critical success factors for effective usage in unique SMEs' situation too meet the hugeness of project selection in Six Sigma structures which is casing of extreme consideration through experience of previous explores. Nomi [22]. summed up significant SPI models and approaches those involve powerful arrangement of practices which can help SME to improve the quality of product. Neeraj [23]. indicated the fruitful utilization of Six Sigma in software organizations for quality improvement. Jyotsna *et al.* [24]. made a study on assortment of programming measure models and investigation different issues in software improvement. They demonstrated the need to build up another methodology, model or procedures to determine the significant issues of software advancement. Rupa *et al.* [25]. mirrored the generation of CSF using various statistical and non-statistical method in information Technology industry.

Jiju [26]. proposed the study which plainly demonstrated how an appropriate six sigma model can be used in large organizations and small organizations. Ebert, Pekka and Oza [27]. addressed how lean principles delivers value and introduced to manage the change. Perstal, Feldt and Tony [28]. inferred distinctive lean holes during lean item advancement and agile Software improvement in enormous scope Software framework advancement. AI-Baik and Miller [29]. proposed another model to characterize waste happened in IT associations. They built up another model of waste arrangement for medium scale IT associations. Likewise, the talked about various waste disposal techniques by expelling the underlying driver of waste and accentuated the need of lean think. Kundu [30]. derived how to distinguish and sort non esteem include exercises in various industry settings. He also highlighted eliminating wastes can be processed through lean thinking and applying lean principles. Poornima and Ramesh [31]. focused on lean software development, different practices are used lean with agile, usage of lean for reducing wastes during software development and maintenance. They also derived continuous improvement model which insights stable development model for different organizations. Todd, Paul and Cecile [32]. conducted participants observation study to distinguish and portray various kinds of waste in Software improvement. They iterated between theoretical and analysis sampling and introduced empirical waste taxonomy which insights different types of waste and it's cause along with how it is related with lean software development. Sedano, Ralph and Peraire [33]. conducted in depth study on software development waste and wasteful practices. They also described different types of waste and different process for eliminating those. Miikka, Mika, Farooq and Claes [34]. investigated how time pressure can

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affect software quality and productivity through different experiments and case studies. They concluded with the time pressure; the productivity may increase but the quality of the product will be reduced.

Research Finding
- Using Lean Six Sigma, the productivity can be improved, the waste can be minimized and the quality along with customer satisfaction can be improved.
- SME can adopt Lean Six Sigma Method to improve the overall quality along with process optimization.
- Lean methods for the application in small sized organization and production improvement.
- The maintenance project related defects can be decreased using six sigma methods at software industry.
- Empirical waste taxonomy which insights different types of waste and it's cause along with how it is related with lean software development.

The current investigations lead towards the combination of six sigma and lean in SMEs. This paper attempts to propose that the combine strategy can be used in software process improvement. It leads two major concepts that are eliminating waste and improving the production flow during software development & maintenance and aware about the wastes occurring while developing a product and how it can be eliminated.

RQ1: How Lean Six sigma approach can be implemented and valued by IT SMEs for the improvement on flow of productivity along with social and economic growth during the software development and maintenance?

RQ2: How Small and Medium IT Enterprises respond to frequently changing customer needs with very short lead-time with improved quality along with employee and customer satisfaction?

Objectives

Primary Objectives
1. To study software development life cycle and understand the processes adopted in each phase with the help of Object-Oriented Models
2. To conduct a Questionnaire survey for quality experts in software firms for understanding the various defects impacting the lead time
3. To identify the processes to be improved using quality control tools and its improvement measures
4. To carry out a comparative study before and after implementation of the framework suggested
5. To Finalize the model for generic purpose based on results

Secondary Objectives
1. To find out the challenges raised using Lean Six Sigma
2. To reduce implications of Lean Six Sigma Approach on requirements engineering and product release at Small Software Firms at Bengaluru City
3. To improve employee and customer satisfaction

RESEARCH METHODOLOGY
Fig.2: Research Road Map

CONCLUSION

The research helps to accomplish the improvement cycle at product industry at SMEs along with the elimination strategy for waste during software process optimization. A vigorous model will be created which helps SME to improve the productivity. We need to accomplish more investigations for disposing the research gap.

RG1: How can be the issues related Lean Six Sigma Approach implementation in software development organizations at SMEs will be reduced?

RG2: What are the implications of Lean Six Sigma Approach on requirements engineering and product release and on the coordination mechanisms within Small and Medium Enterprise (SMEs)?

ACKNOWLEDGEMENT

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Fig 1: Root Cause of Project Failure

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Fig 2: Research Road Map

RESEARCH ARTICLE
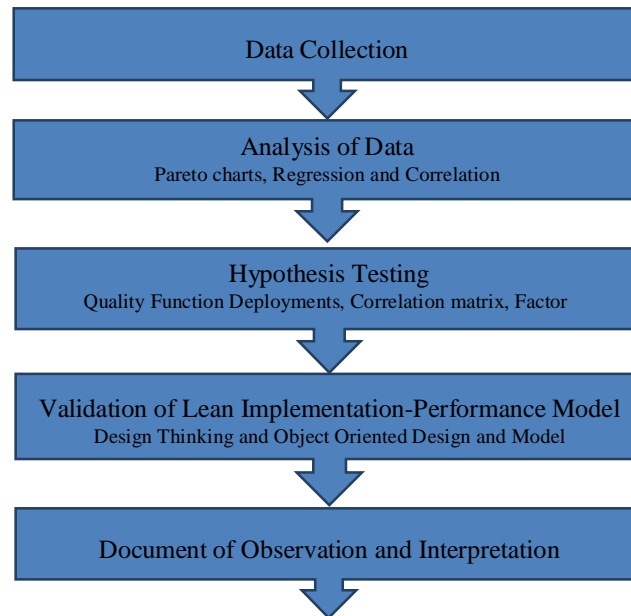
On Domination Number of Some New Types of Graphs

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ABSTRACT

In this paper we investigate the domination number of double graph of cycle and double graph of comb graph. We also focused on domination number of middle graph of comb.

Keywords: domination number, domination, dominating set, double graph, middle graph.

INTRODUCTION

In the branch of graph theory, domination is widely researched area. The idea of domination number was first introduced by Berge [1]. In 1958. The domination is applicable in real life problems such as networking, communication network, modelling of networks, defence surveillance. Throughout the paper $K = (V,E)$ is finite, simple and undirected graph. We follow West [2] for basic terminology and notations related to graph theory.

Terminology and Notation

Definition: A dominating set R of vertices of graph K satisfies that, every vertex $p \in V - R$ is adjacent to atleast one vertex in R. The domination number of K is cardinality of minimal dominating set of K. We shall denote it as $\gamma(K)$.

Definition: Consider K' a copy of simple graph K, we shall represent vertices of K and K' as p_i and q_i respectively. A new graph D(K) is named as double graph of K if $V(D(K) = V(K) \cup V(K')$ and $E(D(K) = E(K) \cup E(K') \cup \{p_i q_j : p_i \in V(K), q_j \in V(K')$ and $p_i q_j \in E(K)\}$

Definition: Consider $K = (V, E)$ a graph. The middle graph M(K) of K whose vertex set is represented by $V(M(K)) = V(K) \cup E(K)$. The 2 vertices $p, q \in V(M(K))$ are adjacent in M(K) if one of the following cases satisfies a) $p, q \in E(K)$ b) $p \in V(K)$ and $q \in E(K)$. p, q are incident in K.

Definition: A resultant graph K = Comb graph is constructed with attaching a pendent edge to every vertex $p_1, p_2, \ldots, p_n$ of path.

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RESULTS

Theorem 3.1. For r ≥ 4,

$$\gamma(D(C_r))=\begin{cases} \frac{r}{2}, & if\ r \equiv 0\ (mod4) \\ \frac{r+1}{2}, & if\ r \equiv 1\ or\ 3\ (mod4) \\ \frac{r}{2}+1, & if\ r \equiv 2\ (mod4) \end{cases}$$

Proof: Let $V(C_r) = \{p_1, p_2, . . . , p_r\}$ and $V(C'_r) = \{q_1, q_2, . . . , q_r\}$ be the vertices of $D(C_r)$. We represent double graph of cycle by $D(C_r)$.

Case 1: For r ≡ 0 (mod 4)
The vertex p_1 of C_r dominates neighbour vertices p_2 and p_r and also dominates q_2 and q_r of C'_r. The dominating vertices of the set $D = \{p_1, p_5, p_9, . . . , p_{r-3}\}$ of cycle graph C_r. These vertices dominates neighbour vertices $p_2, p_4, p_6, p_8, . . . , p_{r-2}, p_r$ and also dominates $q_2, q_4, q_6, q_8, . . . , q_{r-2}, q_r$ vertices of C'_r. Similarly, the vertices of the set $D' = \{q_2, q_6, q_{10}, . . ., q_{r-6}, q_{r-2},\}$ of C'_r dominates neighbour vertices and also vertices $p_1, p_3, p_5, . . . , p_{r-3}, p_{r-1}$ of cycle graph C_r. Thus, it is clear total $\frac{r}{2}$ number of vertices dominates all vertices of graph. So that $\gamma(D(C_r)) = \frac{r}{2}$.

Case 2: For r ≡ 1 (mod 4)
The dominating vertices of the set $D = \{p_1, p_5, p_9, . . ., p_{r-4}\}$ of cycle graph C_r. These vertices dominates neighbour vertices and also $q_2, q_4, q_6, q_8, . . . , q_{r-2}, q_r$ vertices of C'_r. Similarly, the vertices of the set $D' = \{q_2, q_6, . . . , q_{r-3}, q_r,\}$ of C'_r dominates neighbour vertices and also vertices $p_1, p_3, p_5, p_7, . . . , p_{r-1}$ of cycle graph C_r. Thus, it is obvious $\frac{r+1}{2}$ number of vertices dominates all vertices of graph. So that $\gamma(D(C_r)) = \frac{r+1}{2}$.

Case 3: For r ≡ 2 (mod 4)
The dominating vertices of the set $D = \{p_1, p_5, p_9, . . . , p_{r-1}\}$ of cycle graph C_r. These vertices dominates neighbour vertices and also $q_2, q_4, q_6, q_8, . . , q_{r-2}, q_r$ vertices of C'_r.Similarly, the vertices of the set $D' = \{q_2, q_6, . . . , q_{r-4}, q_r,\}$ of C'_r dominates neighbour vertices and also vertices $p_1, p_3, p_5, p_7, . . . , p_{r-1}$ of cycle graph C_r. Thus, it is obvious $\frac{r}{2} + 1$ number of vertices dominates all vertices of graph. So that $\gamma(D(C_r)) = \frac{r}{2} + 1$.

Case 4: For r ≡ 3 (mod 4)
The dominating vertices of the set $D = \{p_1, p_5, p_9, p_{13}, . . . , p_{r-6}, p_{r-2}\}$ of cycle graph C_r. These vertices dominates neighbour vertices and also $q_2, q_4, q_6, q_8, . . . , q_{r-1}, q_r$ vertices of C_n .Similarly, the vertices of the set $D' = \{q_2, q_6, q_{10}, q_{14}, . . . , q_{r-5}, q_{r-1},\}$ of C'_r dominates neighbour vertices and also vertices $p_1, p_3, p_5, p_7, . . . , p_{r-2}, p_r$ of cycle graph C_r. Thus, it is obvious $\frac{r+1}{2}$ number of vertices dominates all vertices of graph. So that $\gamma(D(C_r)) = \frac{r+1}{2}$.
Example 1: The domination number of $D(C_8) = 4$ is elaborated in the following figure 1 under condition r ≡ 0 (mod4).

Theorem 3.2. For m ≥ 2, $\gamma(D(Comb\ m)) = m$, for m is even or odd
Proof: Consider the $\{p_1, p_2,....,p_m\}$ set of vertices of path of graph and $\{q_1, q_2, ..., q_m\}$ the set of pendent vertices of (comb m), which satisfies the condition p_i is adjacent to q_i when i= 1,2,....,n.
Similarly, we shall consider the $\{p'_1, p'_2, ...p'_m\}$ set of vertices of path of graph and $\{q'_1, q'_2, ...q'_m\}$ the set of pendent vertices of (comb m'), which satisfies the condition p'_i is adjacent to q'_i when i= 1,2,....,m. We represent double graph of comb as D(Comb m).

Case 1: When m is even.
The dominating set R= $\{p_1,p_3,p_5,p_7,.....,p_{m-3}, p_{m-1}\}$ of (comb m) dominates neighbour vertices $p_2,p_4,p_6,...,p_{n-2},p_m$ of path and also dominates pendent vertices $q_1,q_2,q_5,q_7,.....,q_{m-3},q_{m-1}$ of (comb m). These vertices of R also dominates pendent vertices $q'_1,q'_3,q'_5, q'_7,.....,q'_{m-3},q'_{m-1}$ and vertices of $p'_2,p'_4, p'_6,...,p'_{m-2},p'_m$ of path of (comb m').Similarly, the vertices of

dominating set R' = {p'$_2$,p'$_4$, p'$_6$,...,p'$_{m-2}$,p'$_m$,} dominates remaining vertices of D(Comb m) graph. Thus it is clear m vertices of graph D(Comb m) dominates all vertices of graph. So that γ(D(Comb m))= m.

Case 2: When m is odd.
The dominating set R = {p$_1$,p$_3$,p$_5$,.....,p$_{m-2}$,p$_m$} of (comb m) dominates neighbour vertices of given set and also dominates pendent vertices q$_1$,q$_2$,q$_5$,q$_7$,......,q$_{m-2}$,q$_m$ of (comb m). These vertices of R also dominates pendent vertices q'$_1$,q'$_3$,q'$_5$,.....,q'$_{m-2}$,q'$_m$ and vertices of p'$_2$,p'$_4$, p'$_6$,...,p'$_{m-3}$,p'$_{m-1}$ of path of (comb m'). Similarly, the vertices of dominating set R' = {p'$_2$,p'$_4$, p'$_6$,...,p'$_{m-3}$,p'$_{m-1}$,} dominates remaining vertices of D(Comb m) graph. Thus it is clear m vertices of graph D(Comb m) dominates all vertices of graph. So that γ(D(Comb m))= m.
Example 1: The domination number of D(Comb 5) = 5 is elaborated in the following figure 2 when m is odd.

Theorem 3.3.For m ≥ 2, γ(M(Comb m)) = m
Proof: We shall represent vertices of path by p$_1$,p$_2$,...,p$_m$ and pendent vertices of graph by q$_1$,q$_2$,..,q$_m$. Consider the vertices t$_1$,t$_2$,t$_3$,..., t$_{2m-1}$ as mid vertices of graph M(Comb m). The vertices of dominating set R = {t$_1$, t$_3$, t$_5$,..., t$_{2m-1}$} dominates all vertices of M(Comb m). It is clear m vertices of graph M(Comb m) dominates all vertices of graph. So that γ(M(Comb m)) = m.
Example 1: The domination number of M(Comb 6) = 6 is elaborated in the following figure 3.

CONCLUSION

We introduced domination number of double graph of cycle and double graph of comb graph. In this paper we also investigated domination number of middle graph of comb. To elaborate various classes of graph which satisfies similar results is an open problem for researchers.

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Figure 1: γ(D(C$_8$)) = 4

Figure 2: γ(D(Comb 5)) = 5

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Figure 3: γ(M(Comb 6)) = 6.

RESEARCH ARTICLE
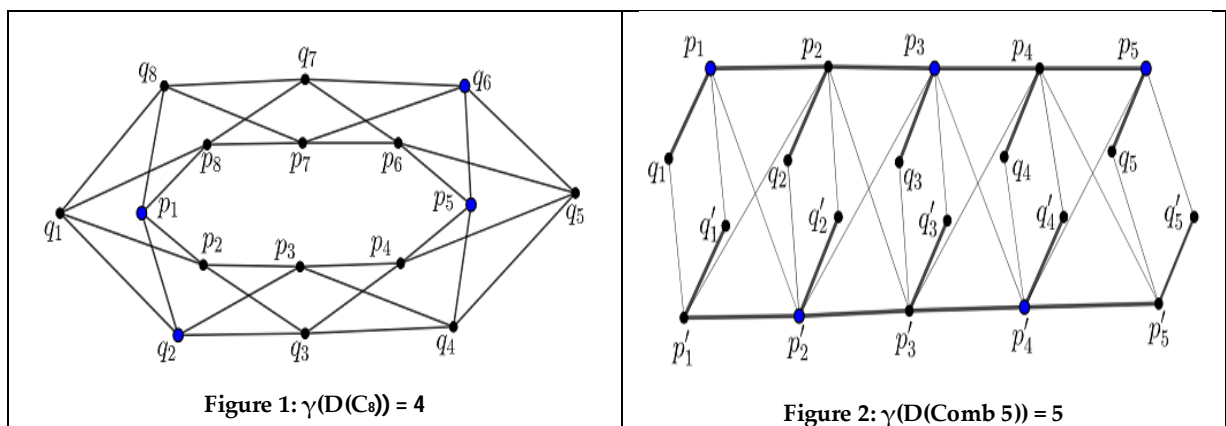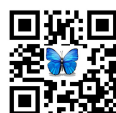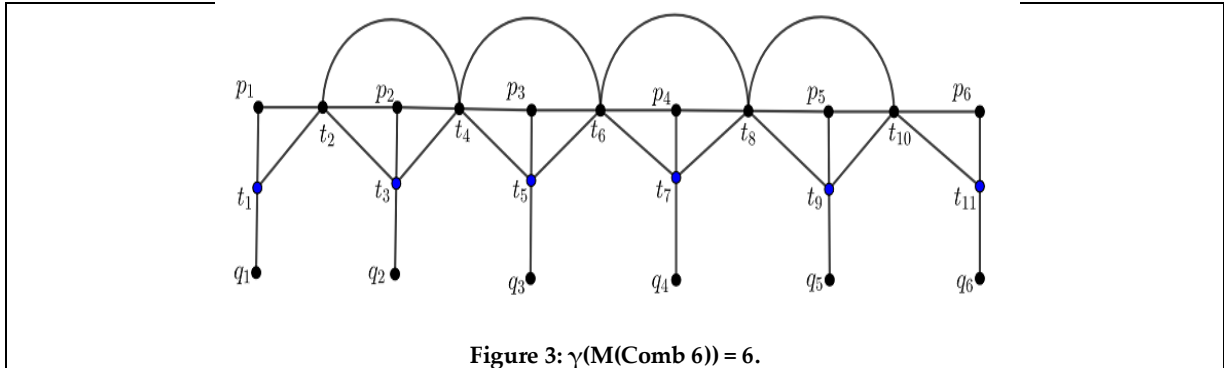
A General Survey on Internet of Things (IoT)

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ABSTRACT

The internet that we are familiar with today is for the people i.e. a system that one person uses to communicate with another person. But the craze is shifting towards Internet of Things (IoT). The modern smart devices can converse with one another without human involvement. The rate at which technology is increasing or decreasing in size, it can be expected that very shortly we will be in a world where everything is connected. IoT can be described as a cluster of interrelated things that are distinctly identifiable and can communicate with each other when connected with internet. It will change how people interact with the world around them by making use of connected devices that is used to collect and analyze data and alter their behavior accordingly. IoT very soon will start enriching our life with practical changes that will benefit us in many ways. The objects in IoT are equipped with sensors which collect, generate and maintain a variety of data with different representation, scales and densities. Apart from sensors, other components like software, network connectivity and necessary electronic devices enables the interconnected objects to collect and exchange data which makes them more responsive. This paper surveys and analyzes the key components of IoT (hardware and software), Technology and protocols that are being used, Data processing concept and possible usage scenarios and key research areas associated with IoT.

Keywords: Internet of things, Sensors, RFID, actuators, Sensor Networks.

INTRODUCTION

Kevin Ashton was the one who used the terminology" Internet of Things (IoT)" for the first time in 1998 [1]. He wanted to keep track of the some goods that he was selling and was keen to know the current status of the goods. He then attached a radio-enabled chip to the items which was later called RFID that help him to track his sold items. And after several trial and errors, this concept was termed as IoT. It refers to a technical concept that will help people to get connected with objects around them in several ways [10]. The whole concept can be thought of as a smart

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situation that consists of interconnection of sensing and actuating devices that help to exchange and integrate data and information over various platforms [2][6]. Along with complex objects like computers and mobiles, things that can include IoT are foods, clothing, refrigerators, lights, fans, vehicles and many more[17]. All of these objects are equipped with a sensor, a device that detects and responds to some kind of input from surroundings. IoT is possible today because of sensor's ability to collect and transmit data in real time [3][4]. IoT has applications across all industries and markets. IoT is being commonly used in Engineering and Industry, government safety, Home and Offices, health and medicines etc. A real world example of applications of IoT could be –Mr. Ram is the manager of XYZ institution. When he enters into office, he is automatically recognized by some device attached in his office. The humidity, temperature and other conditions that are suitable to Mr. Ram are adjusted automatically. His computer starts itself and automatically tells him what he was doing yesterday when he left the office.

LITERATURE REVIEW

The notion of Internet of Things was planned many years back but even today it is in early stage of growth and development. Home automation industries and transportation industries are seeing rapid growth with IoT [17].In [3] the authors have described the concept of IoT very precisely as "Internet of Things is a combination of smart object like wireless sensors, mobile robots, and wireless sensor network technologies that uses non-identical but interoperable communication protocols and realizes a dynamic heterogeneous network that can be useful to monitor events in remote and dynamic areas where people do not have easy access". In this infrastructure, different "things" discover and search and interact with each other for performing several activities which increases the value of the resulting service. In [4] the authors have addresses the fact that introduction technologies such as RFID and smart computing which are termed as ubiquitous and pervasive ,assure a world of connected devices which sooner or later will replace the today's internet of people by internet of things where interconnected things will be communicating with each other without human intervention. In [5] the authors surveyed on the most important points (protocols, algorithms, solutions)of internet of things that have been done till date and the key research areas such as standards, mobility support, data integrity, privacy were addressed. The authors in [6] have highlighted the idea, the difficulties, probable use cases and technical in gradients of "Internet of Things". In [7],the Internet of things have been referred as an initiative where different objects in the world which can be identified uniquely and can be connected to each other by some medium. These connected objects can be used to execute different functions without human intervention. In [8], future IoT predictions, trends and market analysis were highlighted. "Business Insider's premium research service states that there will be more than 24 billion IoT devices on Earth by 2020 which is approximately four devices for every human being on the planet"[8]. The affect of IoT on various industries like manufacturing, transportation, defense, agriculture, banks were also mentioned. In [9], the Internet of Things is considered as the next-big-thing that will grow around the world. Concepts of sensors, machine-to-machine communication, cloud computing were highlighted as major technological change towards the successful implementation of Internet of things. In [10], the authors have proposed a concept of Smart Hospitals using Internet of Things that control switch of the electrical equipments and watch the level of the saline from distant positions. In this system sensor will collect data from the surrounding environment which are transmitted by Universal Serial Bus to Arduino mega board. This data is then sent to the server through LAN cable. In [11], the authors have projected an IoT based Smart Parking System. Smart parking is a component of a new concept called Smart City. The concept of Smart cities has always been a vision of people which has become possible with the help of IoT. The proposed system provides real time information processing regarding availability and accessibility of a parking gap in a parking area. Users from a remote location can book a parking area by the use of mobile applications. In [12], the authors have proposed Smart Classrooms using Internet of Things. A smart classroom is one that permits immediate, real-time feedback on the quality of a lecture and the satisfaction level. Using such feedbacks the lecturer can adjust and update his lectures accordingly. In [13], the authors have designed IoT based system that is capable of measuring the amount of water used and quality of water on a real-time basis. It may be an improvement over the existing water metering systems in many aspects such as minimizing the water usage and improving the quality.

IoT- Key Features: As the basic function of any IoT system is to sense and process data in real time, therefore sensors and artificial intelligence becomes the core concept of IoT. The concept of AI and sensor are essential because the focus is to make any object virtually smart or intelligent [1][2]. In simple sense this can mean something like Air Conditioner in your home adjusts itself according to temperature outside. Connectivity is another feature of IoT. All the devices involved should be connected anytime. Sensor have low cost and low range of communication and can communicate only with its neighbors, so network of IoT devices exist in smaller and cheaper scale but are able to perform many practically important task. IoT has introduced a new idea of active engagement means that devices do not wait for someone to access them but are capable of actively engage themselves in accomplishing some real time task [15].

Applications of IoT: We can find applications of Internet of things in all industries and markets. In Engineering, Industry and Infrastructure, it can be applied in increasing production, marketing, service delivery and safety. In the area of government safety it can be applied in enhancing law enforcement, Defense and City planning [15]. In Homes and offices IoTs can be used to improve overall satisfaction and improve health and safety. In the health and medicine sector it can be used in enhancing medical research, devices and improving emergency care, improving accuracy, faster reaction to events etc. Therefore it can be said that application of IoT is rising steadily since the last decade.

IoT Hardware: The IoT hardware consists of sensors, bridge device, device for a remote dashboard, device for control, servers etc [15]. These devices administer key task and functions such as system activation, action specifications, security, communications, and detection to support specific goals and actions [8] [9].Sensors are the backbone of any IoT system. These devices have energy component, power managing component, Radio Frequency (RF) component and sensing component. RF modules are responsible for communications through their signal processing, Wifi, ZigBee, Bluetooth, radio transceiver and duplexer [15]. Example of sensor includes accelerometers, temperature sensors, pressure sensors, photo sensors, image sensors, humidity sensors etc. Wearable Electronics may be part of IoT hardware and includes small devices worn on different part of the human body. Some of the smart wearable devices may include glasses, smart watches, bands, rings, helmets, shocks and shoes. Personal Computers, tablet, and cell phone are fundamental part of IoT. PCs are used for overall control of the system; tablets may have the similar functions as of PCs but additionally can be used to control the system from remote location. Cell phones are used for performing some important system settings and also have remote functionality. Switches, routers are some of the essential component used for connecting the devices in IoT [4][5][6][15].

IoT Software: Software for IoT can be generally categorized on the basis of device integration, data collection and management, real time analysis [15]. Sensing data, filtering data, aggregating data are some of the functions of data collection software. They differ from traditional data management technique which deals only with input, processing and storage of data. These software use certain rules to help sensors installed in one device to connect with others in real time. The function of device integration software is to connect various devices so that they can communicate, collaborate, interact and interoperate. This kind of software ties together all the devices and built the body of the IoT system. It also ensures stable collaboration among all the devices. Real time data analytic software are visual analysis tools which input data from various source and tries to find patters that may be useful for human study[15][8][9].

Technology and Protocols: Even though IoT take advantage of many existing networking protocols and technologies, the technology and protocols requirement of IoT system are significantly different from the existing ones. This difference is due to specific kind of functions performed by IoT system. A very essential technology adopted by IoT is Radio Frequency Identification (RFID). It is a wireless technology which is basically used to identify some object. RFID consist of a Tag and reader for identification [15].Near field Communication (NFC) is another technology which is similar to RFID but it is a two-way system. RFID is one way which means information sent from card to the reader cannot be returned. NFC only works within a very short range about 10cm and is

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basically used for data transfer, device pairing etc [15]. Low energy Bluetooth is another low power wireless technology used in IoT applications. It is used for connecting devices and is generally intended for applications that consume less power. It is not an extension or upgrades to the original Bluetooth rather a new technology that focus more towards IoT and its applications [15]. IoT systems make use of Wifi Direct technology that is used to connect devices without any access point. It is similar to peer-to-peer but have lower latency. Long Term Evolution-Advanced (LTE-A) is a technology for mobile communication. It is faster than 3G which use the concept of carrier aggregation to improve the data rate [7] [9][15].

Data Processing in IoT: In IoT data processing involve data ingestion (Harvesting), data storage (Persisting), data analytics (finding value).The Internet of Things will create enormous amount of data. To manage access and make use of these data, digital storage and processing becomes a critical factor. There is new approach called Edge computing which helps in processing of Raw IoT data. Lot of people might assume that IoT will put its data into Cloud. However, it will be effective if data storage is done locally because this minimizes communicating the long term aggregated data in the cloud and to manage the bandwidth requirements. The bandwidth requirements would be huge if the storage and analysis of raw IoT data is done in data centers. It may make a lot of sense to do the initial analysis of the data at the local storage and only send the processed result to the cloud [5][6].Time-dependent data are processed by smart and intelligent devices where they originate [16]. Time independent data are directed toward the cloud for past analysis and permanent storage. An obvious benefit of edge computing is that it significantly improves the response time. It also reduces latency and network bottleneck. As real time data processing is a key issue during management of data in IoT, therefore much emphasis should be given to infrastructure management for real time data analysis and processing. Existing infrastructure like Hadoop may not be appropriate for IoT as they are meant especially for batch processing [7][8][9]. In simple sense real time processing means that there is a limitation of time for data processing called deadlines. And this deadline cannot be discarded. For example a driver less car cannot wait for a GO signal after the light turns green. There cannot be any interruption in the movement of the car. So this decision should be made on real time.

RDBMS for IoT: MemSQL a relational database management system with SQL interface concurrently ingest, store, and analyze million of events per second on industry standard hardware to deliver real time decisions for sensor based applications. MemSQL has a distributed nature as it runs on group of services and benefits itself from resources from different servers without any distributed system experts. It optimizes transactions throughput by allowing users to directly read and write from the main memory which is necessary for real time data processing and analytics. When defining and creating table and database, it interacts with user whether to store it in primary or secondary memory. The ROWSTORE types are typically stored in main memory while COLUMNSTORE type of tables are saved in hard disk for long term storage and analysis.[5][6][7][8][9].

Key Research areas in IoT: Several research areas of Internet of Things were found during the literature survey[14]. Efficient management of Power/energy resources, Device Management of IoTdvices, Industrial Applications based on IoT, Data Integration from numerous sources, interoperability among diverse devices of IoT, Scalability in Networking, Storage and computation to handle exponential growth of data and sensors, Privacy and Security in IoT, Compatibility among countless sensor data sources, Rich analytics and real time visualization are some important research areas of IoT.

CONCLUSION

The Internet of Things is very new concepts which have many challenges. It changes our life style, our learning style, how we travel in city and how we can remain healthy. It is one of the most thrilling scenarios for today's organizations, as it may modernize everything from the way these organizations function and drive revenue to the types of goods, services and experiences they deliver. Internet of things can be thought of as a place where even

people could be uniquely identified by some form of device or computer chip. It can provide for a safer world, but it could also create fear, where people think they are being watched. The rate at which technology is advancing and shrinking in size, we could be in a world where everything is connected. IoT is slowly enriching our life with many useful and practical changes that will benefit us in many ways making our life simple and easy using various applications and technology. Research on this field should continue to pursue state-of-art applications.

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RESEARCH ARTICLE

DApp for Secure Cheque Exchange and Analysing using Remix-IDE

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ABSTRACT

Block chain Technology is increasing its importance in most of the fields. DApp refers as decentralised Applications that involve Block chain as its Backend. Being a recent hot topic but still we are not much exposed to it. To bridge the knowledge gap of recent trends and development in education sector. This paper gives clarity of the DApp and designed a DApp framework with necessary tools required for building an Ethereum DApp. A sample DApp is developed as proof of concept for cheque processing and Smart contract is also analysed by using remix IDE.

Keywords: Block chain, DApp, Smart Contracts, Ethereum, Solidity.

INTRODUCTION

Block chain applications are being developed in most of the sectors. The Ethereum platform created a way for the developers to create DApp's using smart contracts. Despite in the advancement of the technology we really lack in developing software and methodology. DApp till now did not guarantee any security or a framework for its development. To fill this research gap we had developed a simple DApp for storing a valid cheque in Ethereum Block chain and analysed our smart contract using Remix IDE to ensure the security. Ethereum is an open source Block chain platform that is decentralised in nature enables smart contract functionality and also helps to build DApps and run without involvement of third party. It has its native Programming language and Ethereum main net was launched on July 30, 2015. Remix IDE is an open source web application used for contract development it uses a plugin architecture. JavaScript is used to develop it and can be used using browser and run locally as well we can use desktop version. We can directly write the Solidity smart contracts, compile, deploy and analyse them. Smart Contracts: The name itself refers that the contract is smart enough to verify digitally. Contract is a code written in

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solidity programming language for Ethereum Protocol. Smart Contracts are self-executing code with the terms and conditions between the peers involved in the contract. It allows the transaction between peers without third party. This code controls the transactions and also tracks transaction and makes them immutable and irreversible after confirmation. The belowfig1 is the example of smart contract used to store the hash of the cheque image in ipfs and deploy the hash in the transaction and confirm it using Meta mask.

DApp Framework

Here we would like to help you to develop a DApp by referring our framework shown in fig2. We had designed a framework for building DApp's that explain the necessary tools required to develop a DApp. We have divided into client and server and will further explain in details.

Client

It consists of UI software development tools that act as front end for DApp along with Meta mask a browser extension.

- Frontend:
o Web3: It is a JavaScript library that allows interacting with Ethereum nodes using HTTP, IPC or Web Socket that can be local or remote nodes.
o React JS: It is an open source JavaScript library used for building frontend User Interface.
- Metamask:It can be referred as Ethereum Wallet in your Browser. It is used for accessing DApp Ethereum Applications. Metamask is a browser extension that injects the Ethereum web3 API into our webpage and makes DApps to read from Blockchain. We can also create and manage own identities using private keys basically Dapp will perform and write transaction to the block chain by using this secure interface. We can confirm or reject transaction using metamask interface.

Server

- Backend : It consists of truffle that acts as server and Ethereum nodes that acts as backend to store the transactions
o Truffle: It is a development framework for smart contracts. With truffle we can compile, link and deploy that ease the life of an Ethereum developer. Some of the smart contracts are built-in in truffle suite. We can install truffle by using ***npm install –g truffle*** command from terminal. This command will install truffle globally. Note we need npm installed.
o Ethereum nodes:

Ganache: It is a single click private block chain for test network. We can use ganache as our personal Ethereum block chain Network that consists 10 accounts with 100 ETH each. We can use for testing and confirm or reject transaction using this accounts that can be imported to meta mask by using private key. The following fig3. Shows the accounts on Ganache.

Ethereum Main Net: Ethereum Main Net is the public network that can be accessed by anyone in the world. Anyone connected through internet connection can create transaction and add to Ethereum production block chain and also validate the transaction. All those who had connected through main network can listen to the transaction recorded.
Public test network: Along with publically available main network we have public test network referred as testnets. This can be used by protocol developers or smart contracts for testing before doing with maninet. It is really needed to test any new protocol or smart contract before deploying to Ethereum mainnet. Proof of authority is the mechanism used by testnets that intend to have small network with few nodes to validate transactions and create blocks. We list out few testnets that are available; DApp's can also use this testnets apart from private network Ganache.
a. Rinkeby: A testnet for those running Geth client follows Proof of authority.

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b. Ropsten: A test nets that allows developers to test their work in a live setting follows proof of work
c. Kovan: Testnet for running open Ethereum clients it is a Proof-of Authority.
d. Gorli: It is a proof-of-Authority testnet that works across clients.

ETH on any testnets has no real value and no markets. As we need ETH to interact we get testnet ETH from faucets. For any Ethereum Apps we need to run it on a private network to verify how it works and can be deployed to mainnet. We can create a local blockchain instance to run and test DApp's. Private networks allow much faster iteration than Public testnets. So we had use ganache private network to test our DApp.

Related Work

[1].Ethereum smart contracts: security vulnerabilities and security tools. (ArditDika, 2017) The author says smart contract should always be deterministic and discussed about Reentrancy, Tx.origin, Timestamp dependence, Transaction-ordering dependence some of the vulnerabilities and also discussed Security tools.

[2].Blockchain-based smart contracts: A systematic mapping study (Maher Alharby and et.al, 2017) the author performs his research by extracting papers and focused on technical view. They identified a few research gaps such as

1. Lack of studies on Scalability
2. Minimal knowledge on deploying smart contracts on differentblockchain protocol.
3. Need of high quality research on smart contracts
4. Insufficiency of data related to Security issues.
5. Need for Handling methods criminal activities on smart contracts.

[3]. Building a Secure Biomedical Data Sharing Decentralized App:Tutorial(Johnson et al, 2019)they had developed a working prototype of DApp for real usage in securing data for a Biomedical research and described architecture and a sample iPhone OS interacting Smart contract and also explained necessary tools and libraries required for development. Further tells the limitation of a better user Interface and illustration of how data are used without involvement of third party and revoke for data sharing.

[4]. Software Engineering for DApp Smart Contracts managing workers Contracts (GiorgiaLallai and et.al, 2020) The author had followed a new approach BOSE(Blockchain Oriented Software Engineering) and ABCDE methodology to provide the DAppsystem architecture with the desired properties. This approach helped to reduce risks of failures and developed a prototype where the system is automated frontend as web interface and blockchain as backend.

[5]. Implementation and Analysis of Blockchain Based DApp for Secure Sharing of Students' Credentials(RaajAnand Mishra and et.al)2020. They had proposed an architecture based on blockchain for secure sharing of students credentials by implementing the same and referred as DApp for students credentials and also analysed cost and performance by executing different programs and conducting experiment usingRinkeby test Ethereum Network.

Implementation

We had built a DApp to create a hash of a Cheque image using IPFS that stores our file and returns hash of the file which can be easily shared and it is immutable. Then we store the unique hash generated by IPFS for file storage and sharing. Procedures to build a DApp We have used atom editor and git bash. The cheque can be easily exchanged between banks instead of involves third party and then verify and validate then complete the transaction process. Here we proposed a secure way of exchange of valid cheque for processing.

a. Install Metamask, Ganache and Truffle framework
b. Create frontend using reactJS and design according to UI required
c. Write a smart Contract in Solidity Programming language.
d. Deploy contract using truffle in Ganache Network shown in fig4
e. Integrate contract and Initialize IPFS Daemon in ReactJS. fig.5. shown below is the UI once we click send it the file is stored in IPFS and the hash of the file is returned in the UI and the contract returns the transaction hash to be confirmed / rejected.

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f.   Before running make sure metamask is connected to Private network Ganache and start by executing command ***npm start***.

The command opens client browser and is available at localhost:3000/ fig6. Shows the UI of contract address and the hash of the cheque083654.jpg and also returns the transaction Hash shown in fig.7. After confirming the transaction using metamask

Analysis using Remix

Remix had recently added analysis and it is categorized into security, Gas & Economy, ERC. Security analysis consists of

a.   Transaction origin(tx.orgin): As the tx.origin sets the attackers address as the owner of the contract. Remix checks for this security issue.
b.   Checks-Effects-Interaction: It checks for re-entrancy that has ability toretrieve multiple refunds and modify the balance of contract by emptying it.
c.   Block Timestamp: This security issue allows miner to manipulate the timestamp accordingly for his favour by changing few second to get desired output.

CONCLUSION

We had designed a framework for DApp development. DApp that we executed is based on IPFS+ Ethereum Block chain and analysed contract using Remix. It is recommended that we should analyse our smart contract to avoid security issues and then deploy them. Here we had used Remix IDE to perform the Security analysis but there are many other tools to analyse smart contracts such as Oyente for security. Performance issues can also be tested using Tools like Ethereum Tester, BitcoinJ , Ethereum embedded network ,Truffle, Embark. We would like to continue to build private block chain and write contracts and perform detail study of analysis to avoid issues.

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Fig. 1. A smart contract for storing a valid Cheque
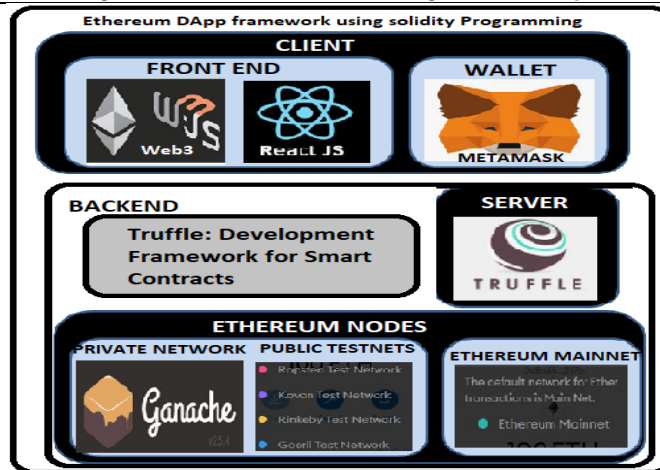
Fig. 2. Ethereum DApp framework using Solidity Programming for Smart Contracts

Fig. 3. Ganache a private local Network

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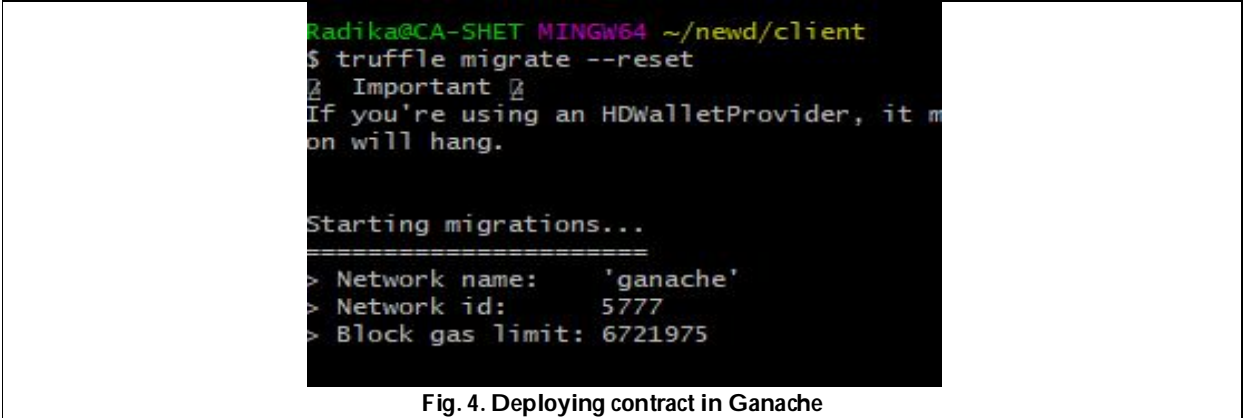
Fig. 4. Deploying contract in Ganache
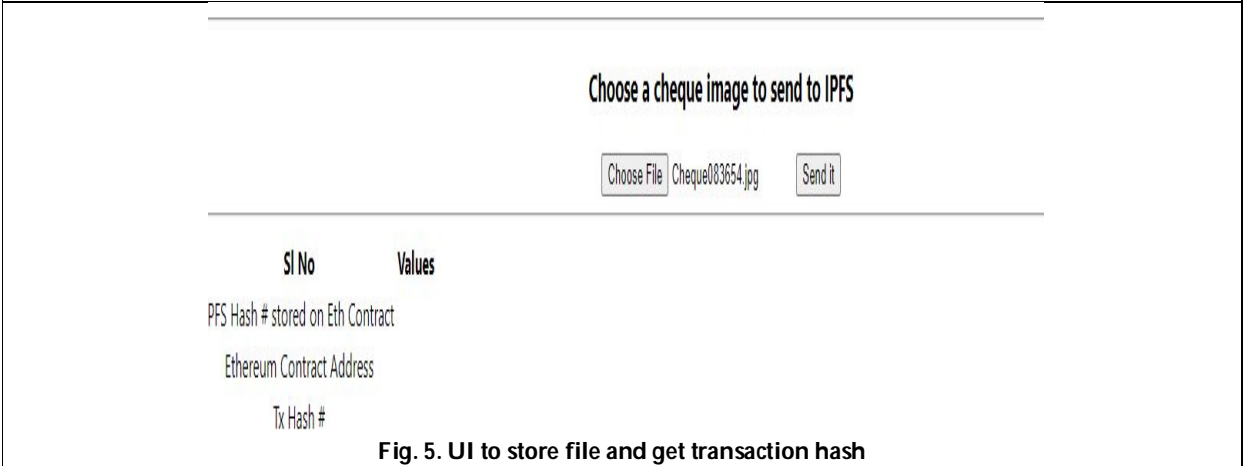
Fig. 5. UI to store file and get transaction hash
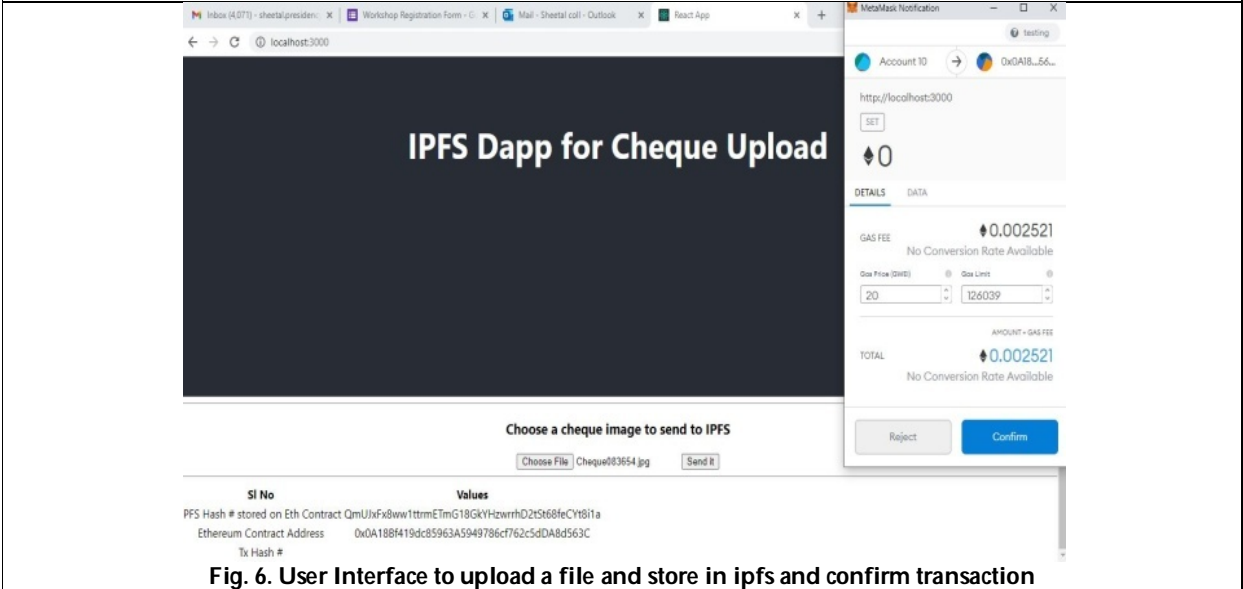
Fig. 6. User Interface to upload a file and store in ipfs and confirm transaction

Fig. 7. Confirmed transaction

Fig. 8. Confirmed transaction in Ganache

Fig. 9. Solidity static Analysis

RESEARCH ARTICLE

Developing a Data Warehouse Framework for Public and Private Entities in the Kingdom of Saudi Arabia

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ABSTRACT

The study intends to develop a data warehouse framework for public and private entities in the Kingdom of Saudi Arabia. Saudi Arabian government has initiated many development programs for both public and private entities to enhance their work environment. The existing literature suggested that there is a demand for decision-making tools for management to make effective decisions. Data is the source for tools to extract an insight that supports in decision-making process. Data warehouse is a structure to store and retrieve huge amount of data. The introduction of modern tools is providing an opportunity to visualize the outcome of a data analysis. In this study, a hybrid dataset is developed and used as a test bed to implement a data warehouse framework for public and private entities. The outcome of the study shows that the framework supports the organization in decision-making process.

Keywords: Data warehouse, Data visualization, Decision making, Data mining, Machine learning.

INTRODUCTION

The Kingdom of Saudi Arabia has initiated many development programs through Vision 2030. Both public and private organizations are following the guidelines and enhancing the functionalities of work environment. Artificial Intelligence (AI) is considered as a crucial tool for decision makers to make effective decisions [1]. The concept of Data Warehousing and Data Mining is becoming increasingly popular as a business information management tool where it is expected to disclose knowledge structures that can guide decisions in conditions of limited certainty [2]. A data warehouse supports business analysis and decision-making by creating an enterprise-wide integrated database of summarized and historical information. It integrates data from multiple and incompatible sources [3-6]. By transforming data into meaningful information, and a data ware house allows the manager to perform more substantive, accurate and consistent analysis.

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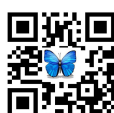
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The availability of business intelligence tool is helping organization to improve the performance. The introduction of Data Warehouse (DW) is used to implement a dedicated database for University to apply statistical tools to generate performance indicators to support in decision-making process.

Motivation of the Research

A DW is a collection of tools and techniques to collect and manage data. It is a digitalized platform to store large amount of data. Data can be transformed into information in a limited amount of time [7-9]. DW is an architectural structure that provide users with past and present data to take an effective decision. It is totally differing in all aspects from traditional database. The DW can be referred as Decision support system (DSS), Management information system, Business Intelligence (BI) solution, Analytic application, and Executive information system. The DW is commonly called as an Online Analytical Processing System (OLAP). It is a data repository to extract, transform, and load data from single or multiple operational source. The nature of DW is allowing aggregation, summarization, and data drill – down. It enables users to increase perceptions on data and take intelligent decisions [10 – 12]. Companies have efficient storage of large amount of data. The influence of BI can support University to improve the standards of both departments and employees. The performance indicators area pattern of activities of a single or multiple departments or employees.

University requires useful and precise information about their departments in order to:
➢ To take decision in short time;
➢ Provide better opportunity to employees and entities.
➢ Generate compliance reports for the improvement of entity;
➢ Attract management by providing effective services.
➢ Generate results as interactive charts according to University, Management, Department and Employee levels.

Most entities are operating with large and complex management structure of employees and relevant departments. The performance of employees and departments are some of the factors related to the University performance.

Objectives

The objective of the project work is as follows:
• To develop an application to extract useful patterns from University data.
• To generate OLAP Cubes for making useful decisions.
• To provide an application to generate interactive performance report using Business Intelligence tool.

The remaining part of the study is organized as follows:
Section 2 presents the background of the study.   Section 3 includes the materials and methodology of the research. The outcome of the study is discussed in section 4.   Finally, section 5 concludes the research with the future direction of the study.

Research Background

University must monitor the factors to improve or maintain their performance to achieve global recognition. The reports should be generated in a periodic manner at all levels to understand the overall performance of University [1-3]. The process of developing and deploying a performance management system is a paramount task for the University. The system should deliver useful and effective performance report of the important parts of the University such as Finance, Research, Student management, and Faculty management.

Role of DW

The aim of a data warehouse is to assist the process of decision-making. Data mining may be used in combination with a data warehouse to assist with certain types of decisions [4 - 7]. To be efficient, data storage and data mining requires a professional user who supplies the correct data and a specialist who can draw analytical conclusions from

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the information that is produced. The DW and Data mining is playing a key role in the organization's decision-making process. Data storage provides the company and the client with answers to a variety of questions and assists in decision making. There are many types of organization queries, such as tactical query, strategic query, and update query. Tactical query is a database process that tries to locate the best co-operation [8]. Tactical queries tend to generate a very limited set of results. It is not uncommon for the result collection to be less than a dozen lines. Usually, the result set is designed to accommodate in a single application on the display screen. A strategic query is a server process that seeks to determine what happened, why it happened, and/or what happens next. Usually, it has access to vast amounts of detailed data.

The most successful DW solutions generate business value on a continuous and iterative basis. The implementation of DW builds on its predecessor to maximize the business value of the information distribution proposal [9-11]. In recent years, the advancement of data storage has reached a new milestone with the introduction of decision-making support capabilities across the enterprise and beyond its conventional boundaries to partners and customers. A DW is a complex task that did not fit to the traditional system. Some roles, responsibilities, and functions should be covered for the implementation of DW. Roles such as builders, providers, maintainers, and analysts are vital for handling DW [12]. Data cleansing, data integrity, and data transformation are the important responsibilities of user to implement a DW application.

Role of DW in Public and Private Entities
✓ A DW is a fixed and flexible data source to make decisions.
✓ A DW is basically a system software that contains hardware and communication tool to design and optimize cross - record analysis.
✓ A DW is an application that allows users to access data independently of the owners of the data.
✓ The DW can be used in an entity to analyse the usage patterns for departments and employees. For example, a usage pattern of departments can provide information about its performance. A decision can be made according to the usage pattern of departments and employees. The existing system is providing data, but not knowledge. The proposed method can provide useful patterns of departments and employees using Online Analytical Processing (OLAP) tools. A clear analysis of the extracted patterns can help decision makers to take useful decisions.

The success of DW is depending on data. Therefore, a proper pre – process of data should be carried out to store data into DW. The following section of this report will provide details about the pre – process and structure of data.

MATERIALS AND METHODS

The aim of the project is to show the importance of DW in a University. The project work has used a synthetic dataset from www.kaggle.com/datasets [5]. The simulated work can be implemented in University to improve their overall performance. The websiteKaggle.com is offering raw and processed datasets for researchers. A sample dataset of a University is downloaded from the website. The figure 1 shows the categories of dataset.The three major categories of dataset are details of correspondence, department, and employee. The correspondence category is involved in both department and employee. The department category is also having two types of classification: correspondence and performance. The dataset has provided only performance data; however, we have included the correspondence classification in department and employee categories with synthetic data. The correspondence classification data will provide details about the total number of correspondence of departments, periodically.   The details classification has offered the basic details of each department in a public entity. Finally, the employee category is classified into two types as correspondence and performance. The correspondence classification will provide details of correspondence for each employee, periodically. The details classification has provided the basic details of each employee. Figure 1 is illustrating the overall structure of the dataset. The department category will provide data for University, management, and department levels. The employee category will provide data for all employees.

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Extraction, Transformation, and Loading Processes

The raw dataset should be cleansed and transformed into a structured format to support OLAP activities. We have used CLOVERDX Designer to perform Extraction, Transformation, and Loading (ETL) processes. The following figure 2 and 3.3 is showing the ETL process to convert raw text file to spreadsheet format. The processes will be followed for employees and correspondence. The reason for converting into spreadsheet is to verify the duplicate files. After changing into spreadsheet, Duplicate and missing files will be removed from the dataset. After removing the irrelevant files, the spreadsheet will be converted into Oracle file format and directly load into Oracle database through CLOVERDX Designer. The tool is providing an option to load data into database. The following figure 11 is showing the process of removing unwanted data from dataset. Table 2 is showing the details of data after pre – process. Figure 4 and 5 are showing the loading of data into Oracle database.

DW – Design

A useful data may lead to an interesting pattern, which helps to improve the quality of service. Therefore, designing a DW is one of the prime factors for the success of an organization. The existing database is not providing interesting patterns, due to the structure of database. It is necessary to build a DW in a way that to provide a better information. The growth of AI based tools are helping to provide OLAP related services with the support of DW. While designing database tables, we have focused on certain developments on existing tables or databases. The introduction of classification of correspondences and time limit for activities can improve the design of data warehouse. It will support the process of internal benchmark.

The following section will provide information about the new improvements that were carried out on the existing DW of an entity.
i. Classification of correspondence
ii. Time limit for the completion of a correspondence
iii. Storing timestamp for each correspondence
iv. Unique correspondence subject

Department Table

This table will have details about the department such as department id, name, status, and hierarchical level. The department id will be treated as primary key.

Employee Table

This table will have details about the employees such as role, name, department id, status, and date of joining. The employee id will be the primary key.

Internal Correspondence Table

This table will have details about the internal communication between departments in the entity. Correspondence Id, subject, and forwarding id are some of the important columns of this table. The correspondence id will be treated as primary key.

Incoming Correspondence Table

This table will have details about the incoming communications of departments in the entity. Correspondence Id, subject, and forwarding id are some of the important columns of this table. The correspondence id will be treated as primary key.

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Outgoing Correspondence Table
This table will have details about the outgoing communication of departments in the entity. Correspondence Id, subject, and forwarding id are some of the important columns of this table. The correspondence id will be treated as primary key.

Forwarding Table
This table will provide details about the correspondence forwarded by employees and department. Forwarding id, date, year, and department id are some of the important columns of this table. The forwarding id will be treated as primary key.

Forwarding history Table
This table will provide details about the forwarded correspondence by employees and department. It is used to connect internal, outgoing, and incoming tables and find the count of correspondence. Forwarding id, correspondence id, date, year, and department id are some of the important columns of this table. The forwarding id will be treated as primary key.

Steps in Implementation of DW
Software used to implementation of DW
In this project, Oracle Warehouse Builder (OWB) software was used to create a data warehouse which is a flexible tool that enables to design and deploy various types of data integration strategies.
The following steps was followed to complete the project in order to meet project objectives.
Step 1: Login OWB with relevant credentials shown in figure 6.
Step 2: Enter Global explorer, create new user under security.
Step 3: Create database user using create user wizard as figure 7.
Step 3A: Register the user as shown in figure 8.
Step 4: After registering new user, login SQL Plus with the newly created user credentials.
Step 5: Load data into new database.
Step 6: Verify whether all data loaded into the data warehouse.
Step 7: Grant permission to user to create any directory.
Step 8: In OWB, Enter into database with credentials.
Step 9: Enter Project Explorer, create new project, in which we create a cube as shown in figure 9.
Step 10: Import tables into the project using the wizard shown in figure 10.
Step 11: Enter Control centre manager to create and deploy mapping.
Step 12: Create a mapping to connect the newly created database.
Step 13: Place all the tables in mapping window.
Step 14: Create an unbound operator from table operators.
Step 15: Join all the tables using Joiner.
Step 16: Use aggregator to group all the tables by clause and validate it.
Step 17: Connect aggregator with table for the process of creation and bind.
Step 18: Select mapping and table in control center and deploy it.
Step 19: Create a new dimension using ROLAP.
Step 20: Create a mapping with newly created dimension.
Step 21: Enter Control center manager, select mapping, dimension, tables, and sequence.
Step 22: Create a new cube with appropriate dimension.
Step 23: Create a map for newly created cube and map all the columns in table.
Step 24: Configure the cube and deploy it.
Step 25: In Control centre manager, select cube, table and dimension.
Step 26: Execute the cube, table and dimension.
Step 27: Explore the cube according to the dimension.

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RESULTS AND DISCUSSION

Creating OLAP Cube
Creating cube for department and employees

Initially, the researcher has created a database with necessary tables in SQL DEVELOPER. Figure 11 shows the snapshot of SQL developer with database. The measures of cube 1 are number of active and inactive employees and departments. After creating the database in SQL Developer, have entered into Oracle Warehouse Builder 11gR2 and shifted the tables to warehouse builder.

Figure 11 shows the fact table with data for cube and the time dimension shown in figure 12.

Figure 13 represents the mapping of cube.

Figure 14 shows the generated cube.

Visualizing of the information of DW
The interface is developed with the help of Canvas is [6]. The cubes from the DW were extracted as XML for analysis (XMLA) format. A simple Java script is used to fetch data from XMLA and build the chart using Canvas.js. The following figures from 7.1 to 7.8 are showing the Key performance indicators (KPIs) for University, Department, and employee level.

The interface is designed to provide information in four categories and as follows:

Level - 1 : Figure 15 provides information about departments in level - 1.

Level - 2 : Figure 16 is designed to provide information about department in level - 2.

Level – 3 : Figure 17 is designed to provide information about department in level – 3.

Level – 4 : Figure 18 is designed to provide information about specific employees.

The following snippet shows the canvas.js script that can be embedded into a Java script and extract items from XML file.

```
<script src="assets/jquery/jquery-3.1.0.min.js"></script>
<script src="assets/tether/tether.min.js"></script>
<script src="assets/bootstrap/bootstrap4-alpha3.min.js"></script>
<script src="canvasjs.min.js"></script>
<script src="assets/web-analytics/real-time.js"></script>
<script src="assets/script/jquery-1.11.1.min.js"></script>
<script src="assets/script/jquery-ui.1.11.2.min.js"></script>
<script src="jquery.canvasjs.min.js"></script>
<script src="assets/jquery.waypoints.min.js"></script>
<script type="text/javascript"  src="assets/gijgo.min.js"></script>
```

Decision Making Process
The data visualization will support decision-maker to identify a number of correspondences in university. In addition, it assists the decision-maker to identify the most time that have more number of action and correspondences. Besides, it helps to identify the achievement percentage of all achieved and not achieved correspondences in managements and departments and employs. As well as, it helps to know the average time they take for achieved correspondences in managements and departments and employs.

CONCLUSION

The performance analysis is an important task to improve the quality of an organization. The work has constructed a data warehouse with departments, employees, internal, incoming, outgoing, forwarding and forwarding history tables. Cubes were constructed with necessary measures to provide information about University, management, department, and employee levels. The cubes were exported as XML for analysis format for the development key

performance indicator charts. The canvas.js application-programming interface was used to render the measures as graphs. The future path of this work is to construct a flexible data integration environment to apply artificial intelligence techniques. Through the implementation of this project, we learned how to create data warehouses, ETL process, create schema and create cube and how data warehouse plays a significant role in the decision-making process. Major challenges faced in the implementation of Oracle warehouse builder. Installing oracle warehouse builder 11gR2 in Windows 8 has required major configuration such as repository settings and database settings. After installing OWB, the database has to upgraded to fit with OWB 11.0.3.2.After upgrading OWB, data import has required special configuration for the extraction of data. After setting all necessary steps, deployment in Windows 8 has faced major issues with data. The fact table has data in hijra year and OWB did not have option to adapt the hijra date. The implementation of time dimension has faced major problems. We encountered these challenges by searching on the internet, and YouTube.

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Table 3.1 Details of dataset

Categories	Classification	Total Number of data
Department	Correspondence	523654
	Details	712
Employee	Correspondence	450231
	Details	1231

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Table 3. 2 Details of dataset after pre-process

Categories	Classification	Total Number of data
Department	Correspondence	521214
	Details	642
Employee	Correspondence	486931
	Details	1091
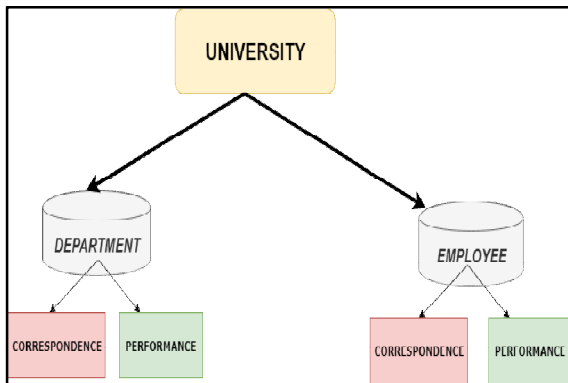
Figure 1 Categories of Kaggle dataset
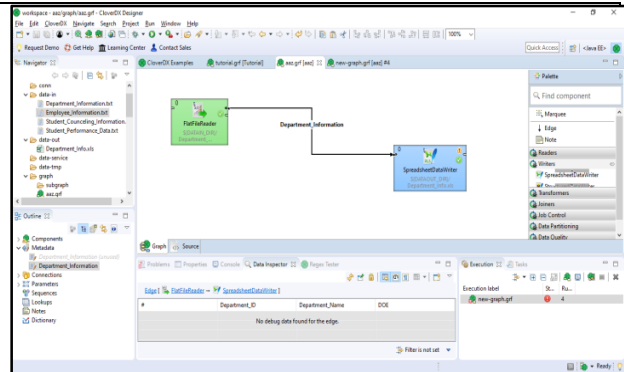
Figure 2 Transformation of raw file into spreadsheet format – (Department details)
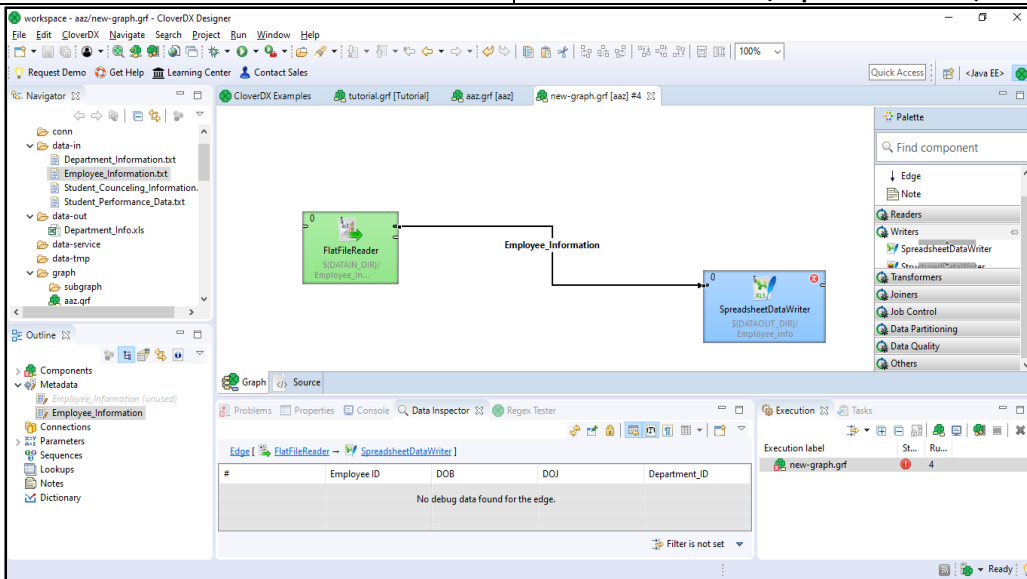
Figure 3 Transformation of raw file into spreadsheet format – (Employee details)

Abdulaziz Fahad Saad Alothman and Thamer Abdullah Alhussain
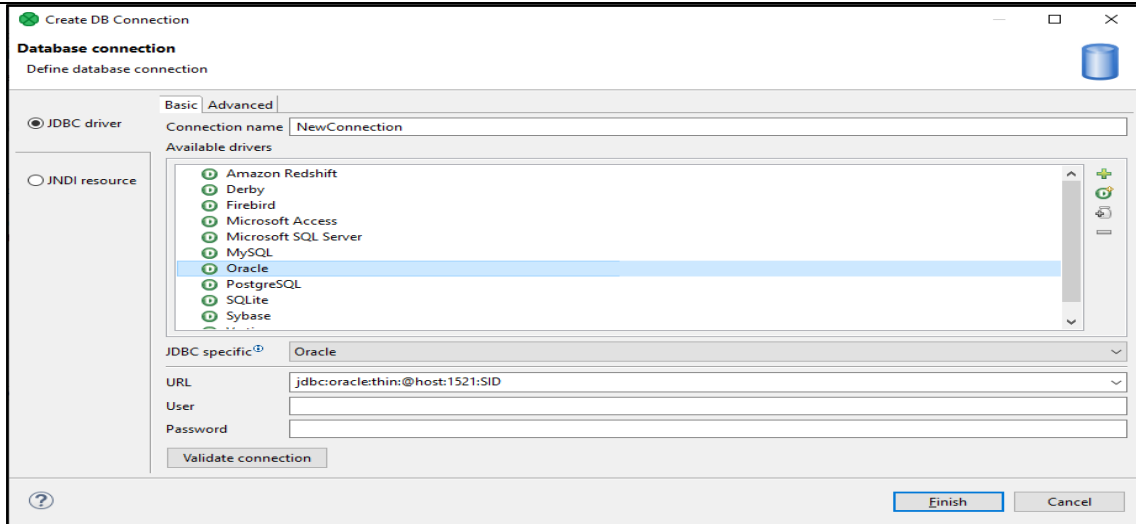
Figure 4 Connection process to Oracle Database
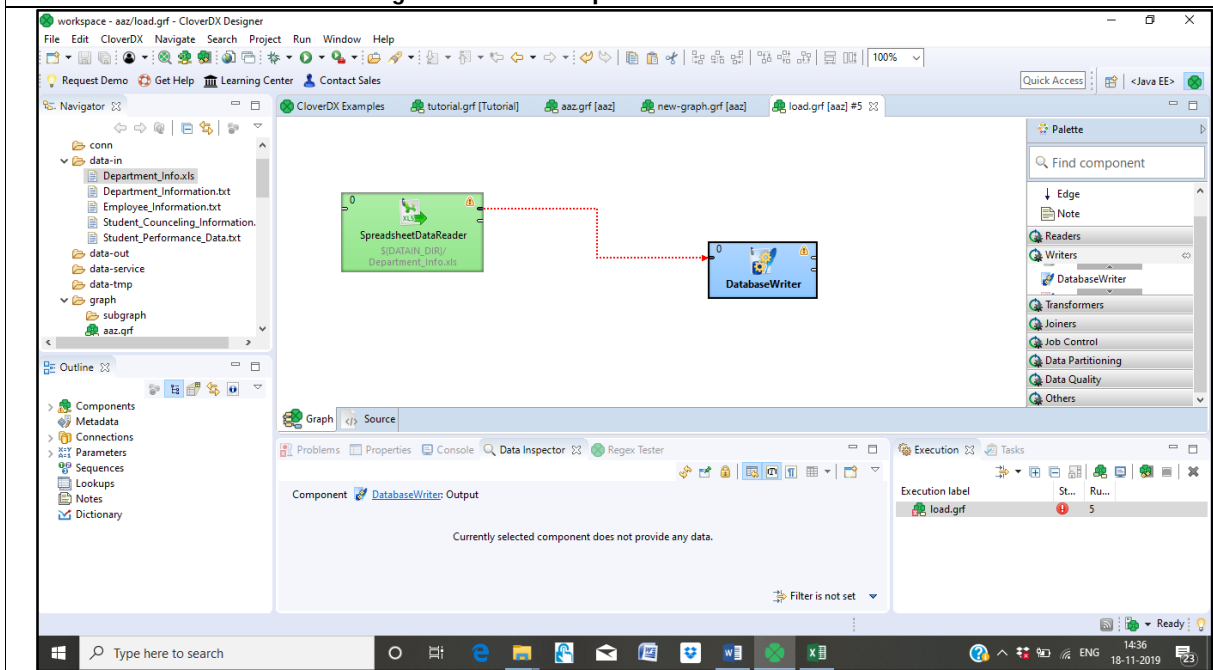
Figure 5 Connection between reader and writer to load data

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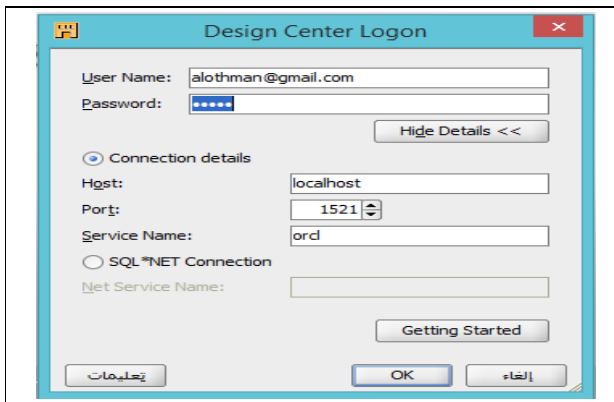
Figure 6 Login Screen
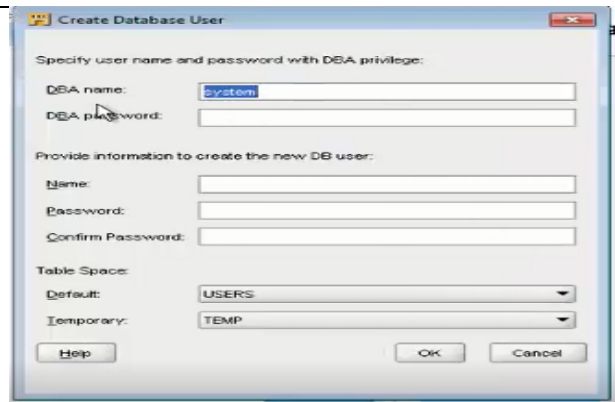
Figure 7 Connection inputs
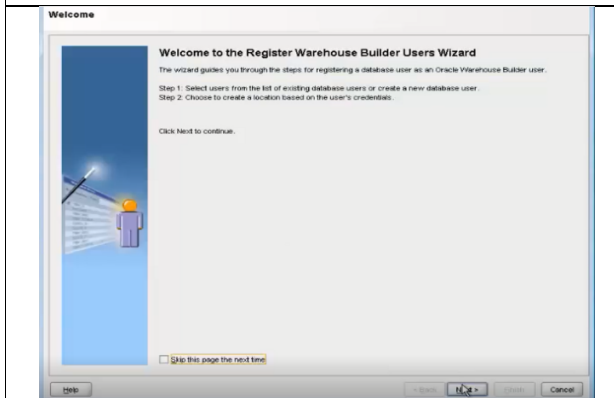
Figure 8 Warehouse builder wizard
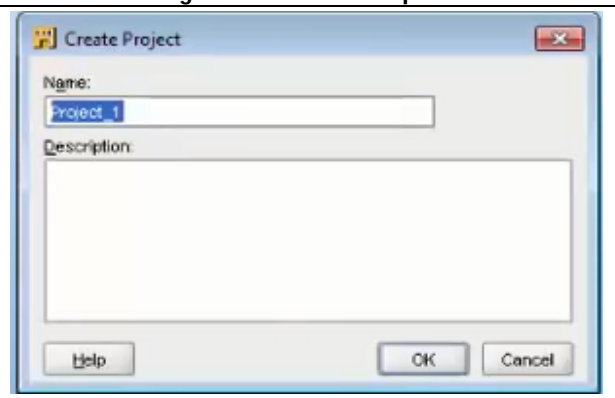
Figure 9 Project dialog box
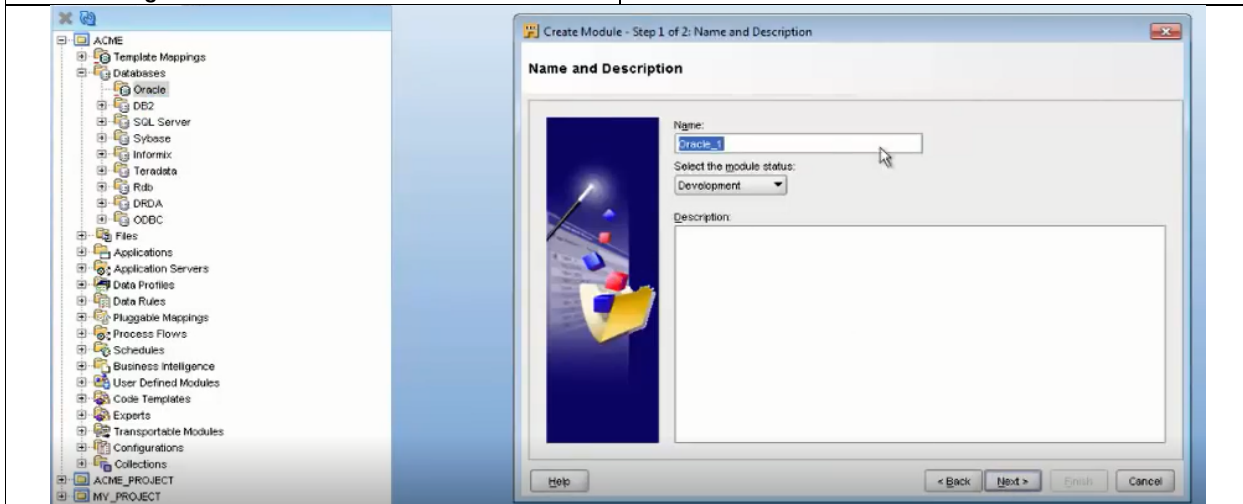
Figure 10 Import table wizard

Abdulaziz Fahad Saad Alothman and Thamer Abdullah Alhussain
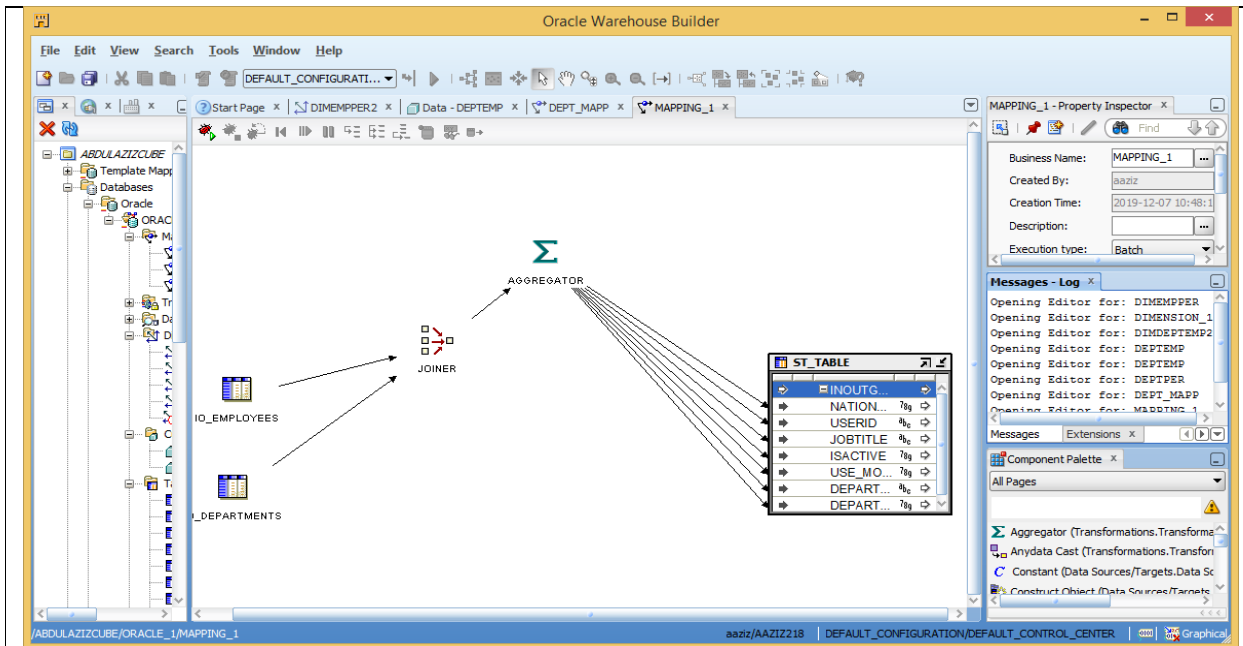
Figure 11 – Mapping for Fact table
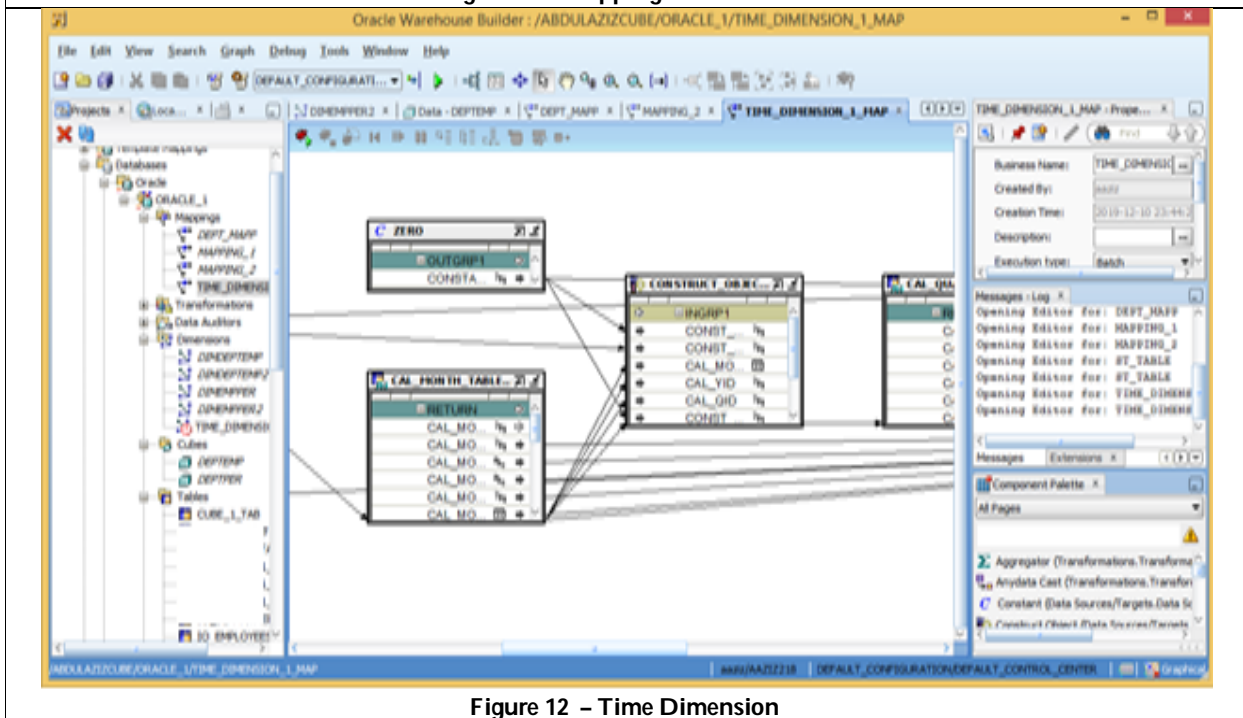
Figure 12 – Time Dimension

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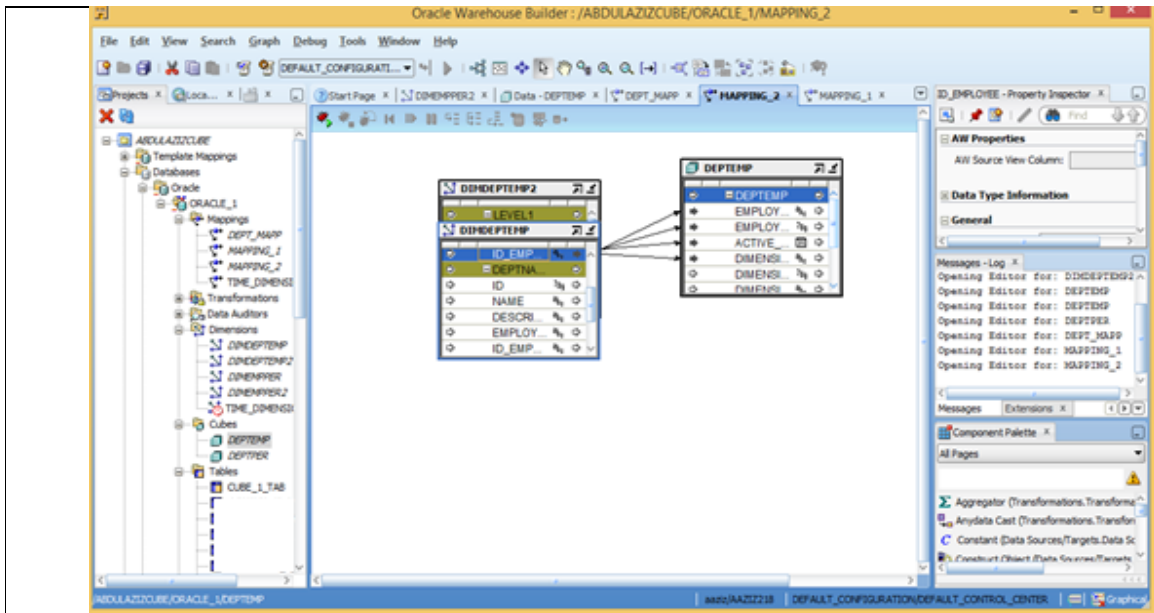
Figure 13 – Mapping of Cube with DEPTEMP AND DEPTEMP2 DIMENSION
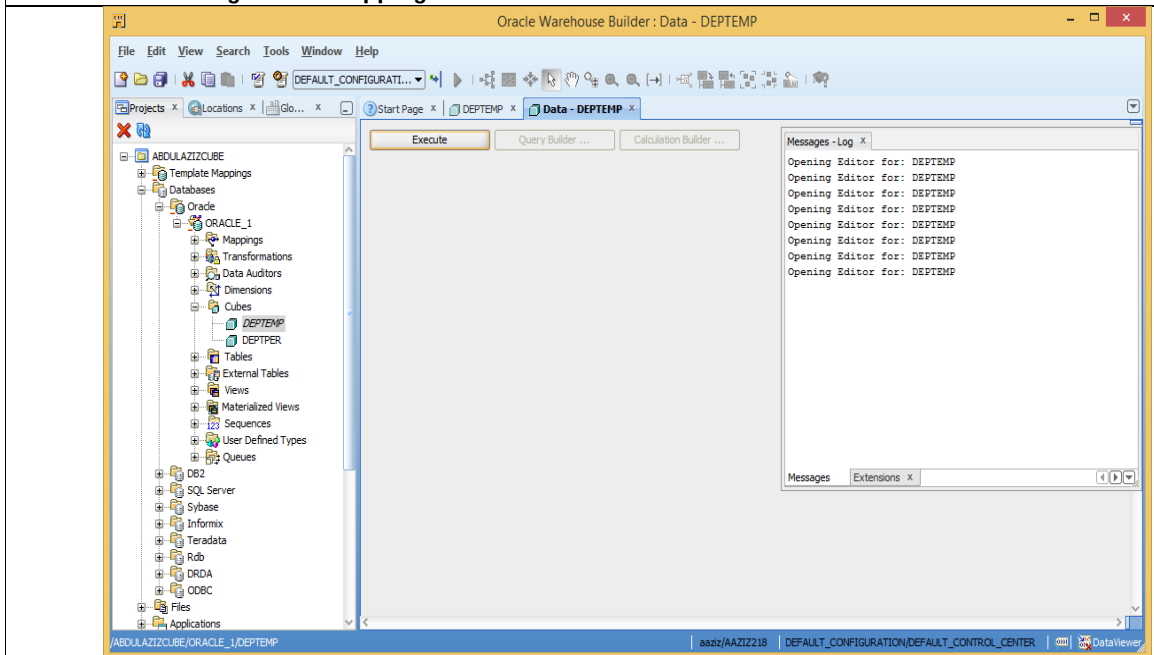
Figure 14 – Cube - Department and Employees

Abdulaziz Fahad Saad Alothman and Thamer Abdullah Alhussain
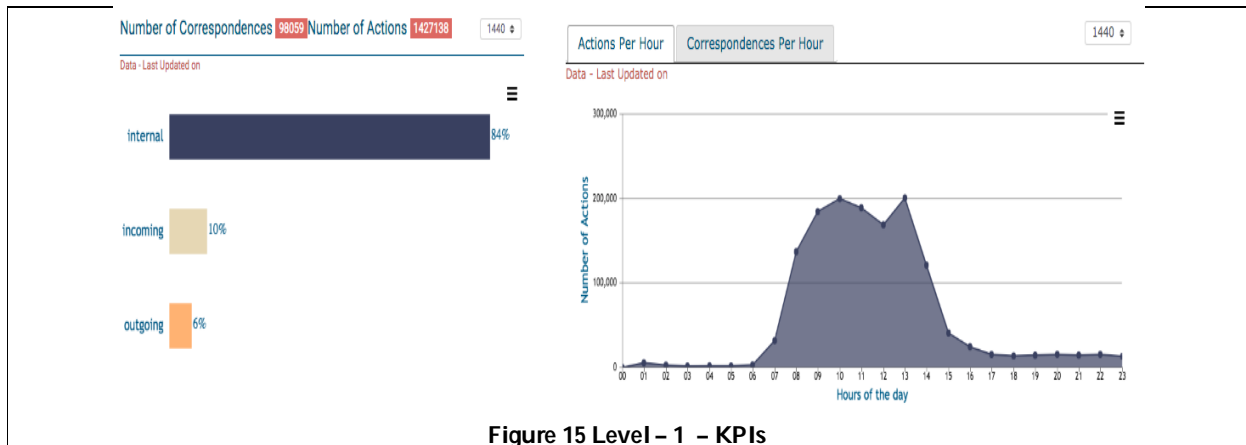
Figure 15 Level – 1 – KPIs

Figure 16 Level – 2 – KPIs

Figure 16 Level – 3 – KPIs
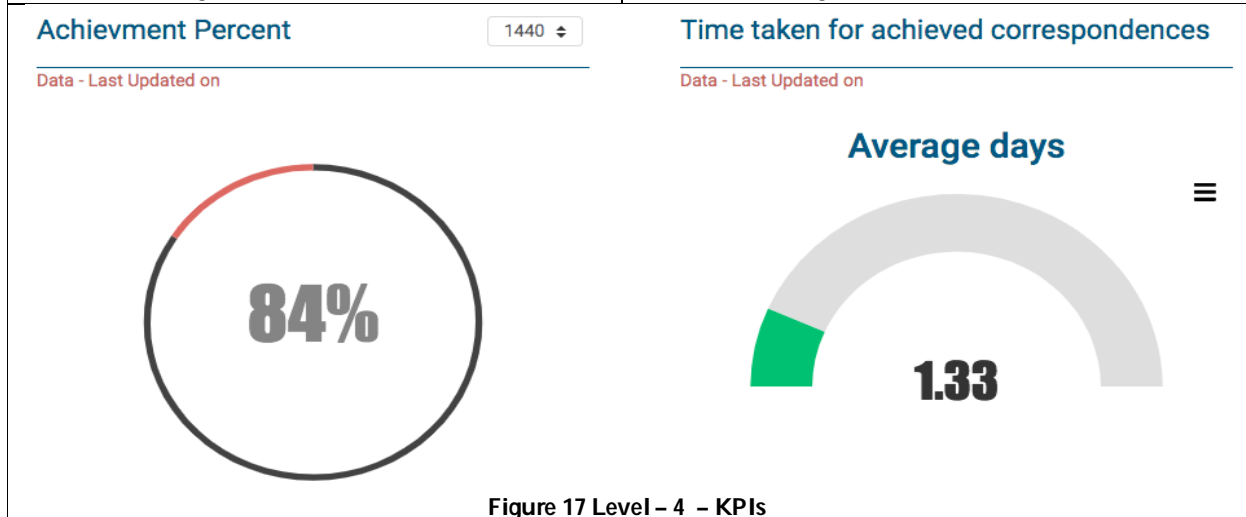
Figure 17 Level – 4 – KPIs

Intelligent Add-Ons using Voice Commands for Assisting Softwares

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ABSTRACT

Manual working has been improved to the voice-based commands in this generation and in the future, more applications are yet to get convert or to be developed from scratch depending on the research and growth of the technologies. In this order, many industries have already started to develop products like Alexa, Cortana, Hey Google, etc. These products communicate or reply through voice commands that make them easier and user-friendly to a certain extend. The major issue voice given as input needs clarity to understand the user needs and these devices have to be carried out for places we go. Instead, this proposed work represents ADD-ONs in the form of new versions that can be added to the respective applications during the installation. Like Grammarly, voice add-ons can be added to the word, Mail, or to any other software. The role of using these voice-based commands in the software is that easy, faster, and parallel completion of work.

Keywords:

INTRODUCTION

A virtual assistant or intelligent personal assistant that can accomplish the services or task based on speech instructions. Virtual assistants like chat bots are used for online chat, especially in entertainment applications. The virtual assistants can understand human speech and react by means of synthesized voices. With verbal commands, anyone can enquire their voice assistant, play music, control home automation devices, and can handle tasks such as email, calendar, and to-do lists. To create a computer that serves as a digital organiser for its master and provides a range of services. It will analyse the possible utility of one particular piece of software as a VPA by looking at examples of programmes and language processing that are currently available, with various levels of support. To
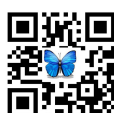
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create a computer that serves as a digital organiser for its master and provides a range of services. It will analyse the possible utility of one particular piece of software as a VPA by looking at examples of programmes and language processing that are currently available, with various levels of support. By 2020, it is projected that 3.5 billion voice assistants will be used in smart devices all over the world. The capabilities of voice assistants are so good that by 2023, demand for voice assistants will outnumber the world's population by about 8 billion. Voice assistants may perform a variety of tasks and actions after hearing a wake-up word or order. They can play music, switch on the lights, answer your questions, and even make a purchase on your behalf. Despite the fact that intelligent personal assistants are now commonplace, testing them is difficult due to the wide range of tasks they can perform. For example, the assistants found on the average smartphone support a wide range of tasks, such as voice commands, web search, chat, and several others. Since the number of tasks that utilize voice commands is inevitably growing, studies that attempt to measure the effectiveness of these assistants are emerging research areas in the computer science domain.

Survey

Ana Berdasco *et al.* demonstrated that standard user interfaces are becoming more well-known. Voice-activated interfaces, especially brilliant individual collaborators like Google Assistant, Alexa, Cortana, and Siri, are perhaps the most well-known normal UIs these days. The paper includes graph that shows the results of a two-measurement evaluation of these four genius individual collaborators: the accuracy of their responses and how similar the reactions sound to clients. The evaluation was led by 92 participants. As compared to Siri and Cortana, the results show that Alexa and Google Assistant are much superior. In any case, the difference between Alexa and Google Assistant isn't important. V.Lalitha *et al.* proposed the basic idea of ensuring the protection of clients' personal data and providing precise assistance for various aspects of life within a simple structure. To gather data, such a system employs order and relapse Machine Learning Algorithms, as well as a basic chatterbot framework to serve as an ideal ally for people.The framework targets giving help to travel, sports, and factual investigation, essential information from the web. The raspberry pi is utilized for insignificant preparing and processing frameworks are recommended for the extemporization of the vision. The framework utilizes the least assets meaning an ideal fit for practical utilization. Likewise, with gradual figuring out how to be sent, exactness and administrations are practically sure to improve manifolds.

Ujjwal Gulatia, *et al.* present a Google Assistant-based voice-controlled vehicle with a genius deterrence location capabilitywould be useful for the genuinely disabled. Device such as Particle Photon is used as part of the vehicle's equipment to provide information. The suggested system is more effective at controlling a vehicle and avoiding collisions.To plan the Next-Generation of VPAs model, V. Kpuska *et al.* used multi-modular exchange frameworks that quantify at least two consolidated client inputs, like video, audio, image, sensor input, movements, look, and growth to improve human-machine interaction by using picture/video recognition, discourse recognition, etc., This VPA platform can also be used in a variety of other applications, such as guidance, clinical assistance, advanced mechanics and vehicles, incapacities frameworks, home robotization, and security access control. Tulshan, *et, al.* new innovation pulled practically the entire world from various perspectives like cell phones, PCs, PCs, and so forth Siri, Google Assistant, Cortana, and Alexa are only a few of the major VPs. The problems of voice recognition, context-oriented structure, and human interaction are not addressed at this time in the IV As. Thus, to address those issues,100 clients took part in an overview for this examination and shared their opinions. As indicated by outcomes, there are a few upgrades needed in voice acknowledgment, context-oriented arrangement, and sans hand association. Ankit Pandey, et al, gives a Savvy Voice Associate (SPA) the ability to organise and maintain data, which includes message management, scheduled events, records, and daily plans. Client should implement the structure and encourage the client to steer a dialogue where it is pleasant to work between these areas, according to Yogendra Kumar Sharma, *et al.* The SPA is used on a professional level and includes a unique PDA regulator for planning the blamed associates and encoding the framework's talk model. The expert-based exchange model is at the highest level of reflection, allowing the discourse model's region free plans to be reused in modify SPA frameworks.

Proposed Methodology
Architecture

The architecture follows the procedure as given below

1. The input is a speech in the normal user speaking English to the ADD-ONs app.
2. Getting the input the cloud service connects to the cloud database and also acts as an internal database.
3. With the help of the Speech Recognition module, the voice is converted to text.
4. The app is designed in such a way that logical analysis is performed by interface and services.
5. The backend process like application, content extraction, and system calls are called upon using python packages.
6. The web browsers are also crawled when the necessary data was not fetched from an internal basis.
7. The derived solution performs the action as the output according to the keywords derived from the input. Example: If the person inputs the words as " Reply to sam" the output passes a text to the person sam informing us messaged to the concerned person.

Component Description
Cloud Services

- Use the Android Framework APIs to record sound after the suggestions on the most proficient method to give sound information to the Speech-to-Text API.
- Use the Cronet Library to transfer discourse information from the customer application to the microservice and to download deciphered messages from Cloud Storage.
- Receive constant discourse acknowledgment results as the API measures the sound info gushed from your application's mouthpiece or sent from a prerecorded sound document (inline or through Cloud Storage).

Speech Recognition Module

- The custom voice association model gives the most authority over the client experience. Plan the arrangement of words and expressions for each activity the ability can perform to convey an altogether custom voice insight. Custom abilities give us adaptability and command over the expertise plan and code. We can incorporate voice, visuals, and contact communications into custom abilities.
- The plans the ability can deal with. The expectations address activities, like arranging an excursion, that clients can do with the ability. Every purpose conjures explicit ability usefulness. Goals can have contentions, called spaces, that gather variable qualities that the ability needs to satisfy the client's solicitation.

App Logic

- At the point when a particular goal is set off by the client, it will send that data as a solicitation to the talented help. This will contain the business rationale to be returned alongside important data to the frontend, which will at long last be transferred back to the client.
- The Python packages are used by the backend process like System Call or Application Programming Interface, Context Extraction Module to provide the essential functions to the client.

API Calls

It enables two apps to interact with each other. The programming interface acts as a messenger, delivering a request and receiving the service between two applications.

Extraction of Background

It aids in the extraction of structured data from unstructured or semi-structured documents, as well as records that are both machine-discernible. The majority of the time, this project entails the preparation of human language messages using a methodology for natural language handling (NLP).

Decision Making
- This makes to decides whether the output to be display as text or the voice translation to the user according to the requirement from the user input.
- The keywords segregated from the input sequence are taken into the consideration to decide whether the output has to be a reply or voice note to the corresponding sender as well as the receiver acknowledgment.

Python Package
For building any voice-based system needs listening to the instructions and to react to your instructions. Also it needs customised commands. The initial step is to introduce and import all the libraries using pip. Following are a portion of the key libraries utilized in this research.
- The Speech Recognition library permits Python to acquire speech inputs, translates the sound and saves it.
- Voice commands are converted to text by Text-to-speech package of Google gTTS.
- To access web pages, Web Browser Packages like Selenium is used.
- Wikipedia is utilized to bring an assortment of data from the Wikipedia site.

Packages used for Implementation
- Fetching data from Wikipedia
- Google Chrome, Gmail, and YouTube are some of the web browsers that can be used.
- Predicting time
- To fetch the latest news
- Searching data from web
- To Configure AI assistant to respond to questions about geography and computation.
- Extra features

CONCLUSION

This work aims to provide an app that roles up in the form of voice or text as output decides itself by the keywords given in the input voice commands. Many devices and research work are still under process in this field producing many versions. As a new version this work outcome an app as an ADD—on to any application or software during the installation or after the installation also. The result makes a simplified or efficient work assistant.

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Stack component	Mycroft	Alexa	Cortana	Google Assistance	Siri	Apple homepod	Amazon Echo	Google home
Wake word	Pocketsphinx, moving to precise	Alexa voice services	Microsoft speech API	Google cloud speech API	Hey siri	Hey siri	Alexa	Ok google
Speech to touch	Morzilladeepsearch (from march 2018)	---	MS SAPI Project oxford	Google SST	---	Siri	Alexa	Google assitance
Natural language understanding	Adapt and padatious	Alexa voice services	LUIS	---	---	---	---	---
Text to speech	Mimic (based on CMU flite)	Polly	---	Google TTS	---	---	---	---
Skills framework	Python	Lambda framework, functional programming	Cortana skills framework, node.js or .NET	Dialog Flow	N/A	N/A	N/A	N/A
Assistant	---	---	---	---	---	Siri	Alexa	Google Assitant
Search engine	---	---	---	---	---	Google	Bing	Google

Table.1: Comparison of Virtual Assistants

KohilaKanagalakshmi *et al.*
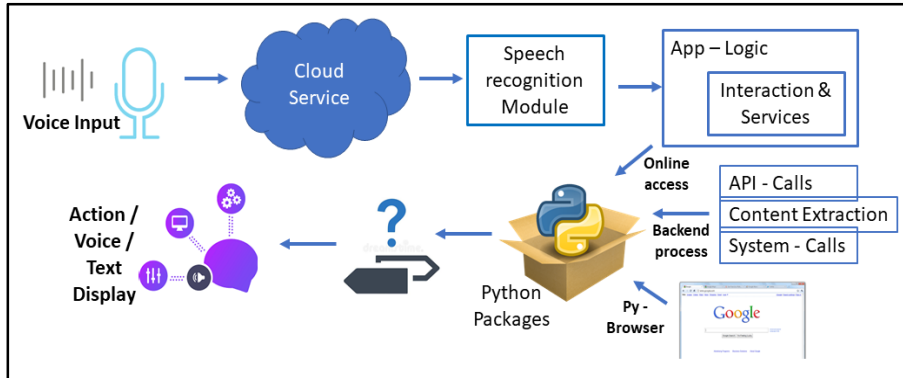
Fig.1: Proposed Architecture Diagram

REVIEW ARTICLE

A Review of Applications of Machine Learning for Smart Farming

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ABSTRACT

Machine Learning has arisen with huge variety of innovations and more skillful computing to set out new open doors for information science in the multi-disciplinary domain of agri-technologies. The advantages of using Machine Learning in agriculture are flexibility, accuracy, agility, high performance and cost effectiveness. Machine Learning creates new opportunities for computations with big data and other technologies and understands data sensitive processes involved in the operational environments. This paper gives, compressive research review related on the applications of Machine Learning in agri-industry and its benefit to the Machine Learning technologies. Machine Learning is applied to real-time applications along with sensor data, farm management systems and Artificial Intelligence which supports farmer's decisions and actions. The refining and characterization of the introduced articles exhibit how farming will profit by Machine Learning advancements.

Keywords: Machine Learning, Artificial Intelligence, Block Chain, Internet of Things

INTRODUCTION

Digital agriculture which is a combination of Agri-technology and real-time smart farming have emerged as new technology that utilizes data intense ways to deal with agricultural productivity and increasing farming efficiency with minimum impact on environment [1]. Agriculture mainly depends on whether and climate [2]. The crops are grown depending upon the climate and soil. Farmers duty is not only growing crops, it takes further duties such as storing crops, transporting, and earning profit in business sector [3]. In day to day life, agriculture is one of the riskiest jobs as farmer cannot predict the result of crops as it depends on the climate [2]. Every farmer aims to get more profit as they put all their efforts to grow good crops [4]. After production only half of the farmer's work is completed, to successfully complete this task, transportation of the goods to the required location such as market, business sector, etc., is also essential [5]. Human life cannot survive without agriculture. Agriculture has many complicated procedures such as ploughing, sowing, watering, fertilizing, transporting, etc. Hence there is a need to implement new trending technologies like Artificial Intelligence, Machine Learning, Block Chain, Cloud Computing,

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etc., and develop a frame set which makes the process of cultivation easier using technologies. This helps both farmers and business. The life cycle of Agriculture is depicted in Figure 1. Farmers can use this technology to check weather-climate, fertility of soil, production, transport, etc., to make their work easier and it can be accessed by naive people through their smart phones so that they can create a smart farm. Sustainable agriculture is important for eradication of hunger and food security of the increasing population. By 2050, the estimated world population is set to touch 9-10 billions, so that production of food must be increased by 60-110%. There is need from the current paradigm to advanced agricultural practice. Sustainable agricultural practice reduces harmful environmental impacts. Figure 2 represents the Agriculture Supply Chain with respect to different stake holders. The sustainable Agriculture Supply Chain is stand on various particulars, skills and technologies. This attributes of this supply chain encourages farmers to enhance and adopt this technology development [3].

Every business has a goal to earn more profit with less risk and low cost. To make the farmer's work easier, new trending technology is used with set of framework and implemented in agriculture [6]. Artificial Intelligence and Machine Learning technology used in agriculture is now being termed as digital agriculture, and new scientific approaches are being used to maximize the productivity along with minimizing the environmental impacts [1]. Resultantly going digital, numerous data is generated in supply chains, using appropriate data analysis tools required data is abstracted organized and useless data is discarded. Artificial Intelligence enables a computer to interact, reason and learn like humans and perform different operations, human intelligence such as visual perception, voice identification, decision making and language conversion which demonstrates the ability and manipulation of objects. This system operates and learns on combination of Big Data Analytics, Cloud Computing, M2M communication and the Internet of Things. Machine Learning algorithms with Artificial Intelligence have wide combination of technologies such as locality intelligence in Agriculture Supply Chain to point out patterns hidden in the given data. The study of Agriculture Supply Chain practitioners with Artificial Intelligence and advance analytics derives digital transformation in Agriculture Supply Chain and develops competitive benefits which satisfy farmers, businessman as well as public according to their demands [3]. In this paper an extensive review of machine learning in the field of agriculture is carried out. The next session includes Machine Learning terminology along with popular models and algorithms, implementation of these technologies for the collection and categorization of the presented works. The advantages of using Machine Learning in agri-technologies are listed along with their future expectations in the domain.

Machine Learning

Artificial Intelligence along with Machine Learning is an arising innovation that helps in the revelation of rules and patterns in huge sets of training data [7]. Machine Learning is defined as, "the scientific study of algorithms and computational models on computers which provides progressive performance on a specific task or to make accurate forecasts" [3]. The Machine Learning process is depicted in Figure 3.

Machine Learning is the capability of a system to acquire and appeal knowledge that is provided to machine and getting desired output from it. Machine Learning is also defined as, the ability of a machine to master without being strictly programmed. Machine Learning is applied in variety of fields like bioinformatics, biochemistry, medicine, meteorology, economic sciences, robotics, aquaculture, food security and climatology [1]. Machine learning has various technologies such as supervised and unsupervised learning. It works on hidden data and algorithms. It develops a machine which accepts the data set of production with its machine and statistical ideas which yield in good result. It uses the database and produces the output of sub-problems and combines it to make a one single machine [5]. It uses database with technologies such as AI, network designing algorithms, sensors, block chain, etc., Machine Learning uses sensors to build a method to look after the security of the crop, level of watering and quality of crops. Machine Learning uses network to know about the climate and weather in their location and develops a smart farming [5].Machine Learning uses cloud computing to store huge data and collect the particular data based on the statistical requirement. It uses block chain, cloud to build a supply chain between farmers and consumers.

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Not with-standing the huge ongoing advancements in Machine Learning and the fruitful application in numerous domains, Machine Learning strategies have some essential constraints when utilized innocently in an absolutely information driven design [8][9]. The exactness of the expectations and their vulnerabilities delivered by the Machine Learning calculations firmly rely upon the quality of information, model representativeness linking information and desired output factors in the gathered datasets. Information with an undeniable degree of commotion, incorrect information, anomalies and inclinations in the information, and deficient datasets may altogether lessen the prescient force of the models. Optimal performance of Machine Learning model depends on geometric progression of covariance function, neural network architecture and SVR parameterizations' [7]. The acquaintance of Machine Learning with agriculture is empowered by other innovative advances, like big data analytics, IoT, robotics, accessibility of sensors, cameras, drone innovation, and large-scale web inclusion on topographically scattered fields. Artificial Intelligence advancements the impact on ecosphere can be discounted and specialist security may expand which reduces food cost and guarantee that the food creation will stay up with the growing population [10]. The information generated in current rural system by sensors that enable a superior understanding of the climatic conditions and the actual activity (hardware information), prompting more exact and faster decision making [1]

When agriculture comes into business production for large or small scale for big or small companies where every business has a goal to get good profit with less cost [5] such as keeping food crops, sowing and harvesting of crops. It uses digital mechanism to create a user-friendly application so that a farmer can access and use it easily [6] which gives job to many other fields such as developers, testers, marketers. Also it guides the farmers on how to implement this technology and get good results [11] [12[13]].

Literature Survey

This session focuses on evaluating the published research work on applications of machine learning in agriculture and attains impartial and objective summaries of the present state of the technology and future capability of Machine Learning implementation in agriculture. Liakos *et al.* [1] looks into the updates of how Machine Learning is implemented with Artificial Intelligence. Machine Learning together with data base technology creates a high-performance agriculture technology domain which looks after all practices of agriculture. Real-time artificial intelligence is used to design and support this existing system. Rehman *et al.* [2] describes about challenges faced by the farmer in production of crops such as watering, the crop processing, storing, climate, weather condition etc., which may affect the production. They used real-time system IOT, Smart developing application which test all these factors and elaborated a machine learning technology with framework of system which accepts datasets with decision algorithm so that it develops a particular system for all factors and merge them together, making one system.

Rohit Sharma *et al.* [3] discussed about challenges faced by farmer in shipping the goods from their place to other location such as business or for government food security board. They came up with a solution using Machine Learning for Application supply chain's application to make decision about transporting the goods to another place with the required quality and how much to be sent to them is decided by this technology so that it helps where to supply more goods such that it maintains good supply chain of agricultural products. Lakshmi M B *et al.* [4] examines about consequences faced by farmers in precision farming to look after the diseases caused in crops. To overcome this consequence Machine Learning and Artificial Intelligence is mixed with other trending technologies. UAV's produce a image of crops and process this image using image processing algorithm and gives the result whether the crop is good or diseased or quality is decreasing and also look after the fertility of the soil. Balducci *et al.* [5] tells about challenges faced by the database for storing the large data and retrieving the data from database for particular application based on decision algorithm. They developed a smart farm model which increases productivity in agriculture. Smart farm model contains other models with IOT sensors which optimize the required information and several experiment to overcome the issues of the product and produce a good system and works for long time.

Adebiyi M O *et al.* [6] applied machine learning to develop an application using database and parameters which make decision setting parameters. They applied machine learning techniques to provide a user-friendly application which can be accessed by the farmer in their smart-phones to develop smart farm using trending technology to look after crop growth and to produce good yield. Anna Chlingaryan *et al.* [7] discussed about the problems faced by farmer in finding nitrogen content in soil. This is solved using Machine Learning with RS based approach which process enormous data of remotely sensing and produce results of high performance with less cost effective and yields good result of testing nitrogen level in soil with produces good yield. It uses different sensors with Machine Learning and created a solution for this problem. Sudhadra Mishra *et al.* [8] reviewed existing technology and used decision tree, Artificial Intelligence, regression analysis, cloud etc., to make product much more effective. It gives sustainable production with good weather forecasting system.

José Padarian *et al.* [9] discuss about status of soil. Soil is the main source of agriculture and this paper reviews about status of soil how soil efficiency can be known using trending technology Machine Learning with its methods and algorithms which mainly focus on 12 topics of agriculture with capability of non linear relationships and provides knowledge on outfit and understand and soil science. By knowing about soil and its usage the crops can be grown better according to its behavior. Eli-Chukwu *et al.* [10] focussed on limitations and advantages of application utilizing fewer resources and yielding gaining more profit. This skilled system has trained with accurate time response such that time efficiency is more. Dataset is used with Artificial Intelligence, Machine Learning and internet which reduces the risk, restriction usage and can remote access in rural areas. Since big data is used it has expensive expandable data storage which helps to work the system easier. Khoa TA *et al.* [11] proposed geography of sensor hubs dependent on the utilization of cheap and profoundly productive parts, for example, water level, soil dampness, temperature, mugginess, and downpour sensors. Moreover, to ensure great execution of the framework, the pre-owned transmission module depends on LoRa LPWAN innovation. The plan of the principle circuit leading group of the framework is improved by consolidating two layers and carrying out programming streamlining. It is more affordable than different arrangements with a comparable precision. The framework can continuously notice the deliberate qualities and convey them to clients through an organization and mobile application. Besides, the framework can send alerts to clients and actuate decrease gadgets.

R. G. Alves et al [12] discussed about the consequences while watering crops and soil perfectness. To overcome this digital environment cyber-physical-system is generated to control watering and soil absorption monitoring operation with digital twin. The main platform for farm water management was internet of things. This enables farmers to settle on better choices and to diminish the environmental effect in water, land and soil assets. A thorough review of the literature revealed that various innovations are happening in the field of agriculture by applications of Artificial Intelligence and Machine Learning. Numerous studies are carried out in this field to make farming easy with the help of latest technologies. The noted limitations in the use of technology are that the end users are not aware of the technologies and even if they are aware they are not ready to migrate to the new innovations from the traditional model of farming [13] [14] [15].

CONCLUSION

By 2050 worldwide population may reach more than nine billions which mean a seventy percentage expansion in agricultural production is required to meet the demand. Just about ten percentage of this increased production may come from unused terrains and the rest ought to be satisfied by current production intensification. In this specific circumstance, the utilization of most recent technological innovations is very much essential. Most of the farmers still not implemented these technologies in their farm, so that it should be accessed by everyone such that it reduces the risk and provides good quality of yield production which benefits both business man and farmer. The reviewed literatures suggest that with applications of Artificial Intelligence and Machine learning the agriculture can be digitized. Technological advances like machine learning framework implemented on Artificial Intelligence, block

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chain, decision algorithm, etc. which is real time working model with updated versions can enhance future works and can generate a machine which can help the farmer and the businessman to communicate with each other.

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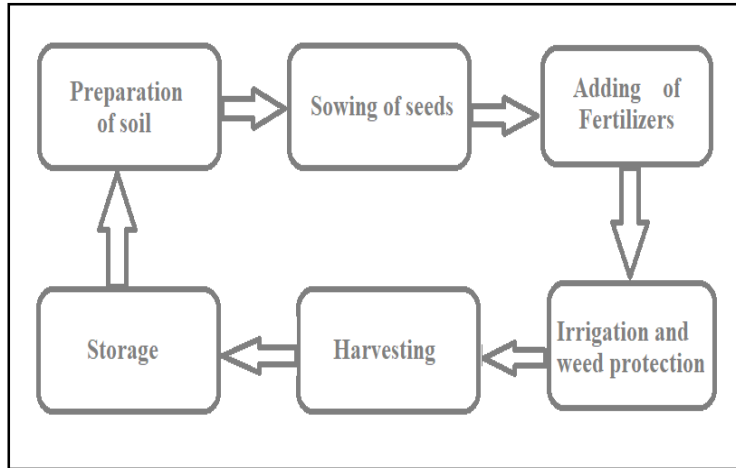
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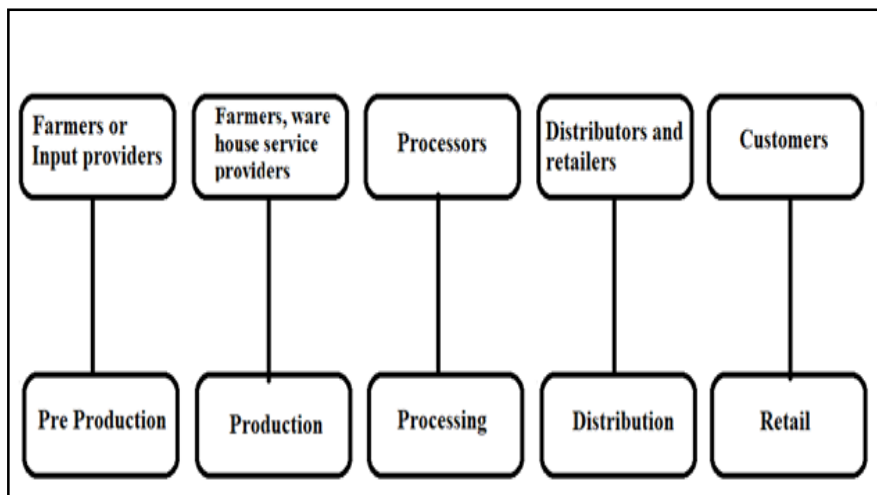
Figure 2. Agriculture Supply Chain

Figure 3. Machine Learning Process

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RESEARCH ARTICLE
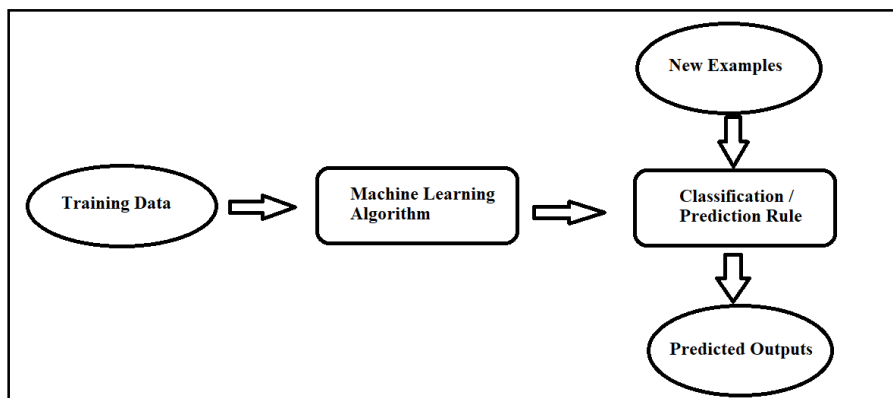
Adaptability to Virtual Learning Due To Onset of Pandemic COVID 19 – A Survey among Students

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ABSTRACT

The unprecedented COVID-19 has made all institution to think differently and come out with viable and rational teaching and learning practices through where its main stake holders i.e. students are taken care of with respect to curricular and co-curricular activities for their holistic development. Compelled need raised under special circumstances has drifted teachers from regular classrooms to online. The goal of this paper is to gather information on how well the student are able to adapt to new and sudden shift in their academics due to COVID-19 pandemic, study effectiveness of online teaching and student's ability to understand and identify difficulties encountered.

Keywords: Virtual learning, Pandemic, Viable, Holistic, Handiness, Google form

INTRODUCTION

The outbreak of Covid-19 pandemic has become a global health issue and played a major impact on many industries including field of education. Teachers and student community who never presumed teaching beyond conventional class rooms have currently glided to digital learning halfway through the academic year 2019-2020. Complete learning procedure is now implemented through various online approaches. This paper we aimed to collect information and assess the students outlook on virtual learning and their adaptability. A survey was done amongst various students group through google forms consisting of fifteen questions. The data was collected by sharing the online survey form through class what'sapp groups.

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A total of 443 responses were received. The pie chart illustrates the percentage of male and female responded to the survey. There were 53 percent of male responders and 47 percent of female responders, pursuing different courses of which majority of them were undergraduates(80%) and 18 percent of them pursuing post graduation and remaining are plus two students and high school students (fig2). The majority of the students were of the age group 20 to 25 years with 59 percent, 39 percent of them belong to 16-20 years, and 2 percent of them belong to the age group 10-15 years. Due to appearance of pandemic as most of the schools, colleges and universities are connected online to complete the syllabus those students who do not have laptops, made use of smart phones to connect to the classes. From the responses received   84 percent of them are using smart phones and16 percent using laptops (fig3).

Most of them prefer using smart phones as they are portable and can access the internet outside their homes. As digital learning is going on now 60 percent of them are learning both the theoretical and practical subjects, remaining 35 percent for theoretical and 5 percent for practical subjects. According to the survey the number of learning hours have reduced in majority, almost 52 percent are learning for 2 to 4 hours, 33 percent of them are learning for less than 2 hours and 15percent for more than four hours. The learning hours without this digital learning was for more than 5to 6 hours. Although there is accessibility to various applications and platforms for everyone on smart phones and laptops the most popular ones used for online classes are Google Class room, Microsoft Teams and Zoom Meetings. Digital classes have proven to be more effective and has many advantages (fig 4) . Survey shows that 54.4% of students found digital learning more resourceful as they can learn at their own pace, re-read concepts multiple times .Availability of learning materials in multimedia formats and ease of accessibility of study contents has made learning fun and understand concepts thoroughly also changed the students perception about subject.

As digital learning now has become a part of student life, students still long for offline class learning and interactions with peers. When students were asked to choose , majority of them showed their disliking for virtual learning and rather opted for offline classes. As depicted in chart below (Fig. 5), 37 percent of them says full time digital learning is not possible, 35 percent of them agreed that it is accessibility in cities is much easier which is true because not all rural areas have connectivity to the internet and 27 percent of them agreed that fulltime digital learning is possible.

Since the pandemic has confined every individual to home premises and disrupted the normal life style of people across the globe, the virtual world has come to rescue. It also plays a key factor in students' life helping them connect to their academics and strive a balance between student/personal life while majority about 46 percent of them could not decide, 21 percent of them feel virtual learning does not alter much of their personal life (fig6). All of this raises a question about how effective this online classes are to the learning, 43 percent of them say its neutral, 29 percent of them say it's not at all effective and remaining 27 percent agree that it is effective (fig7).

Despite of all the advantages of digital learning, there are external factors that poses a challenge to digital learning, our survey showed that about 70 percent of the students didn't have backup facility in case of power outage (fig8). Apart from   the above factor, even poor network connection (94 percent) and the limited data packs for smart phones hinder students from attending online classes.

CONCLUSION

In conclusion, Covid-19 as a pandemic has posed a contemporary threat to humanity. This pandemic has successfully forced global shutdown of several activities, including educational activities, and this has resulted in online learning serving as the educational platform. The survey was carried out to understand the how students were able to adjust to the new change in their academics .With the data collected it is evident that online learning is different from physical teaching, and students and teaching fraternity are captivating to online learning speedily. However ,in a country like ours where people value traditional education more , there is an ambiguity if digital learning will be believed. Virtual education will be more sustainable provided the challenges experienced during this pandemic are well exposed and transformed to opportunities.

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Fig. 1.Gender responses

Fig. 2.Course pursuing currently

Fig. 3. Digital device used to connect

Fig. 4. Digital learning advantages

Fig. 5. Implementation of digital learning to full extent

Fig. 6. Acceptance of online learning by students

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Fig. 7. Effectiveness of learning online
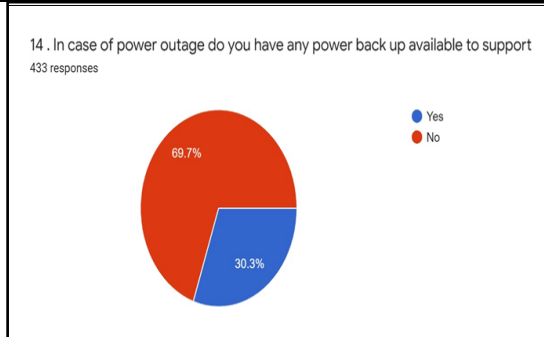
Fig. 8. Backup support responses

RESEARCH ARTICLE

Machine Learning Approach for Retinopathy Detection using Retinal Images

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ABSTRACT

In recent days, retinal diseases are gradually increasing and results in blurred vision, side vision defects and in bad situation people may lost their vision. From the literature, it is noticed that macular degeneration, diabetic eye disease and Glaucoma are termed as important aspect and discussed. With that motivation, this research focused on Glaucoma diseases and its detection. Glaucoma segmentation is critically significant for medical research and diagnosis. The conventional research has focused mainly on developing the retinal image segmentation process and detection. Since, there are various other possibilities are there to merge previous algorithms to form best hybrid segmentation process. Likewise, the research focused on improving the average correlation, average F-score and reduce the average boundary distance of the segmentation process. For achieving such objectives, the adaptively regularized Kernel is considered for maintaining the robustness and maintains the image quality. This research aims at developing a computer based diagnosis technique to assist ophthalmologists in diabetic retinopathy screening programs. Thus the principal research work demonstrated in this proposed system acts as a pre-screening system to assist ophthalmologists in diabetic retinopathy screening programs, for the early detection and diagnosis of diabetic retinopathy

Keywords: Indian Diabetic Retinopathy Image Dataset, lesion segmentation, Threshold value of the image Component

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INTRODUCTION

Medical image processing has become an imperative domain in current medical research for the diagnosis, treatment and care of various diseases. Nowadays data mining can be used as a learning tool in healthcare in detecting fraud and abuse. It can be used to make better customer relationship management decision and enable the hospital personnel to provide better and affordable healthcare services [1]. On the treatment side, it enables physicians to identify quality courses of procedure. Medical applications where data mining algorithms are commonly used are data modelling for healthcare applications. Handling heterogeneous data has been attempted in data medical filed. Managing metadata for integration of data from multiple sources has proved to provide richer information content for the data mining algorithms. Conceptual data model has been used earlier for the above purpose and demonstrated certain drawbacks. Here, the schema of the data was enclosed in a wrapper model and the productivity was found to be limited [2].

Blood vessels detection techniques are also discussed for the diagnosis of proliferative diabetic retinopathy. In human eye, retina is the interior surface and it act like a film of eye. Through optic nerve the light rays are converted into electrical signals which present to the brain. The eye and brain is connected by optic nerve. In retinal image, the optic disc is the brightest part or region. The blood vessels enter the eye where the optic nerve leaves and spot into the retina. Retina has many layers; the supply of blood to all the layers is made by the small blood vessels. This will result in the increase of uncontrolled level of sugar in blood. So that, more quantity of glucose or fructose will be accumulated in the blood. By this accumulation, the blood vessels get damaged due to the inadequate delivery of oxygen levels to the cells. If any blocks present in the vessels, it causes rigorous injury to eye. Finally, the rate in metabolic system will be reduced which leads to the physical irregularity in blood vessels that intern. The issues arising from using medical retinal data for data mining purposes are two-fold. One is heterogeneity of database during data integration and the other that has far-reaching consequences is legal, ethical and social issues[3].

The other category of legal and ethical issues arising out of using medical database has been studied in [4] Indian doctors while using medical data have their retrospective studies reviewed before publishing and carrying out experiments consequently. This research describes a computer based automated system, which assists in the diagnosis of DR by segmenting the retinal blood vessels and detecting the presence of exudates in retinal images [5]. During this research, the following specific objectives are established for the development of an automated screening system used for the early diagnosis of DR. The first and foremost objective is to develop an algorithm to detect and segment the blood vessels, which is the major retinal anatomical feature in retinal images. The locations of these blood vessels provide an outline of reference to establish the relative spatial positions of the lesions present in the retinal images. Evaluate these algorithms in the context of diabetic retinopathy screening. Ultimately an absolute algorithm to diagnose diabetic retinopathy from the lesions detected in retinal images of DR patients was developed. A pattern recognition technique called medical image classification is used to categorize different images into several groups based on their similarity measures. One of the important applications of medical image processing is the severity analysis of diabetic eyes using retinal images. The organization of the paper is described as follows: Section 2 analyse various merits and demerits of literature and considered its future suggestions for advancement of such methodologies. The proposed concepts and its problems are coined out under section 3. Some result and discussion for proposed system analysed in all the methodologies are verified with the MATLAB tool and tabulated under chapter 4 Finally, the segmentation and its outcome are summarized in section5.

LITERATURE REVIEW

Medical diagnosis by learning patterns through the collected database of diabetes, hepatitis and glaucoma diseases has been explored. Medical support intelligent decision support system had also been explored. The most important

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risk factors based on the classification rules to be extracted were identified. The integration of data mining and decision support system had been undertaken. This integration was found to significantly improve earlier approaches and paved the way for creation of new approaches to problem solving, by the enablement of fusion of knowledge from experts and knowledge extracted from data [8]. Nath and Dandapat (2012) mentioned that primary hazard components of glaucoma are hoisted IOP applied by watery diversion, family history of glaucoma (genetic), astigmatism or partial blindness, glaucoma in the other eye, retinal separation, injury to the eye, diabetes, pigmentary scattering disorder, slender points, low fundamental circulatory strain, headache migraines or visual headaches, raynaud's disorder, blood thickening, irregular visual field tests.

Thulasiraj *et al.,* (2003) stated that glaucoma effects on aged 40 years or older people as per the survey around Tamil Nadu, southern part of India. They conducted the survey based on the aravind Comprehensive Eye camp around rural population in the state. India is the second most populated nation among the world. The effect of visual failure and visual deficiency from glaucoma is in all likelihood expensive. In spite of its general wellbeing essentialness, there has been constrained information accessible on the pervasiveness of glaucoma and conceivable hazard factors for glaucoma in India. Past populace based investigations from India have announced the predominance of glaucoma in urban populaces. There has been no investigating on the pervasiveness of glaucoma in provincial populaces from India. Also, in these earlier examinations, perimetry was restricted to the individuals who satisfied certain conditions like IOP or optic plate measuring [12]. Taylor and Keeffe (2001), portrayed diabetic retinopathy as an endless disease, caused by inconveniences of diabetes mellitus and establish the essential driver of visual impairment among individuals of working age in created nations. As diabetic retinopathy is difficult sickness, Jain et al (2003) recommended that laser photocoagulation can forestall significant vision misfortune if identified in beginning times. As doctor-patients can't manifestations until their visual misfortune creates, diabetic patients require a yearly eye-fundus examination [13].

Khaing, T. T., & Aimmanee, P(2017)brought up early recognition and consequent treatment is fundamental to anticipate visual harm. With the new advances in advanced modalities for retinal imaging, there is a dynamic need of picture handling instruments that give quick and solid division of retinal anatomical structures. The complex and heterogeneous nature of medical data makes it difficult to extract useful information from the data stores. An retinopathy-based method has been employed using the concepts of semantic web to enable interoperability between data stores of different hospitals. These data stores may be heterogeneous in nature. The data is annotated using Resource Description Framework and Extensible Markup Language and elevated to the ontology level where this becomes the domain knowledge with respect to the hospital data store (Singh *et al.,* 2015), ACM based on different feature values (Khaing and Aimmanee, 2017),adaptive threshold based algorithm (Issac*et al.,* 2015), ACT for algorithmic detection for glaucoma (Kumar *et al.,* 2012) etc.,.

System Design

Diabetic Retinopathy is commonly known diabetic eye disease which leads to blindness. This causes damages to the blood vessels in the retina and can be a source of losing the vision. A careful distillation of the training samples into a reduced set of super samples such that the prominent information in the data is contained in the reduced set, can help to improve the classification accuracy at the same time reducing the time needed for the classification. It aids in the improvement of image quality and enables easy observation of retina by enhancing the interpretability of the fundus image. Non-uniformly illuminated or contain some artifacts or external noise. Hence, several techniques are developed for retinal image quality assessment and enhancement. Similarly, few others devised techniques for noise identification and removal. Such, retinal image enhancement and noise removal techniques can act as an aid retinal images. The first part addresses the segmentation of Blood vessels, which is one of the critical diagnostic features and the second part proposes a system to detect exudates from retinal images, which helps in the diagnosis and follow-up of diabetic retinopathy. To detect DR automatically from digital fundus images, many techniques are implemented recently. Digital images pose a considerable responsibility in The classification of DR by manipulating variety of colour spaces in segmented area. The disease is found with the help of fundus pictures identified in the DR

lesions. Proposed Diabetic Retinopathy detection multilayer perceptron neural network (ANN) is implemented. After detection of disease, the same classifiers are used to classify the disease types. Image classification refers to extracting information classes from a segmented image. For example, does it contain a disease or not. The result from image classification can be used to create confusion matrix. The present study is conceived with automatic Diabetic Retinopathy detection technique from fundus images. In addition, it is also smoothen the detection technique to avoid complexity and confirm a higher accuracy. Even with the increasing number of images, the proposed Automated Detection of Diabetic Retinopathy (ADDR) from digital fundus images confirms higher accuracy and provides with an efficient detection at a higher level of sensitivity. The simulation is carried out with MATLAB Band existing automatic detection of Diabetic Retinopathy on fundus images so as to evaluate the comparative performance in terms of sensitivity, specificity disease diagnosis rate, segmentation accuracy ratio with false positive per image, number of testing images and number of digital fundus images. The proposed scheme is said to achieve a high level of accuracy rate and sensitivity.

RESULT AND DISCUSSION

The examination of proposed system is tested with MATLAB simulation environment and compared some other existing methodologies. Retinopathy glaucoma Images for Segmentation Database consists of optic nerve retinal images dedicated to the research. The input samples are represented in the figure 2. Initially, the input image is processed with median filter based the super pixel generation and identify the Glare area which is not visible in the framed pixel is analysed. It is important to detect the glare image because there are relatively constant aspects of digital cameras. The traditional methods to glare detection are generally relying on one or two simplistic image properties. Instead of adaptive and threshold concepts are combined with the features. It is displayed. Then, the Red Green Blue(RGB) histogram features are reviewed here to find the concentration of Signal to noise and detect the complexity of visualization. Adaptively Regularized Kernel adapts k-means segmentation red channel based output shown in the figure 4 and 5 shows the proposed system blob detection using K-means.

An approach to detect the diabetic retinopathy disease based on multilayer perceptron neural network (ANN) data mining and network analysis was proposed. The figure 6 shows the top k features and accuracy values. Proposed system 13 GLCM features used and test features values change over demonstrated in the figure, and train data separated 20% of total data and compared to the test accuracy. Proposed test dataset almost 82% satisfied to the last sequence of train dataset. The modern mydriatic fundus camera is used for scanning the retinal images. The automated methods described in this, have been prospectively validated on the databases of retinal images with variable contrast and quality in order to evaluate its aptness for clinical environment. To analyze the performance of the proposed Bags of Visual Words based ANN classifier with that of Multiclass ANN classifier and hybrid kernel based ANN classifier. The overall exploration has been revealed with outstanding results and it is proved that the entire system is well suited to detect exudates and can assist the ophthalmologists in their daily medical practice. Performance measures are carried out, using a tested on series of digital fundus images to evaluate the metrics, such as sensitivity, specificity, segmentation accuracy ratio, disease diagnosis rate, etc. The techniques demonstrated in this were the relevant knowledge gained during the progress of this research work signifies a major step forward towards the objective of automated screening. Eventually, this results in the earlier diagnosis of diabetic retinopathy and deterrence of blindness.

CONCLUSION

It is critical to maintain healthcare records properly and the interest towards the data capture, storage, preparation and mining should be improved. Sharing data across organizations and standardization of clinical vocabulary will benefit the healthcare data mining process. In this proposed research work, we have explored and developed novel computerised techniques to segment the retinal blood vessels and detect the presence of exudates in retinal images

automatically, which serve as a clinical aid for the diagnosis of DR in mass screening programs. This method has proved itself to be efficient for image segmentation and classification by identifying the blood vessels and detecting the exudates in retinal images. Since, emphasis on public health is given high priority, the need for prognosis and diagnosis of infectious diseases becomes important. In spite of the growing popularity of many other data mining algorithms, the interest in proposed is mainly due its simplicity. This simplicity comes at the cost of certain drawbacks. More specifically, proposed belongs to the category of instance-based or lazy learning where generalization is deferred until the actual testing. In other words, the training data does not take part in the generalization process and the function approximation is done only locally. As a result, the algorithm is highly dependent on the local structure of the data and also not robust to noise and outliers. The future scope is the development of research software applications, which amalgamate various computer assisted retinal image analysis algorithms like vessel segmentation, image registration, detection of pathologies, vessel calibre measurement and crossover detection. The development of integrating all these individual tasks is the new research direction. In the future work, all these techniques can be combined together, to develop a software package, that accepts retinal colour fundus image as input and provide a set of numerical indices as output that describes the current status of the vessel morphology.

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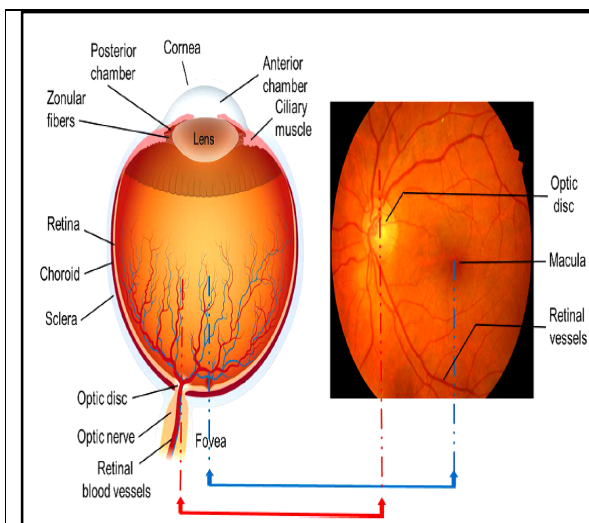
Figure 1. Anatomical structure of eye and color fundus image
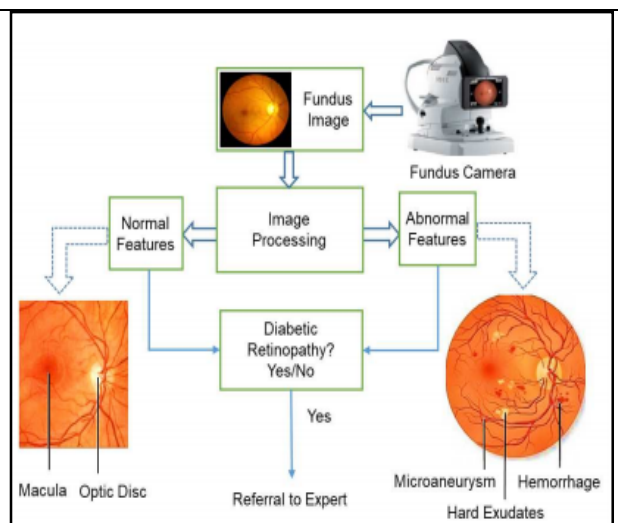
Figure 2. Proposed system retinopathy detection
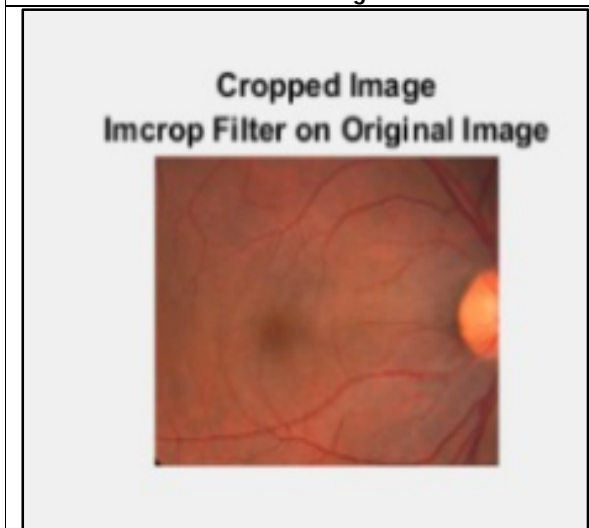
Figure 3. Input retinal image
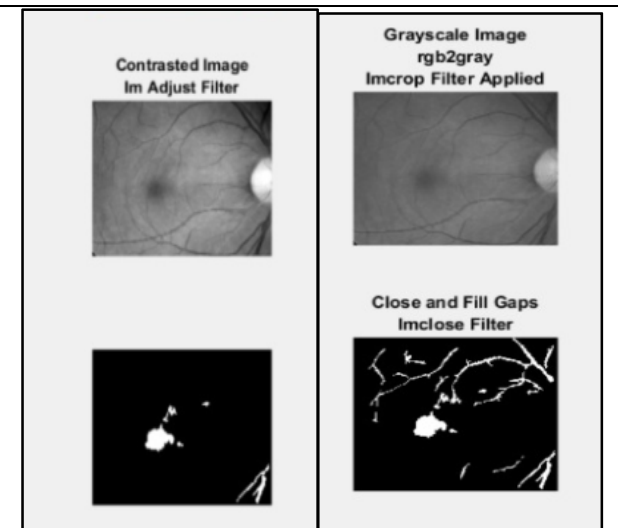
Figure 4. Pre-processing retinal image

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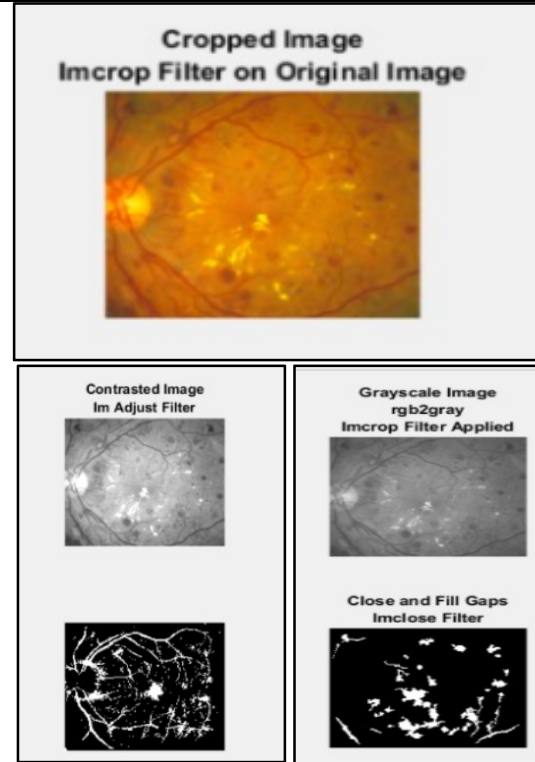
Figure 5. Defective Image retinal image processing
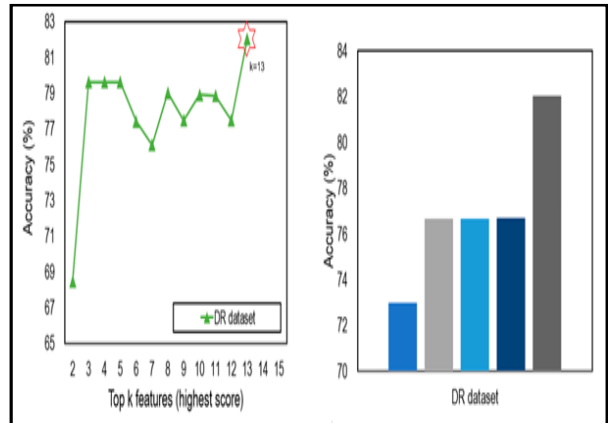
Figure 6. Accuracy calculations in blob counts

RESEARCH ARTICLE

Diagnosis of Diabetes Mellitus based on ABO-HELM Machine Learning Classifiers

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ABSTRACT

In modern technology, diagnosis of health is a very crucial task. Diabetes Mellitus is one among the seviour challenging disease in both developed and developing countries. In medical science diagnosis of disease data involves of a number of medical tests which are needed to diagnose a certain disease and the diagnosis depends on the surgeon experience, if a less experience surgeon can diagnose a problem incorrectly. So, a surgeon needs to analyze a lot of issues and factors which makes the surgeon's job difficult for diagnosing the disease. A medical diagnosis is a classification process. The machine learning and data mining techniques have been considered to design automatic diagnosis system, with the focus of reporting and predicting diabetes mellitus. In current research many techniques and procedures are employed to conquer the biomedical datasets for hidden information including Neural Networks, Decision Trees, Fuzzy Logic Systems, Naive Bayes, Support Vector Machine, Ensemble model, Extreme Learning Machine and Logical Regression. (ABO)- Hybrid Extreme Learning Machine (HELM) implemented in this work produces high accuracy than the above said methods.

Keywords: African Buffalo Optimization (ABO), Diabetes Mellitus (DM), Extreme Learning Machine (ELM), Machine Learning Algorithms, Optimization, Gray Wolf Optimization (GWO),Bat Analysis(BA)

INTRODUCTION

Diabetes is a common health issue in most of human indeveloped also in developing countries and its rate is growing [1]. The insulin hormone is not being produced or not properly insulin. The insulin hormone unlocks the body cell, allowing glucose to enter and fuel them. Diabetes intensifies the risks of circulatory systems, Nerve system and urinary system and it may cause cardiac problem [10]. In the year 2000 WHO – "World Health Organization" designated there were roughly 17,00,00,000 people with diabetes, and estimated that the number of cases of the disease will be more than doubled to 36,60,00,000in next two decades around the world. Medical health care systems contain waste set of information but the weak in knowledge that acquired from that. So, there is a compulsory need of having a techniques and tools to extract knowledge from the huge dataset so that medical diagnosis can be done very accurately [13]. The predictions that are used to find the knowledge from the large database are determined with the help of various techniques like Artificial Intelligence (AI), Machine Learning (ML), Statistics, Business Intelligence (BI) and Database System [11]. Many classification systems like Expert systems and ML techniques are gradually increasing for diabetes diagnosis problem. The accuracy of the techniques are also increasing gradually. ML techniques flattering computer-aided medical diagnosis should have good clarity. It has the shot of diagnostic familiarity and the description ability. ML technique with classification outperforms in the means of providing inexpensive prediction, or detection of firm conclusions in health care research.

LITERATURE REVIEW

A surveillance algorithm for diabetes to recognize diabetes. It also specifies type 1 versus type 2 diabetes via organized "Electronic Health Record" (EHR) data had applied [5]. EHR data could generously improve diabetes observation by encouraging nonstop assessment of extensive populaces. Type 1 and Type 2 diabetes within the population of patients hailed by the general diabetes algorithm. It starts an iterative procedure to recognize both the types. An approach joining Support Vector Machines (SVM) and Fuzzy modelling (SVM-Fuzzy) for better accuracy in risk classification in medicinal diagnosis and chronic illness administration and to examine preparing the machine learning algorithm utilizing test true information [2]. Diagnosis of diabetes mellitus (Type 2 diabetes) is the persuading issue for risk classification. The level of danger is group from the information using Fuzzy. SVM is utilized to plan the fuzzy rules. The tests from the model demonstrated that a generally small subset of dataset was adequate to prepare the machine learning algorithm [12]. A disperse end-to-end 3-level unavoidable healthcare system framework engineering had produced using Artificial Neural Network (ANN) computation. It is a novel approach for diagnosing diabetes by building up ANN framework [4]. The sensors and wearable gadgets are used to observing essential biological changes on human body. These sensors and gadgets are implemented in principal level. The client end gadgets, for example, PDAs and PCs play an arbiter. These are communicator parts between the primary level and the second level [2,3]. The last and third level has intense desktop servers for giving social insurance administrations and database operations to the clients.

African Buffalo Optimization
The optimization technique is utilized with the knowledge that will procedure each demand and allocate the resources and adjust the workload. African Buffalo Optimization (ABO) based workflow scheduling is chosen for recognizing the users in light of their advantage [7]. It is chosen for clustering due to its speed and efficiency. ABO was outlined essentially to give answers for issues of delay in getting arrangements, stagnation, the utilization of a few parameters and so forth in the current calculations like the Genetic Algorithm, Simulated Annealing, Ant Colony Optimization and Particle Swarm Optimization. The Africa Buffalo is Africa's only cow.. They are also referred as Buffalo, Cape buffalo,

The main animal that challenges to travel up against a lion with regards to one of their own in peril.By reacting to the misery/ready decision from a bison in threat or totally different wild oxen watching the rate. Due to the misery

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"waaa" calls, the crowd will aggregate together to guard another of their kind that is underneath assault from a predator [6]. Their well-known agreeable capacities are additionally featured by their selection conduct in basic leadership. It is trustworthy that the buffalos usually among themselves in taking decision regarding the decision of munching fields. In an investigation, it was found that their developments are controlled by the greater part choices. This they do by standing up and looking at a specific course in turns. At the purpose once the conventional course of look is contrasted and the ensuing development of the crowd, the normal deviation is just three degrees, which is well inside estimation blunder. On days in which cows vary pointedly toward them of look, the group tends to part and graze in freelance patches for the night.

ABO is an endeavour to use successful, proficient, easy to-execute procedure that will show extraordinary limit in the misuse and investigation of the inquiry space. It endeavours to tackle the difficulty of pre-mature merging or inactivity by guaranteeing that the area of each buffalo ox is frequently refreshed in connection to the specific buffalo best past area and the present area of the best buffalo in the crowd. In a circumstances, for instance, where the principal buffalo's location is not enhanced in a number of repetitions, the complete herd is re-initialized. It guarantees fast merging with its utilization of not very many parameters, fundamentally the erudition parameters. These parameters empower the development of the creatures towards more noteworthy abuse or investigation relying upon the concentration of the algorithm at a given iteration. In another occurrences, the same "waaa" vocalizations is used to call other buffalos and also make them to come to the aid of other animals in danger. Their democratic nature is their third, that borne out of extreme intelligence.the buffalos have a way of doing an election, in cases of opposing calls by members of the herd, where the majority decision determines the next line of action.

Working of ABO

The algorithm starts by preparing the populace of buffalos with the function f(x). The location allocation is random within the N-dimensional space for each buffalo. After allocating, it updates the buffalo's fitness separately within the search space [9]. The following two factors (bpmax) and (bpmax) vary based on the fitness value. If the fitness is better than the individual buffalo's maximum fitness (bpmax). In another case, it saves it as the herd's maximum (bgmax), if the fitness is better than the herd's overall maximum,. After completing all process, the algorithm m updating for the best buffalo. If it is updating, then it moves on to validate the stopping criteria. Finally, it gives the location vector as the solution to the given problem, if our global best fitness meets finishconditions. It is detected that the algorithm's procedure has three parts. Initially w.k represents the memory of the buffalos past location. The term m.krepresents "maaa" sound of buffalo k (k = 1,2,3….n) and the term w.k represents "waaa" sound. Mathematically, the democratic Equation (1) governs the drive of the buffalos. A list of resolution sepitomizes the memory of each buffalo. That capacity can be used as an substitute for the current local maximum location. Instead of the present herd's maximum point, choosing one of the target lists of solutions of the buffalo's memory is applied with probability.

$$m.k + 1 = m.k + Ip1(bgmax - w.k) + Ip2(bpmax - w.k) \qquad \text{Eqn (1)}$$

Equation (1) consists of three portions namely, the memory portion $(m.k + 1)$ is an warning that the creatures are attentive that they have relocated from their earlier locations $(m.k)$ to a new one. This is a warning of their widespread memory volume. That is a vibrant tool in their refugee lifestyle. The second portion represents the co-operative attributes of the animals $Ip1(bgmax - w.k)$. The buffalos are admirable communicators and are able to track the location of the best buffalo in each restatement. The last part of the equation $Ip2(bpmax - w.k)$ carries out the special cleverness of these animals. The ABO exploits the memory and efficient caring capabilities of the buffalos in arriving at solutions, basically, forces the buffalos to a new location following the outcome of Eqn. 1. The steps of ABOs are given below.
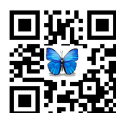
Step 1- Objective function $f(x)$ $x=(x_1, x_2, \ldots\ldots\ldots x_n)^T$

Step 2 - Initialize the randomly place buffalos to nodes at the solution space

Step 3- Update the buffalo's fitness values by Eq 6.1

Step 4 - Update the location of buffalo k in relation to $bpmax.k$ and

$bgmax.k$ using $m.k+1 = \lambda (w.k+m.k)$. Where '$\lambda$' is a unit of time

Step 5- Check$bgmax$ if it updating or not. If yes, go to Step-6 else, go to Step-2

Step 6 - If the stopping criteria is not met, go back to algorithm Step-3

Step 7- Output best solution.

Movement of the Buffalos

The travels of buffalos are measured with in solution space using two main equations. The Equation (1) represents the prototype for the movement of the animals. The "waaa" update (move on to explore, eqn. 2) provides for the real modification of the herd travel also gives the two challenging forces (waaa and maaacalls). The final outcome is a new position for the animals. The first equation has two major parameters, namely, the global maximum ($bgmax$) and the personal maximum ($bpmax$) positions are each working out, its impact over the animal's choices. The Figure 1 shows the flowchart for ABO.

$$\omega \cdot k+1 = \frac{\omega \cdot k + m \cdot k}{+5}$$

Eqn. (2)

The algorithm materializing the animal to explore the search space from the maximum vector (($bgmax.bpmax.k$) by subtracts the "waaa" element (w.k) and then multiplies this by the learning parameters ($Ip1$, $Ip2$) usually set to between 0.1 to 0.6.

Proposed Methodology for Predicting Diabetes Mellitus

The prediction of diabetes mellitus as diabetic and non-diabetic are evaluated by HELM with the integration of ABO. In the first stage, to update the existing spots of population in the discrete searching space and for better classification purpose the ABO was instigated. The operative and efficient ELM classifier is conducted in second stage based on the finest attribute subset obtained in the previous stage. ABO avoids coverage of early meeting until it finds the best solution by updating the position of the finest buffalo. After performing countable account of iterations, if the location of the best buffalo location is not improved then the entire herd is re-initialized[14]. ABO

promises fast mingling with the use of very few parameters. ELM works on shorter working out time and in compressed model size which is comparable to that of Support Vector Machine (SVM). The Pima Indian diabetes dataset is collected and used in HELM as dataset. The labelled dataset is and divided into training and training sets to train the HELM with overall test performance. The ELM model's classification has been established for the classification of diabetes dataset. At last stage the classifier result as diabetic and non- diabetic dataset is obtained with best solution. With the input layer and random weight, the training set is a straight forward technique. The output weight is computed by updating of fitness value.

EXPERIMENTAL RESULTS

The experimental results for proposed TELM are simulated by MATLAB Tool. It is important to conduct a set of experiments to set parameters and examine the effectiveness of our repository which is classified under two methods are ELM and ABO. The performance evaluation carried out using PIMA dataset. The performance metrics such as Accuracy, Precision, Recall, F-Measure and Execution Time are used to evaluate HELM.. The work used PIMA dataset and the result has been compared with other techniques such as K-NN, Artificial Neural Network, Bayesian Network, SVM, Extreme Learning Machine and Transudative Extreme Learning Machine (TELM). Table 1 shows the performance evaluation of HELM- ABO with various classifiers in terms of performance measuring metrics.

CONCLUSION

The section describes about the Hybrid Extreme Learning Machine (HELM) - African Buffalo Optimization for DM Diagnosis. Optimization techniques are used to search and classify the diabetic data and to give vibrant picture to find the feature that causes the diabetic. This prediction supports for early diagnosis of disease. Hybrid Extreme Learning Machine (HELM) is proposed for the determination of weight by integration with African Buffalo Optimization attempts to develop an algorithm in search of best output fitness in exploration of the search space. The proposed HELM shows better results when compared with traditional techniques with high classification accuracy and less execution time.

Future Work

Thus, there is need of machine learning classifiers for diabetes prediction. The early intervention can reduce the prevalence of diabetes. The traditional classifiers do not address the prediction of disease and have severe limitations. Future work is planned to build a new classifier and upgraded in terms of learningalgorithmssuchasusingGWOandBAwhicharefreshlysuggestedswarm-based meta-heuristic.

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Table 1: Performance Evaluation of Classifiers

Classifier	Accuracy (%)	Precision (%)	Recall (%)	F-Measure	Execution Time (Sec)
KNN	56	62	89.5	0.52	54
ANN	72	69.3	85.6	0.62	53
Bayesian N/W	76	74	84.2	0.75	52
SVM	81.8	85	81.5	0.84	49
ELM	85.7	89	78.6	0.89	43
ABO	87.5	90.6	76.8	0.92	41
TELM	93.4	91.5	75.2	0.91	36

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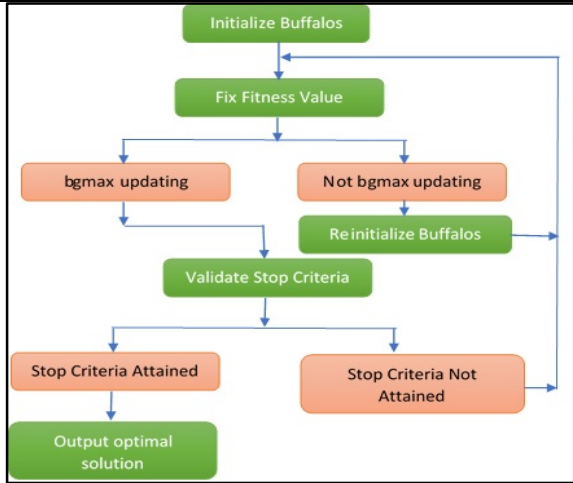
Fig. 1: African Buffalo Optimization Flow
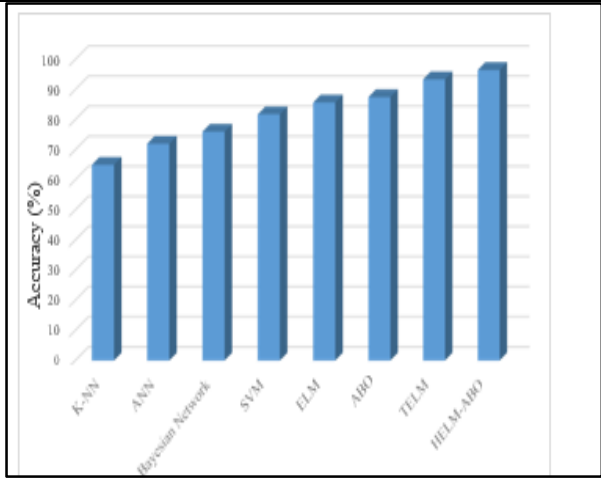
Fig. 2. Accuracy measure and Comparison of HELM
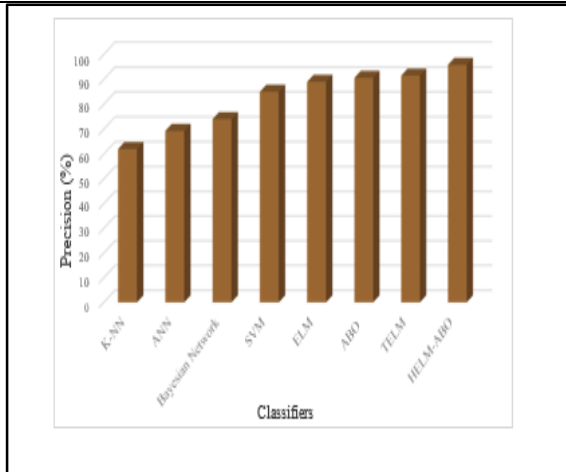
Fig. 3. Precision Evaluation and Comparision of HELM
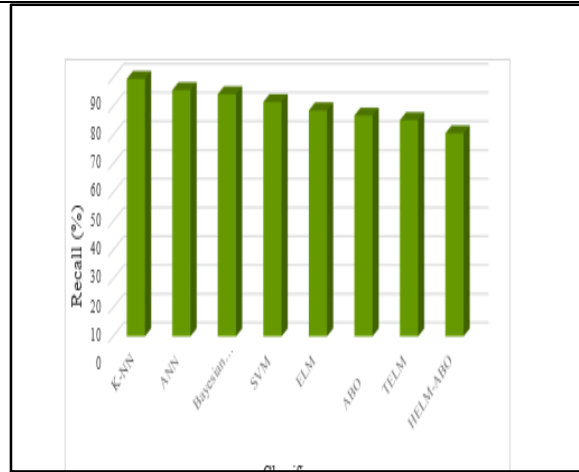
Fig. 4. Recall Evaluation Comparison of HELM

REVIEW ARTICLE

Review on Advanced Image Compression Techniques: CS Image Compression

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ABSTRACT

An image compression technique has been extremely important which can be used to reduce the size with improved quality. The increasing demand of effective quality compressed images and saving and sharing it, grabbed the attention of researcher toward many compression methods. The improvement and advancement of technology is also widely useful for the medical imaging purpose. The usage of image compression techniques in the field of medical diagnosis field help to increase the quality of medical images as well as solve the issue of storage in hospital database. In this paper we are specifically comparing the Candes and Donoho methods which introduces a new compression technique to overcome the limitations of Shannon-Nyquist Sampling. This paper is presenting a survey on different hybrid image compression techniques, which can be used for medical purpose. The newly defined compression technique is called as "compression sensing or sampling (CS)" theory which is equally used and applicable for digital images. It states that the image can successfully recover from its few sparse data.

Keywords: Image Compression, Shannon-Nyquist Sampling, Sparse Data, Compression Sampling (CS)

INTRODUCTION

A data compression technique is grabbed an attention of researcher in the present scenario to solve the data storage issue. The compression methods generally affect the effectiveness and quality of data which can be used for specific

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applications. But the compression technique should not compromise with the quality of data or loss of data. Therefore, the data compression method used can be totally depends on the quality of input data or used applications [1, 2]. The data compression techniques can be applied for motion picture, steady images, sound signals and text data [3, 4]. The compression method is also used to reduce the repetition and losses of data. Coding redundancy, interpixel redundancy and psychovisual redundancy are three major kinds of redundancy in image compression techniques [5, 6]. In similar way of data compression technique, image compression technique is an important method which is used by researcher working on digital image processing. The image compression technique is mainly used to reduce the size of image with fulfilling the purpose of easy data transfer, data safety and data backup process [7]. Data compression, data transfer and data safety process are interlinked with each other. The primary requirement of image compression is signal acquisition which can be done by sampling-based techniques. After the signal acquisition process the image can be reconstructed from sparse measurement by using different optimization mechanisms on the basis of images and applications. In present world its is very common and frequently used to compress the picture, so a new image can have features which can fulfill the criteria. This paper is concentrating on comparing on different image compression techniques which can mainly use for medical imaging system.

In year 2005, researcher started exploring the possibility and introduced compression techniques for medical images [8, 9]. In this techniques researcher mainly focused on the chain codes with respect to every pixel and encoded it. The main focus of this article to define the conventional image compression technique and to introduce the newly defined mathematical models which overcome the limitations of conventional method. In the conventional image compression method, which was well known as Shannon-Nyquist sampling method, the most of the transformation takes places by ignoring many transform coefficients. The basic criteria to recover or compress image by using Shannon-Nyquist sampling techniques, is it requires the coefficient transformation size should be double of more than the actual pixels of images. This criterion became the limitation for compressing many images. Therefore, Candes and Donoho approached and worked on new mathematical theory called "compression sensing or sampling (CS)" [10-12]. This new compression techniques used a minimal sparse data to successful recover or compress the image. The image should have sparse to its own domain which is a necessary criterion for CS theory. This theory can simultaneously compress the image which is having multiple matrixes of measurement such as gaussian, binary or Fourier function. The details of CS theory-based image compression method are shown in Fig.1 [13].

METHODOLOGY

Image Compression using CS Theory

The CS image compression or acquisition techniques mainly used to convert the image into the compressed image by using sparse measurement coefficient matrix. CS theory is known as unique sampling/sensing pattern which opposes the general wisdom of data acquisition. CS theory consider and work on two important principles [14]:

Sparsity: this concern about the interested signal and incoherence with respect to sensing modality. The sparsity also expresses the concept of "information rate" of a time dependent continuous signal. The obtained signal might be smaller than expected in view of bandwidth. The CS theory utilizes maximum possible naturally occurred signals which are sparse or compressible when appeared in basis form.

Incoherence: this expresses the relation between frequency and time and exploits the concept that the signal having sparse representation may also spread through put the domain at which it acquired. There is important observation regarding CS theory is that, anyone can design an effective sampling or sensing algorithms which can capture the information which embedded with condensed and sparse signal into compressed form. The most exceptional thing about theses theory is that, it allows sensors to capture all the signals and information very effectively without comprehend the signals. Overall CS theory is an important, very simple, easily applicable, efficient and effective

signal acquisition protocol [15, 16].One of the attractiveness of CS theory it attracts the multidiscipline within the applied mathematics.

The CS image acquisition process has the compressed sparse measurements of the image also called as compressed image follows following steps [13]:

Image can be converted by using basis matrix of image transformation into sparse coefficient given by:

$$\chi_{N \times N} = \Psi_{N \times N} \cdot f_{N \times N} \cdot \Psi_{N \times N} \quad \text{(Eq.1)}$$

Where, χ is sparse coefficients of the image, f is the original image, Ψ is the transform basis matrix.

The measurement matrix $A_{M \times N}$ is generated to decide the compression factor of the image.

The sparse measurements of the image are generated by multiplying sparse coefficient with measurement matrix A.

$$CS_{M \times N} = A_{M \times N} \times \chi_{N \times N} \quad \text{(Eq. 2)}$$

Where CS is the compressed sparse measurement.

In CS theory the process of compression and reconstruction includes the measurement of sparse coefficient as an input information. This process uses CS recovery measurement matrix and algorithm to perform the compression and reconstruction process which are based on optimization and properties of linear algebra [17, 18]. The restricted isometric property (RIP) is a necessary condition to get satisfied for reconstruction of images using sparse measurement. The measurement matrix which is an important criteria of CS theory, should be random, easy to generate and symmetric in nature. CS theory mainly use DCT, DFT, SVD and DWT methods for compression methods due to presence of sparse property. In present scenario researcher started working and implementing the CS theory for medical data compression. In year 2012, Mishra *et al.,* advanced and suggested wavelet transformation and CS theory to compress the ECG signals [19]. In similar way, Sevak *et al.,* proposed a related technique which used for the compression of MRI and CT scan images [20].

CS Theory Applied for Medical Image Compression by Using Discrete Fourier Transform (DFT)

The image compression technique used in the field of medical is most useful and feasible in present scenario. The basic design of medical image compression technique done by using DFT and CS theory is shown in Fig.2. [13].

In discrete Cosine Transform a signal is expressed as cosine functions with finite intervals. It is used in most digital media, similar to DFT, this technique maps the time domain signal into frequency domain. The following steps are applied for compression of medical images:

Step 1: Calculate the size of N x N uncompressed medical images. Then the multiplication of inverse basic matrix and Fourier basis matrix with the medical image to obtain the DFT coefficient.

$$\chi_F = \Psi_F \cdot f \cdot \Psi_F \quad \text{(Eq. 3)}$$

Where the DFT coefficient of N x N medical images is represented by χ_F and Fourier basis matrix of size N x N represented by Ψ_F.

Step 2: By using zero mean and variance value is equal to 1, the Gaussian matrix can be generated. The matrix size will decide the size of compressed images which will be achieved using this technique.

Step3: The generated compressed medical images (CS) using gaussian matrix and DFT coefficients can be given as:

$$CS = A \times \chi_F \quad \text{(Eq. 4)}$$

χ_F represents compressed DFT coefficient of the N x N size medical image.

Step 4: After completing the process of compressed sparse, the DFT coefficient of the medical images χ_F^* can be compressed by using orthogonal matching pursuit (OMP) algorithm which is a type of CS recovery algorithm.

$$\chi_F^* = OMP(CS, A) \quad \text{(Eq. 5)}$$

Step 5: Finally, to compress and reconstruct the medical images, the compressed DFT coefficient should be multiply with inverse of basis Fourier matrix and original basis matrix.

Researches have applied many different algorithms for compression and reconstruction of medical images. Fig. 3 shows certain examples of original and reconstructed images performed by Paul Nii et al in 2019 [21].

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CS Theory Applied for Medical Image Compression by Using Discrete cosine Transform (DCT)

The images having a sum of different frequencies and magnitudes sinusoids are represented by discrete cosine transform (DCT). In DCT most of the information about an image can be obtained from very minimal coefficient of DCT [22]. Therefore, DCT method is most frequently used for compression of images. Taking a correlated image and focus on its energy during initial transform coefficient. DCT also provides the information of low frequency images which obtain at early coefficient and large frequency images represented by later coefficient [23].

According to Rohit M. *et al.,* 2019, there following algorithm steps can be followed for CS theory applied for medical image compression by using discrete cosine transform (DCT) [13].

Step 1: Calculate the size of N x N uncompressed medical images. Then the multiplication of inverse basic matrix and cosine basis matrix with the medical image to obtain the DCT coefficient.

$$\chi_C = \Psi_C \cdot f \cdot \Psi_C \qquad \text{(Eq. 6)}$$

Where the DCT coefficient of N x N medical images is represented by χ_C and Fourier basis matrix of size N x N represented by Ψ_C.

Step 2: By using zero mean and variance value is equal to 1, the Gaussian matrix can be generated. The matrix size will decide the size of compressed images which will be achieved using this technique.

Step 3: The generated compressed medical images (CS) using gaussian matrix and DCT coefficients can be given as:

$$CS = A \times \chi_C \qquad \text{(Eq. 7)}$$

χ_C represents compressed DCT coefficient of the N x N size medical image.

Step 4: After completing the process of compressed sparse, the DCT coefficient of the medical images χ_C^* can be compressed by using orthogonal matching pursuit (OMP) algorithm which is a type of CS recovery algorithm.

$$\chi_C^* = OMP(CS, A) \qquad \text{(Eq. 8)}$$

Step 5: Finally, to compress and reconstruct the medical images, the compressed DCT coefficient should be multiply with inverse of basis Fourier matrix and original basis matrix.

Fig. 4. Shows the significant performance of this technique over the medical images. The performance characteristics of this method indicates the lossy nature and compression ratio is almost constant for all the medical images [24].

CS Theory Applied for Medical Image Compression by Using Discrete Wavelet Transform (DWT)

Discrete Wavelet Transform (DWT) technique is also known as multi-resolution decomposition techniques which can be used for images and signal analysis. Multi-resolution analysis of images or signal used to perform by using low pass and high pass filters for wavelets and scaling function respectively. The following steps are applied for compression of medical images using DWT techniques:

Step 1: Calculate the size of N x N uncompressed medical images. Then the multiplication of inverse basic matrix and wavelet basis matrix with the medical image to obtain the DWT coefficient.

$$\chi_W = \Psi_W \cdot f \cdot \Psi_W \qquad \text{(Eq. 9)}$$

Where the DWT coefficient of N x N medical images is represented by χ_W and Fourier basis matrix of size N x N represented by Ψ_W.

Step 2: By using zero mean and variance value is equal to 1, the Gaussian matrix can be generated. The matrix size will decide the size of compressed images which will be achieved using this technique.

Step 3: The generated compressed medical images (CS) using gaussian matrix and DWT coefficients can be given as:

$$CS = A \times \chi_W \qquad \text{(Eq. 10)}$$

χ_W represents compressed DCT coefficient of the N x N size medical image.

Step 4: After completing the process of compressed sparse, the DWT coefficient of the medical images χ_W^* can be compressed by using orthogonal matching pursuit (OMP) algorithm which is a type of CS recovery algorithm.

$$\chi_W^* = OMP(CS, A) \qquad \text{(Eq. 11)}$$

Step 5: Finally, to compress and reconstruct the medical images, the compressed DWT coefficient should be multiplied with inverse of basis Fourier matrix and original basis matrix.

Fig. 5. shows the performance of the present discussed DWT technique applied on various medical images[13].

CONCLUSION

In upcoming years, the image compression techniques will be fascinated and vital field. Researchers introduced and worked on different compression techniques in these past years. This paper mainly consists the brief comparative studies and review of important compression techniques in view of quality estimation parameters. The CS based image compression techniques using DFT, DCT and DWT methods are major concentration in this present articles. These mathematical methods using CS techniques provides the high compression ratio of images. The objective of this review also mainly focuses towards the medical image compression. The compression technique in the field of medical is the requirement of the present and future generation. The medical image compression output obtained by using CS theory with different mathematical methods will help readers and researchers to understand the vector quantization approach and lesser bit compression methods. Overall results and studies show that the compression of medical images can be achieved in much better by using CS theory in comparison to conventional compression techniques.

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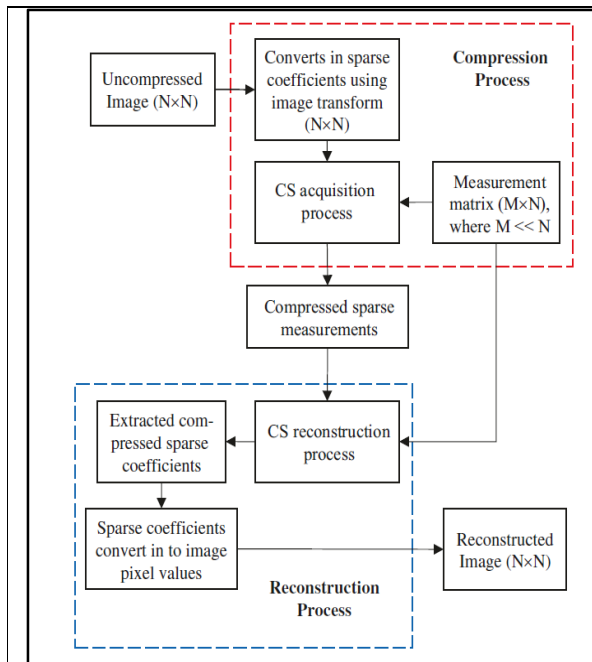
Fig.1. Details of CS theory-based image compression method [Ref: 13]
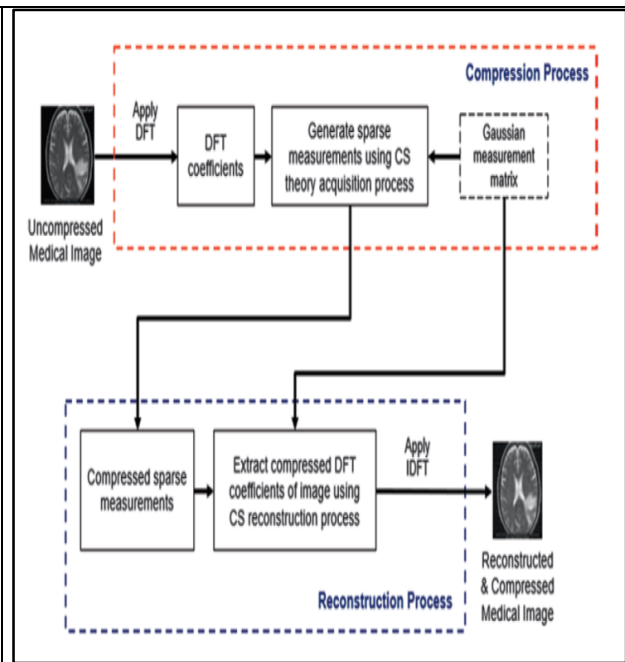
Fig. 2. Block diagram of medical image compression technique done by using DFT and CS theory[Ref: 13]

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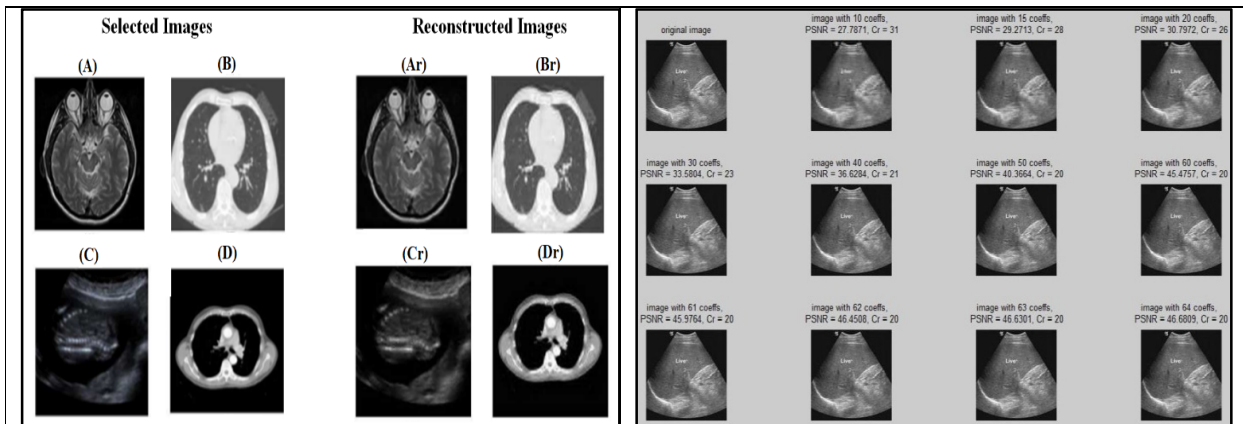
Fig. 3. Original medical images of (A) MRI brain, (B) Lung cancer diagnostic image, (C) Ultrasound festal spine and (D) CT chest scan. Ar, Br, Cr and Dr are Reconstructed medical images. [Ref: 21]

Fig. 4. Compressed medical images using DCT. [Ref: 24]
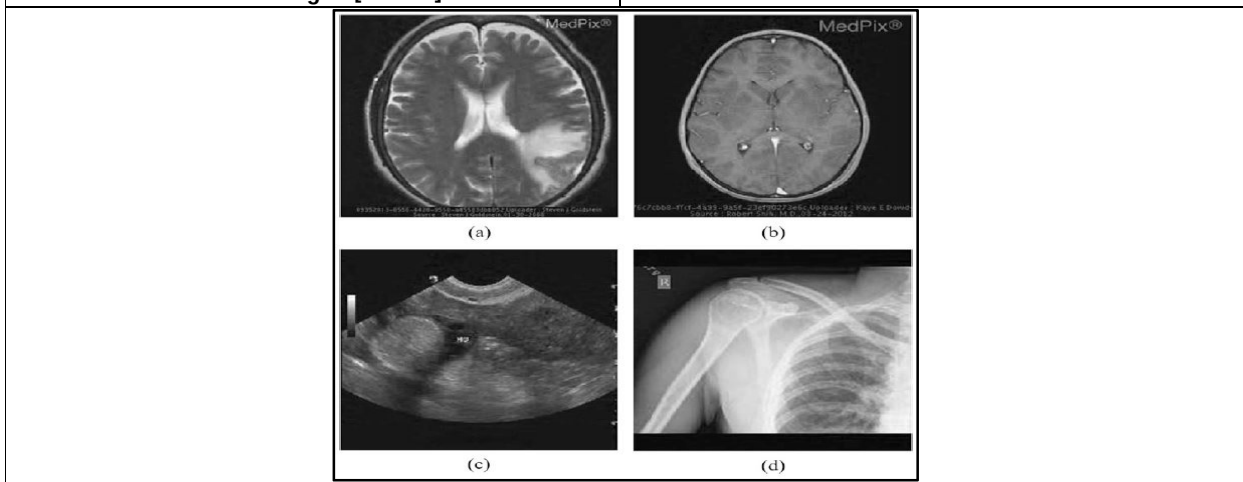
Fig. 5. CS-theory based medical images compressed by using DWT (a) CT scan of brain, (b) MRI of brain, (c) Ultrasound and (d) X-ray chest [Ref: 13].

RESEARCH ARTICLE

Cloud Computing and its Convergence with Mobile Computing and IoT applications

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ABSTRACT

In the web application enhancement the immersive area is cloud computing which gives multidisciplinary developments and convergence of many individual computing technologies like distributed computing, centralization, usage based payment mechanism, elasticity, virtualization, storage, security, data offloading and also services and tools to develop the Internet of Things packages. Cloud computing design consists of facilities like rapid scalability, self services based on demand, wide network access, measured service characteristics along with deployment model and standardized service like IaaS (Infrastructure as a service). With less managing efforts these facilities can be requested and released. This paper presents briefly on cloud computing and its convergence with mobile computing and IoT centric cloud infrastructure. The cloud computing, mobile computing and wireless networks makes Mobile Cloud Computing which gives powerful computable resources for mobile consumers, cloud suppliers, network controllers and from mobile cloud applications, the processing happens outside the mobile devices. The cloud computing with Internet of Things, wireless communication provides interaction and cooperation between things and objects and fulfills the objective set to them.

Keywords: On-demand self service, Elasticity, standardized service IaaS, Deployment models and MCC, IoT centric cloud platform

INTRODUCTION

The norms of cloud computing is highlighted on resources, information and software sharing through a web over a accessible network of points like client systems, hubs and utilities of web. Cloud computing, a software infrastructure which is application-based and data can be stored on remote serves a distant data center and internet

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is used for access. It refers to any kind of hosted service delivered over the internet that eliminates the need of nearby physical hardware [1]. Many organizations use cloud for electronic mail, package testing and development, data pools, disaster retrieve, analysis of big data, virtual desktops and end users web programs. The cloud computing abilities along with mobile device develop a new model for mobile computing called mobile cloud computing and it also helps in development of IoT cloud platforms. This study covers cloud computing concept and its integration with mobile computing and IoT infrastructure.

Cloud Computing: Characteristics, Models and Services

By cloud computing evolvement, resources can be accessed from the cloud at any instant as they are required. This resource setup can be expanded or compressed as requirement varies. They have capability to enhance for new areas and globally deploy with few minutes. It provides various capabilities to organizations and consumers to cache and operate their data in a storehouse of third-party through storage programs. The cloud computing model displayed in figure 1. Convenience access to a wide variety of ready-made packages helps in quicker innovations, building anything from service such as program, storage and data centres, to IoT, machine learning, data analytics, and many more perhaps be possible through cloud computing.

Characteristics

On Demand Self Service

By an internet-based self-service site consumers can unilaterally provision the resources of cloud computing without human interaction.

Broad Network Access

The heterogeneous clients like Smartphone, tablets, laptops and office computers can utilize the capabilities of cloud with a simple online access point.

Resource Pooling

Multiple consumers dynamically on demand can access the pooled resources of cloud suppliers that are maintained logically to avoid conflicts.

Rapid Elasticity

On request the processing resources can be setup and released, which helps the software packages to posses required powerful tools at any given time.

Measured Service

It supports for usage based payment working, resource utilization details are transparency for both users and cloud service contributors [2].

Deployment Models

Public Cloud

The infrastructures of this kind are available to general public, are owned and managed by service provider by hosting through internet. It is economy because costly physical hardware organization and maintenance are avoided for working.

Private Cloud

These types of infrastructure are dedicated to a particular organization and may be managed by it or by service provider to support various user groups. It provides high privacy and security which meets nowadays organizations requirements. They are costlier because it involved initial development and maintenance cost.

Community Cloud
Community cloud is multi-tenant setup which is made by using cloud among various organizations belonging to a particular area or community.

Hybrid Cloud
Hybrid clouds are collection of many unique cloud infrastructures like private, community, or public, these single entities are all interconnected through *technologies which, enables portability of data and application.* It offers multiple deployment models advantages [3].

Service Models- SPI Model
The design is splits into three layers to support the type of service they provide. There are three service models

PaaS
Using Platform-as-a-Service service, Custom applications may be developed simply by using programming languages, development middleware and APIs which is obtained to the subscribers, rather than installation or configuration of the development environment.

SaaS
The Software-as-a-Service service offers subscription or pay for use based access to packages or services to users which are in the cloud and not on the user's storage space.

IaaS
The Infrastructure-as-a-Service provides the infrastructures like network connectivity, VMware, OS, central hubs, storage & etc the services of which are provided on demand. The infrastructure of type "Public cloud" is taken as it provide self service resource sharing flexibility through the web [4].

Advantages and Disadvantages
Advantages and disadvantages are discussed in Table 1 [5].

Mobile Cloud Computing (MCC)
The Mobile cloud computing specifies new model where computation and information storage happens away from the mobile devices in a centralized computing platforms of cloud that can be accessed over the wireless devices like in Gmail, Google Maps and a few navigation apps. For mobile users, cloud computing providers and network operators offers several computational resources.

MCC Architecture As increasing demand and mobile application MCC give an integrated service of Mobile technology and cloud computing. In MCC architecture displayed in figure 2, using base transceiver station which setup and manages the connection, the mobile user and the network operators of mobile are connected to each other. BTS provides necessary interfaces for network and equipment. When Mobile device request, the central processors which in turn connected to servers receive the information. Based on data space of subscriber and home agent constraint, the billing, authorization and authentication service are formatted. Through ISP the Subscribers request are transmitted to cloud and request is processed by the cloud controller and the corresponding service is given to mobile user [6].

Mobile Cloud Computing Environment
Migrating the Load to Remote Server Mobile cloud computing means using a remote server running an application like Gmail for Mobile where, the client i.e. mobile device through the web connected to the remote server [7]. Same is indicated in figure 3.

Offloading to Local Cloudlet

Another approach is wherever the offloading of workload of mobile device to neighborhood 'cloudlet'. Cloudlet is computers cluster connected to the remote cloud data center. The Computers will be best applicant for cloudlet servers due to their diversity, less power utilization and design. This architecture includes normal computers which are smaller, not more powerful and not even expensive, therefore good for moderate data centers which are in the public cloud framework. Cloudlet framework consist distributed mobility equipments connected through web so, the number of switch of information to connect data center can be reduced to one-hop to neighborhood moderate data centers in that locality [7]. A moderate data centers cloudlet enabling mobile device to utilize its resources, is depicted in figure 4.

In Mobile p2p Network Work Sharing

MCC is where mobile units itself used as cloud resource providers which provide a setup of mobile p2p (peer-to-peer) network or client server network as in [7]. A virtual resource cloud within the vicinity shown in figure 5.

MCC System Infrastructure includes hardware and software. Hardware includes mobile devices, network infrastructure, and cloud-based-resources like DIC or MDICC (Mobile Distant Immobile Cloud Computing), PIC or MPICC (Mobile Proximate Immobile Cloud Computing), PMC or MPMCC (Mobile Proximate Mobile Cloud Computing) and H (Hybrid). Whereas software includes Cloud-based Mobile Augmentation a model up holds the principle and computing methodology of clouds to enhance and grow the mobile computing capabilities [8]. MCC basic block is indicated in figure 6. Depends on Cloud-based-resources different MCC kinds are discussed using table 2.[8]

Challenges and Services of MCC

Mobile devices face several challenges such as battery life, storage and bandwidth. On-demand services to the mobile users are provided by MCC by using a variety of Mobile Cloud Service Providers. In mobile cloud computing, the several cellular network and different network resources can intensely setup. The mobile applications and data using mobile cloud to process the task can point to different class of service such as location-based-services, conserved services, social networks and more. Such general scenario in MCC is depicted in figure 7 [9].

Out of many alternative mobile clouds, the consumer selects best MCSP (Mobile-Cloud-Service-Providers) depending on radio technologies like WLAN, 3G/4G, availability of network resource. MCSP if only provide best network and not efficient service of data from content system then extended services are not provided to mobile user. And even in the point of fact, energy optimization is crucial challenge in mobile devices as it had restricted power supply and it utilization power while execution and data transmission, these challenges have overcome with composed computing of mobile and cloud applications under Agent-Based-Resource-Management Architecture.. This model helps mobile user to select best MCSP and MCSP service, and optimized task scheduling, cloud resources utilization, with on-request service and fulfilling all request from consumer [9].

The Role of Cloud Computing In Iot

Internet Cloud Services provide innovative platforms as it incorporate IoT (Internet of Things) which is a collection of technologies that might be observed as a use of networked devices. IoT overwhelmed several industries throughout the global along with environmental health professions, farming, travel convenience, building developments and management. IoT central cloud infrastructure can visualize in figure 8. Any artificial or naturalistic object that may allocate with an Internet Protocol address and has the ability of data transmission through network without system or human interaction comes in IoT. In Internet-Of-Things, Cloud Computing acts as a collaboration part that is employed to store IoT data. While IoT provides a tons of data, cloud computing allows

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the travel of this data. A public cloud service is offered by IoT in cloud which helps the IoT domain, by giving intermediary control to the cloud organization. The processing equipments and Internet-of-Things data which operate using IoT based devices can be helped by integration [10].

Benefits of IoT Cloud Platform

The cloud computing delivered as a end-to-end service and also the capabilities of IoT devices are brought together by IoT cloud platforms. Such IoT cloud platform is depicted in figure 9. IoT Cloud Platforms usually work with multiple parties like telecommunication providers, hardware vendors (both for cloud services and IoT devices), system integrators and software service providers to create the platform. To facilitate the auto-arrangement, management, and delivery of smart devices within an allotted IoT framework, the Internet of Things relies on IoT platforms. IoT structure provides a domain or gathering place for all networked equipments and also for data collecting and handling over network. Cost effectiveness, scalability, data mobility is that the beneficiaries of IoT platform. For each IoT deployment, IoT platform is that the centre which establishes the connectivity between hardware and software and user level software or interface provide a low-priced facilities for networked device arrangement and management, remote data collection and handling, activation of cloud or physical hub applications and connection [11].

CONCLUSION

Cloud computing itself could be a new field in web computing that is evolved by consolidating several technologies like SaaS, virtualization etc and provide an extension of distributed computing. As, it delivers the appropriate resources only, during the time of need reduces the investment cost. Creating convenience of this new technology to the mobile user will operate at lesser cost with minimal technical support. Most of latest options may be accessed in finger tips. It helps mobile user to store and access massive information on the cloud by that we will avoid losing data in the event of hardware failure. So, by MCC we can be integrated the services from multiple different service providers. On another end Internet of Things cloud solution provides a new paradigm to IT utilities, cloud computing a enhance technology has captive user and business world into the web based platform, that permits the business organization to optimize their IT functionality as it provide cost efficient cloud based resources and platforms for application running and data processing instead of physical IT architecture.

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Table 1: The Cloud Computing Of Pros and Cons

Sl.No	Advantages	Disadvantages
1	Cost economical method	Less Security
2	Unlimited storage capacity	Prone to attack
3	Backup and recovery	Possible downtime
4	Automatic package Integration	High price
5	Easy Access	Inflexibility
6	Quick Deployment	Online dependence
7	Easier scale of services and flexible	Technical drawback because of less standards of maintenance.

Table 2: Comparisons of Types of MCC

Factors	Distant Immobile-Clouds	Proximate Immobile-Clouds	Proximate Mobile - Clouds	Hybrid - Clouds
Computational Resources utilized in MCC	public clouds	Nearby public places desktop computer	Nearby resource rich mobile devices	Consolidate various resources to build
Processing	larger intermediate hops	Single intermediate hops within area	Short single intermediate hops	Heterogeneous cloud-based resources.
Resources availability	Rich	Ordinary	Low	Rich/Low
Localization	Short	Moderate	Huge	Short/Huge
Scalability	High	Moderate	Low	Huge/Short
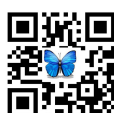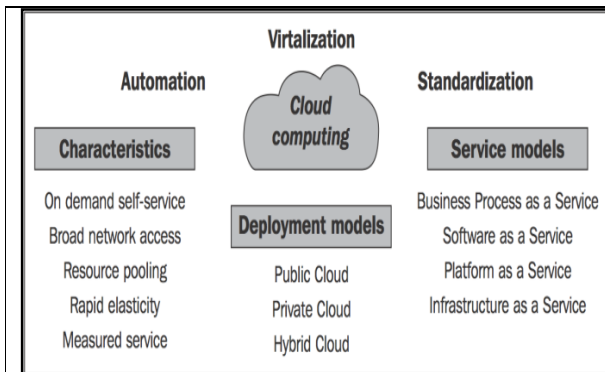
Figure 1: Cloud Computing Dimension
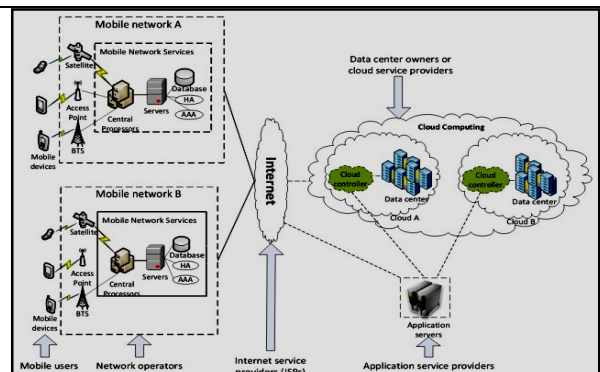
Figure 2: MCC Architecture
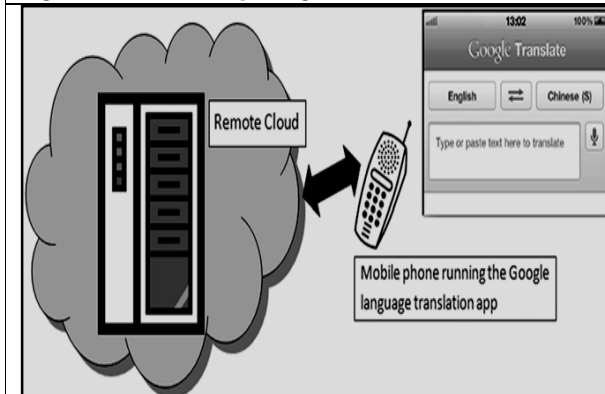
Figure 3: Provisioning of remote cloud server to mobile devices though the web.
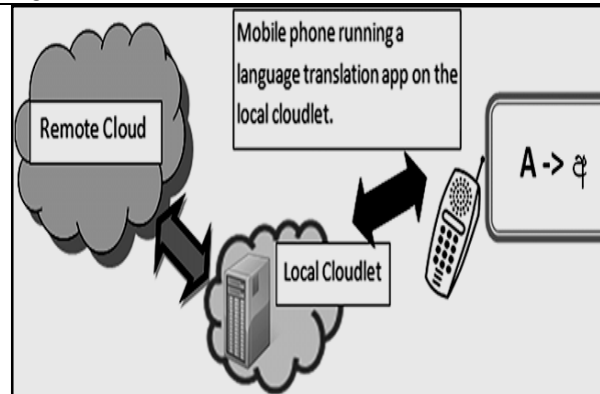
Figure 4: A moderate data centers cloudlet enabling mobile device to utilize its resources
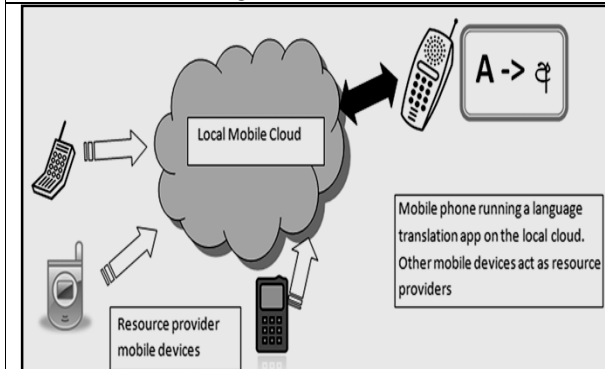
Figure 5: The Mobile Devices Making Virtual Resource Cloud Within The Region.
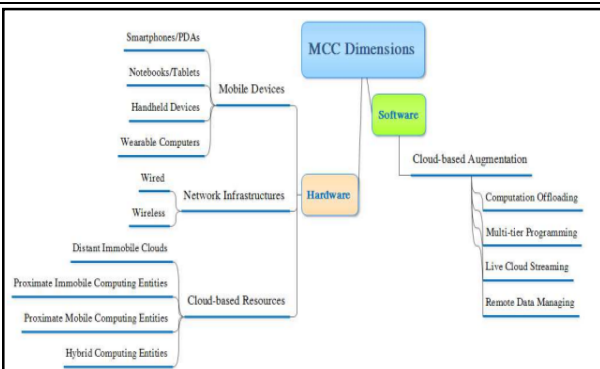
Figure 6: MCC Basic Blocks

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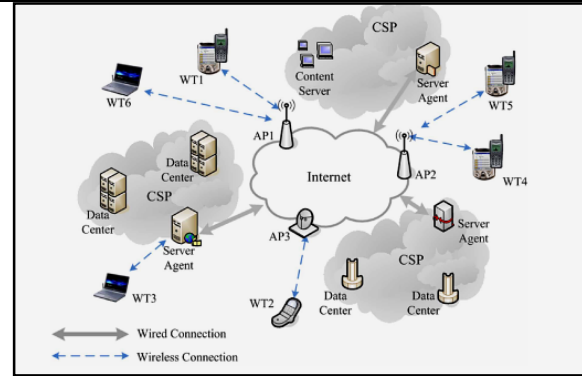
Figure 7: MCC General scenario
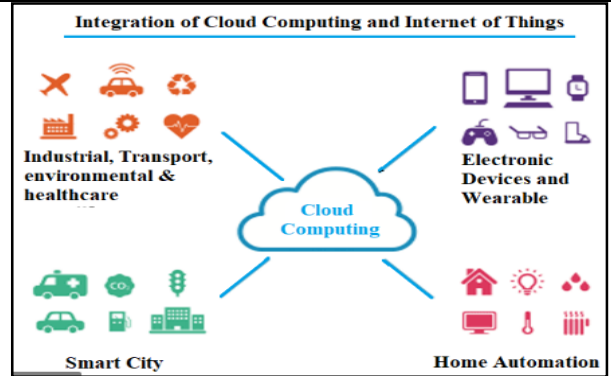
Figure 8: IOT central cloud infrastructure.
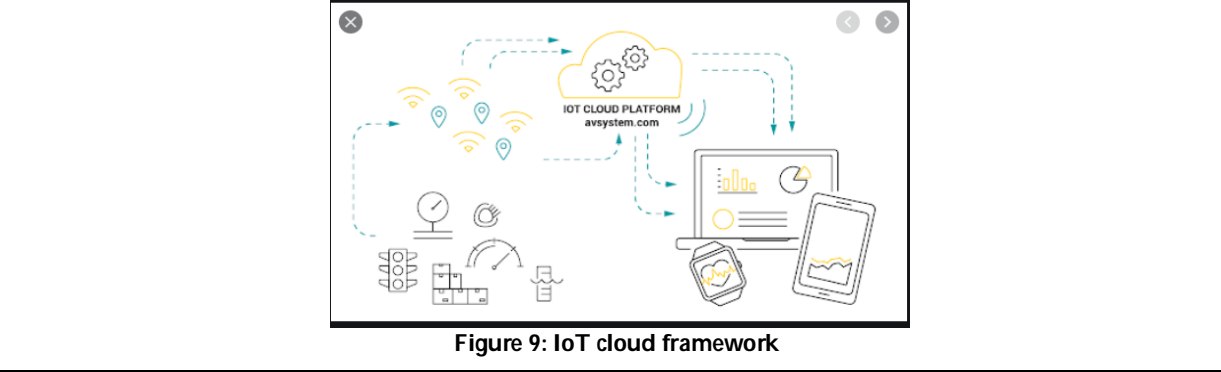
Figure 9: IoT cloud framework

A Survey of Health Care Data in Cloud Environment

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ABSTRACT

Cloud computing is a fast-growing industry used in day to day life. Cloud is an emerging as a new paradigm in digital technology and recently extensively used in the healthcare industry for security and confidentiality of medical data. Cloud computing not only provides convenient storage it provides easy access or transmission of medical data between several shareholders. In this pandemic situation Doctors, Patients preferred for virtual consultation. Instead of maintaining medical records in hospital they prefer to store patient health records in cloud for easy access and wide storage facility. Medical records include patient critical disease details, credit cards and payment details, social security number details. In case of sensitive data leakage may cause financial losses and distress to patients and his family. The medical data need to be secured using cryptographic encryption methods to overcome security and privacy-preserving challenges in medical data. By using these encryption techniques like AES (Advanced Encryption Standard), RSA, Homomorphic encryption, Proxy Re-Encryption schemes to encrypt the medical records before moving to third-party cloud storage. This survey paper aim to focus on security challenges of medical data in cloud and preserve the e-health records with enhanced security.

Keywords: Cloud computing, Encryption, Medical data, Security, Privacy-Preserving.

INTRODUCTION TO CLOUD COMPUTING IN HEALTH CARE

Cloud Computing is a way for delivering of resources on-demand computing services over the internet. Cloud provides a network of remote servers hosted via Internet for storing, managing, and processing the data without the need of local servers. In recent times various industries like Agriculture, IT sector, Medical, Transport industry moved to cloud because it provides wide data storage and flexibility to process the data. Cloud computing offers great service in the Healthcare industry which is rapidly growing. Traditionally hospitals maintain patient records in paper format like prescription, Medical history, bill payments details and medical diagnosis records like lab reports, ECG reports, are stored in physical storage without any secured format the data simply stored in hospital system. Increased population which leads to maintain large volume of medical data is difficult. With the advancement of using cloud technology for improving security, quality of patient care and reducing health care delivery costs.

Now a days cloud computing has raised its applications in versatile field like medications, digital data processing, digital marketing etc. out of this the most expected humanities field is paramedical where the data transfer storage security is most needed one in the recent era, various high profile corporate companies like Sun, Microsoft, Amazon, IBM & Google etc., are producing the platform for the above requirements. As discussed earlier the main issue in the data storage is data security and it's mandatory to have the data secured of all the patients since it's related to their life and moral value. The most safe and best way to data storage by using Cryptography methods, it has the process of inbuilt data encryption and decryption process where it ensures the high line of data secured storage without leakage to the third party. With this back ground of knowledge we infer that the importance of the data security related to medical field. Our literature review is going to give us very detailed study on the past and present updated portfolio regarding the health care related data security methods and its updated tools and methodologies used till now.

The black mark of the high-profile online data storage cloud computing is data insecurity other way called as data theft. Various research had stepped in towards to clear this black mark in the cloud storage they had discovered various data security methods to eradicate the problem they are named as i) data revelled with automation with security codeii) sensor coding iii) patient data secured with encryption iv) signal processing towards medical data v) data storage duplication technology, the above detailed technologies are as of now developed technology to eradicate the cloud data security issue.

LITERATURE REVIEW FORCLOUD MEDICAL DATA SECURITY

Shruthi Ramesh (2020) proposed a framework by developing a test bed to secure sensitive and personal data into the cloud storage. This current work calculating the computation latency of actual medical ECG records from the TELE ECG database. This methodology is based on fully homomorphic encryption with proxy Re-ciphering encryption. In existing system static key is used to for encrypting and decrypting the data over the network this leads to high chances to intruder attack. To overcome the drawbacks to ensure long-term security of data. This proposed technique is best suited for Io T devices. Using Chameleon Hash Functions (CHF) provides dynamically refreshing the encryption keys. The advantages of the proposed methodology provides the secure, scalable scheme and also an extended form of security, confidentiality to maintenance of cloud data incloud - IoT applications[1].

Sumana Maiti (2020) proposed a methodology using proxy Re-encryption (PR) which delivers constructive way to secure the confidential information in cloud storage and share the data to the receivers. In this method sender will hide the receiver's identity in the group of receivers in a Broadcast Proxy Re-encryption (P2B). In existing system consists of infinite amounts of receivers connect via Identity Based Proxy Re-Encryption system (IPR), in this method the sender computes discrete Reciphering key for individual receiver in the group, which is overhead at sender side. To overcome this communication overhead issue, the knowledge of Identity Based Broadcasting Proxy Re-

Encryption (IBPR) was proposed. By using Lagrange interpolation polynomial function to provide confidentiality to individual receiver in a specific group in the broadcasted encrypted data. This method decreases the decryption time by 68% than compared with existing schemes and provide privacy preserving of data 98% compare than existing methods[2].

Munachiso Ilokah (2020) proposed a framework called Multi Authority Cipher text Policy Attribute Based Encryption with Outsourcing (MACP-ABEwO) system is reducing the decryption time. In this work the electronic medical data sharing between multiple parties. The health record shared in cloud the owner has limited control to use the sensitive data. The owner/user need for flexible and fine-access control to secure the data. In purposed system using Attribute Based Encryption (ABE) with multi authority scheme to providing security to the medical records. ABE is a pairing based cryptographic method it framed constructed on Identity Based Encryption (IBE). Advantages of purposed framework to provide privacy, multileveled security to facilitates at a granular level control of access the information[3].

Song Han *et al.,* (2020)proposed homomorphic Encryption to secure data privacy, specifically for location privacy. One of the instances is spatial crowd sourcing (SC). In existing system workers and requester's location data is exposed and it leads to data privacy issue. In this proposed system to hide the location details of the user. It based on spatiotemporal tasks (tasks associated with time and location) the workers update their actual location details to the server, then the Server Assigned Task (SAT) to workers. Server compute the distance, workers location based on that schedule the task will be assigned to worker. In SC system the distance is calculated using protocols likeEuclidean-L3P, Minkowski-L3P, Manhattan-L3P, and Chebyshev-L3P. To analyse the performance, and estimates the communication and computation overheads among the protocols [4].

Yoshita Sharma *et al.,* (2019) proposed a multi-level encryption algorithm for data security in cloud. In existing system single level of encryption only used for securing the data in cloud. Intruders can easily manipulate the keys to steal the personal data, misuse and explore the sensitive information. In the proposed methodology provides double level of security to protect data from authorized access. It is a combined encryption method using AES and RSA algorithm to ensure high confidentiality to data. The first level of encryption done by RSA then using AES second level of encryption process is complete, finally the data securely stored in cloud. The advantages of this methodology provides high level of security and confidentiality[5].

Qiyu Wu *et al.,* (2019) construct a new scheme called lightweight privacy-preserving equality query scheme (LPEQ) for the first time in edge computing. In existing system data processing will be challenging which comes from different data source and diverse secure keys. To overcome this issue LPEQ scheme process the query, from multiple data sources retains the privacy preserving properties. LPEQ scheme based on Elliptic Curve Elgamal Encryption and it permits only the authenticated users to efficiently perform the parity query and confidentially on the encrypted data outsourced by various IoT devices. The advantages of this method reduce the computation speed and improve the communication[6].

Owusu-Agyemang Kwabena *et al.,* (2019) Proposed Multi Scheme Crypto Deep Neural Network (MSCryptoNet), an innovative framework is based on the multi-scheme fully homomorphic encryption algorithm. MSCryptoNet is for securing healthcare data in IOT combined with deep learning. This proposed design has preserved he dataset using the concept of Neural Network is free from loss of precision, efficiency and effectively working out on diverse dataset encrypted with different schemes or even discrete keys[7].

Shekha Chenthara *et al.,* (2019) Proposed to preserving privacy of Electronic Health care Record (EHR) in cloud computing using block chain technique. In the existing system conventional paper-based method is used to store the health records which is more challenging to maintain and manual effort to secure the data. Block chain techniques is

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used for controlling access permission for authorized users on large ledger based EHR data in cloud. The advantage of proposed methodology easily accesses the EHR data in cloud and enhance security[8].

Linzhi Jiang *et al.,* (2019) proposed somewhat homomorphic encryption (SHE) with Single Instruction Multiple Data (SIMD). This methodology efficient for privacy preserving of patient's data to implement multi retina-image matching and homomorphic surf schemes. This proposed work based on homomorphic encryption for multiretina-image matching, lesion detection and feature point detection for the encrypted form of retinal image for diabetic retinopathy (DR). In the health environment, hospitals can perform medical diagnosis (MD) along with medical sensors, specifically for remote auxiliary medical diagnosis. This proposed model provides encryption scheme it's based on lattice, idea behind on quantum-resistant, can preserve data confidentiality under quantum computation. The advantages of this methodology are privacy preserving of DR detection early and encrypted the medical data[9]. Zainab Hikmat Mahmood *et al.,* (2018)Proposed a methodology using hybrid Homomorphic Encryptionis constructed on Goldwasser-Micali encryption (GM) with partially homomorphic encryption and RSA algorithm to provide two layers of encryption methods. In existing system used fully Homomorphic Encryption algorithm but it has some downsides like big key size, small calculation efficiency and not suited to practicalto secure cloud data. In this proposed method the user data is encrypted by GM algorithm and once first layer of encryption is completed, the second layer of encryption will be done by RSA algorithm. After two level of encryption the data will be stored in the cloud. The cloud computing process the data using PHE (addition or multiplication). The data decryption will be done in reverse process. This concept overcome the issues and drawbacks in the existing system. The current system works three times faster than the existing process and reduces the computation time to 66%. The advantage of hybrid homomorphic encryption is enhanced high security[10].

Qinlong Huang *et al.,* (2018) introduce a new methodology for securely sharing the encrypted medical data and social network profile matching scheme for Mobile Healthcare Social Networks (MHSN) in cloud computing. The proposed technique is Identity based Broadcast Encryption (IBE) with Conditional Proxy Re-Encryption technique is used to securely transmitted the healthcare data. The objective of this work is connecting patients to share encrypted medical datavia their mobile devices and linking doctors, specialists for better consultation on healthcare. Attribute Based Encryption mechanism with CPRE in MHSN, it's permits doctors who met the prerequisites to authenticate on the cloud to change the stored encrypted text into a new cipher text using Identity based Broadcast Encryption for the specialist, without leakage of personal medical information. By using this profile matching scheme to help patients to find friends in secure and an effective technique. The advantages of this methodology to reduce the computation cost on end users[11].

V. Vijayakumar *et al.,* (2018) proposed a double encryption using AES encryption and proxy re-encryption algorithm. The objective of the proposed methodology is securing Electronic Health Record (EHR) in cloud storage. In existing system single encryption technique is used, also the keyword search will be in the plain text is visible to cloud service provider. In this proposed work when user request the medical record to the data owner then the time server assign a specific timestamp using own privately owned key and Proxy Re-Encryption using public keyword search algorithm (PEKS) to encrypt these searchable keywords. In the granted time stamp the data is sent to user so that user can decrypt the data and download it. The access is allowed only for a specific time to authorized users and limited access rights. To data is protected itself from cloud service provider and un authorised users. The advantages of this technique are low cost, reduced computational time compared with existing method[12].

Jieun Eom*et al.,* (2018) proposed technique named multi-client order-revealing encryption algorithm. In cloud large amount of user's personal data collected and stored for utilizing various services. Privacy of personal data is a significant issue to securely store the personal data in a cloud server and avoid the data leakage by using cryptographic encryption. ORE is a special kind of symmetric-key encryption algorithm it can be used for effective range queries over the encrypted data by compare is on the cipher texts without decrypting these cipher texts. In existing system ORE comparing cipher texts generated by one client. In proposed work ORE comparison of cipher

texts generated by single client as well as multiple clients. The advantage of this methodology, to reduce the data leakage and measures the performance of algorithm with added range query methods, it improves the efficient performance in a database range query[13].

Debasis Das (2018) Proposed an Optimal Asymmetric Encryption Padding scheme for encrypting the user data. In the current work is combined OAEP scheme together with Hybrid Encryption is built on Homomorphic encryption and RSA algorithm (HE&RSA). The proposed method permits multiple parties to compute a function from that inputs and preserving the integrity and confidentiality of the data. The Homomorphic Encryption achieves computation over the encrypted data without decrypting. This methodology Secure Multi-Party Computation (SMPC) is used in the cloud environment to safe guard the security and privacy of the users[14].

Akhil K.M*et al.,* (2017) proposed a methodology to concentrate on providing security while transferring data into the cloud using AES algorithm encryption. The major issues of the cloud storage are data security and privacy. In this proposed approach the data access will be denied for third-party auditor. Once the user is authenticated using verification code sent from third-party then user will be prompted with list of available servers to store, view, download and remove the data. Using AES encryption method, the data will be encrypted at the time of storing or transferring the data to the cloud storage. The decryption process will take place at the user end when any user requests the data from cloud server. The advantage of this methodology, no intruder can access the data and it provides overall security. Without third-party verification code the unauthorized user cannot access the data and it will provide enhanced security[15].

Shefali ojha *et al.,* (2017) proposed a methodology combination of AES and MD5 algorithm to secure data in cloud. In existing system cryptographic technique encryption, decryption process is done on only for data to be stored in cloud. In this work provide authentication at the given time of secure login i.e., encrypted login ID and password, thumb impression of authenticated user is stored in database. Any intruders have login ID and password of an existing user will not be authenticated without the user thumb impression. It provides security to the authenticated users and thumb impression travel over the network. The Advantage of this methodology provides double encryption algorithm for secure login[16].

D.I. George Amalarethinam (2017) proposed a methodology named Enhanced RSA algorithm with variable key size for securing cloud data. It is based on concept of High-Speed and security RSA in this scheme the two random numbers are used for generating the key. Normally RSA algorithm used couple of prime numbers for key generations. In this current work Enhanced RSA additionally, two more prime numbers are included for generating public and private keys. Varying the key size will increases the computation time of data execution to overcome the issue data will be divided into blocks. The advantages of this methodology the data is encrypted securely and reduced the computation time it provides overall enhanced security to the data[17].

Sapna Tyagi *et al.,* (2016) proposed work is based on Cloud -IOT in health care systems to efficiently maintain and access the health care in secure manner. In existing system Wireless Body Area Sensor Network (WBASN) here multiple sensors nodes worn by patients for measuring and report the patient health status. In this proposed methodology is Cloud based -IOT to combine all health care data from multiple sources under single Cloud -IOT. The advantage of this concept the patient can access the medical records under single platform without any hassle. Medical data is accessible from anywhere and any device it provides flexibility and portability for the patient[18].

Pradeep Deshmukh (2016) Proposed methodology using Privacy Homomorphic Encryption (HE) with Elgamal Encryption algorithm for securing electronic health records (EHR). The current work is a key control scheme for transmitting and storing the patient's data in the cloud. In existing system medical records are stored in physical device is difficult to maintain the all patient records in single machine, the reports stored in unencrypted format it's not secured. The current methodology provides double data security from data transmitting to data storing. The

advantages of the proposed methodology provide security to sensitive medical data and easy to access the medical data from the cloud[19].

Nathan Dowlin et al.,(2016)proposed a methodology named Crypto Net using Neural Network to predict the medical results from encrypted medical data. In this current work using Homomorphic Encryption (HE) to encrypt the patient medical records and send the encrypted medical records to the cloud server. Using Neural Network (NN) to predict the patient medical report. The advantages of this methodology cloud server do not read the medical record and also compared with existing methodologies this Crypto Net provides 99% accuracy for predicting the patient records efficiently[20].

In the above literature review contains studying and analysing various journals in leading data collections namely IEEE X plore, Google Scholar, Scopus Research Gate, ACM Digital Library, Science Direct and Springer between 2016 to 2020.

Cloud Service Models
Cloud computing delivers three types of service models
1. Infrastructure as a Services (IaaS)
2. Software as a Services (SaaS)
3. Platform as a Services (PaaS)
These cloud service models giving various facilities to Hospitals, patients, and pharmaceuticals. Huge numbers of healthcare organizations are preferring to use the SaaS service-oriented applications.

Saas in Healthcare
In health care SAAS applications delivering clinical information solutions like electronic health record, tele-health data and non-clinical information systems like billing, CRM, supply chain. It provides on-demand services replace the traditional software usage with subscription-based usage services with reasonable cost.

Iaas in Healthcare
In health care industry maintaining voluminous amount of medical data in on premise system is a tedious task. Iaas provides wide storage facility for securely storing the patients records its offers flexibility to maintain the patient medical data in efficient way.

Paas in Healthcare
Paas simplifies to access the medical data instead of web browser it allowed access through cloud apps to provides flexibility to user and stake holders

Transferring medical data to the cloud is very simple process to the delivery of medical records from computers at anywhere, anytime and access on mobile device. Cloud provides more benefits to connecting several medical centers and cloud users for securely sharing the patient health data via the Internet.

CURRENT STATUS OF CLOUD COMPUTING IN MEDICAL FIELD
Information Technology (IT) sector supports the healthcare industry mainly in two processes:
1.Drug manufacturing process
2.Healthcare delivery/provisioning process

These processes generate loads of patient related information and other data such as images, bills, records and more. The drug manufacturing process is an important system of the pharmaceutical industry where novel drugs are discovered through research and development (R&D). IT systems support secured and error free organizing, storage, processing and sharing of tons of data across regions, users and applications becomes mandatory. Cloud computing has evolved as a cost-effective solution that caters to all the requirements of drug manufacturing and other processes

of the pharmaceutical industry [21]. Healthcare in cloud computingis an essential requirement to develop from USD 28.1 billion of every 2020 to USD 64.7 billion by 2025, at a CAGR of 18.1% in accessible time frame.Development in the medical services cloud computing preferring business sector such as advanced upgradation in medical services industry, expanding medical centre and increasing medical care digitization to improve the medical care process [21]. Cloud provides scalability and wide storage space so today's many healthcare organizations are increasingly moving towards the cloud environment for its fabulous features like security, easy to access the data and efficient data sharing.

CONCLUSION

The analysis of the research study, reviews and compares the methodologies, problem definition, implications, merits, and demerits of cloud Computing in health domain. Thus, the motivation of encryption and decryption process is common for securing different formats of data namely ECG image, patient medical records, lab reports details and payment details. But the existing methodologies differ depending upon the various types of data. Thus, cloud computing is growing exponentially in health care sector. As social distancing is the most preferred solution during the COVID-19 pandemic it provides enormous openings for Tele-health consultations. Data breaches in healthcare is almost inevitable and it need to be handled in an efficient way. In my future work, we will analyse the security related algorithms and will propose the best algorithm that avoid data breaches in health domain.

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Source: Amazon Web service Network [24]

Figure 1 : Cloud Computing in Global Market by Region

Source: Amazon Web service Network [23]

Figure 2 : Cloud Computing in Global Market by end user
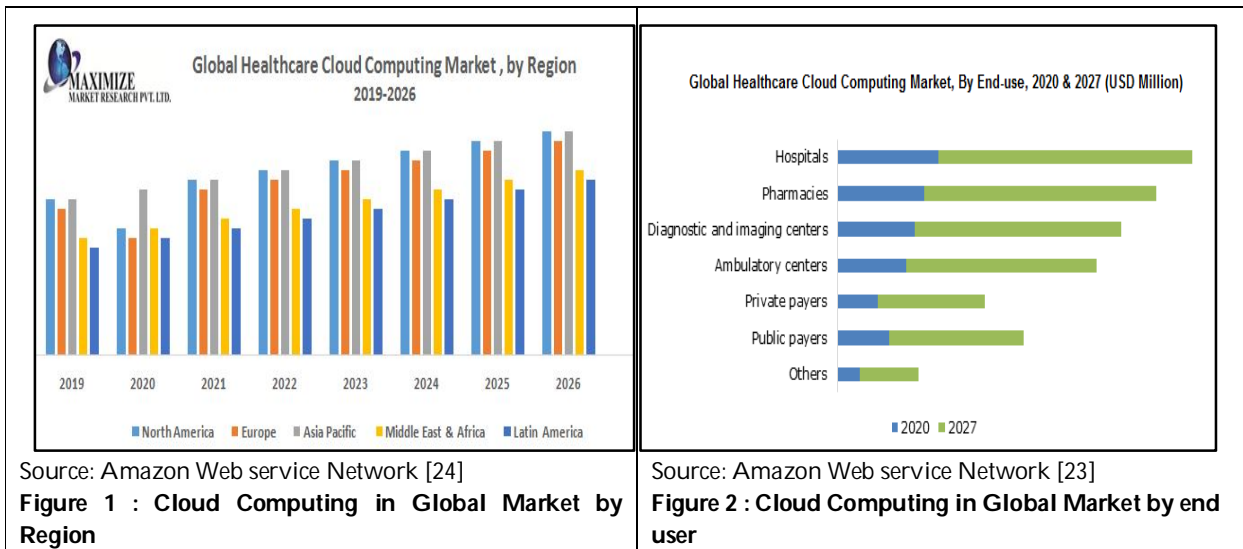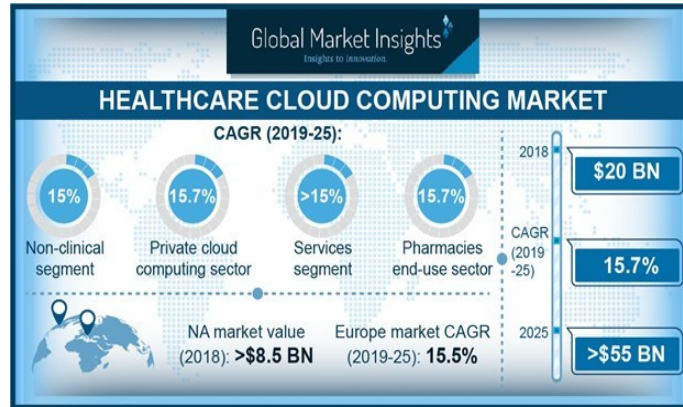
Source: Amazon Web service Network [21]

Figure 3 : Cloud Computing in Global Market
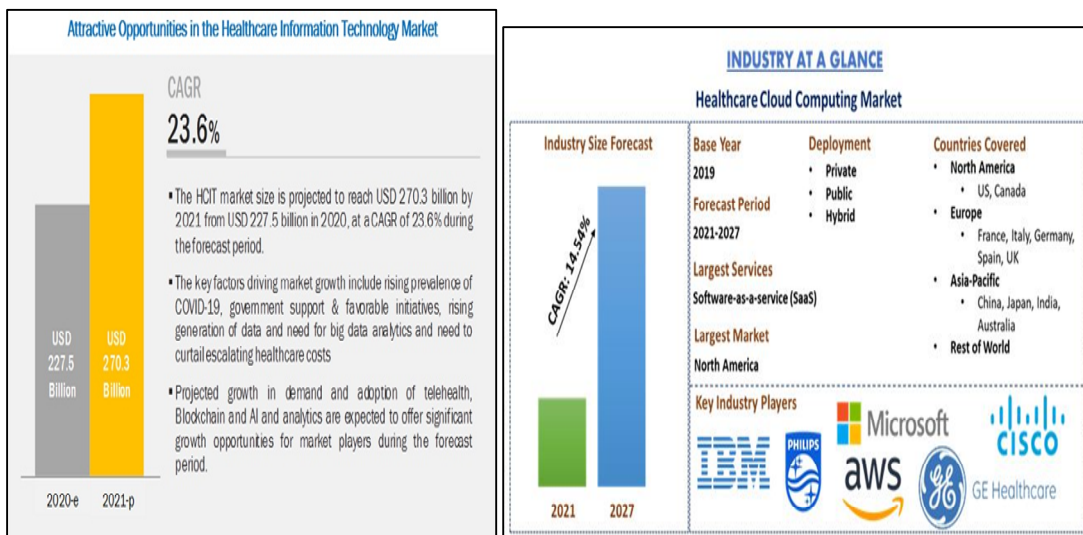
Source: Amazon Web service Network [22]

Figure 4: Cloud Market Size

Review Towards Smart-Agricultural with IoT, Cloud and Data Mining Techniques

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ABSTRACT

There are numerous motivations to execute a smart-Agri arrangement into business and local cultivating. In reality, the Internet of things (IoT) has the prodigious appropriation of information social affair and mechanization, a significant industry, for example, horticulture can doubtlessly profit by the IoT. Monitoring and collecting data for soil moisture, air temperature, air humidity and sunlight intensity across multiple fields will improve productivity of water utilization and harvest yield of huge and nearby ranches. but still the smart-agricultural has many challenges and the those makes many opportunities to the many researchers. in this paper reviews agricultural in the form of IoT, cloud, datamining and many other technologies. the paper concentrated the smart improvement by the performance metrics of the proposed work. the survey makes the creates stepping stones for the many researchers. Many researchers progress verified perceptions in the literature to overcome these problems. Without qualified assessment, using the settled concepts will not meet the expected outcome of forth-coming researchers. Without a detailed review of current signs of progress, the researchers may not find opportunities for forthcoming developments in the direction of excellence. The students becoming good researchers require a comprehensive analysis of unique concepts with contemporary growth. To accomplish these requirements, numerous works issued in the widespread journals between the years reviewed in this paper

Keywords: IoT, cloud, datamining, smart Agriculture, big data.

INTRODUCTION

The difficulties anticipated in farming the extent that the need to twofold food supply is concerned are presently putting horticultural supportability at standard with guaranteeing food security. There is a requirement for an asset productive worldwide food framework that thinks about the part of manageability. For instance, in the event that you are attempting to guarantee proficiency by they way you use water in your ranch, methods of lessening soil disintegration and guaranteeing least corruption, or in any event, limiting energy input, you are in good company. Each rancher everywhere on the work desires to accomplish all these and different objectives at the base conceivable expense. In any case, such objectives post probably the most noteworthy necessities in horticulture which can't be accomplished effectively through conventional methodologies of cultivating. With the expansion in the requests and the requirement for practical horticulture, it is getting truly vital for ranchers and the related partners to put a ton in information and more refined machines and gadgets. In this article, we examine, inside and out, the subject of shrewd cultivating and its job in creating feasible agribusiness.

Shrewd cultivating is a cutting edge cultivating idea that investigates the utilization of innovation to improve farming creation while simultaneously bringing down the data sources altogether. All things considered, savvy cultivating is a data driven cultivating approach, which expands the requirement for it to be noticed. This methodology applies measures that are monetarily and biologically significant to accomplish improved yield underway. Brilliant cultivating runs on the standards of accuracy cultivating, for example, the utilization of GPS direction in the use of measures that are site-explicit. In any case, given that accuracy cultivating is fundamentally zeroing in on the selection of certain cultivating innovation, the execution of auto-guided collectors and work vehicles, among different gadgets and ranch hardware, moves the way to deal with a comprehensive and more adjusted methodology where the spotlight isn't just on spatial exactness yet to most astute treatment.

The ordinary issues that savvy cultivating focuses to settle incorporate perspectives, for example, how much manure one necessities to apply, season of use, and the particular region to be applied, which assets are required for plant insurance, and related viewpoints. Be that as it may, the field of agribusiness faces a complex data challenge. Most ranchers have little plots where they produce food; a circumstance that prompts the execution of high spatial and transient measures on any checking framework utilized. Likewise, complex data is required for better outcomes where savvy cultivating is utilized. Keen cultivating accompanies such countless freedoms with the point of lessening natural impression. The utilization of information sources that are site-explicit or negligible utilization of assets, for example, pesticides and manures can help in the moderation of draining issues and the arrival of unsafe ozone depleting substances to the climate. ICT improvement currently permits the formation of a sensor network whereby ranchers can interconnect and see the situation with the dirts, animals, and plants and adjust it to creation data sources' requirements like meds, manure, and water.

Besides, with brilliant cultivating, it is not difficult to accomplish benefit in horticulture. The utilization of specific strategies to decrease asset sources of info can guarantee that ranchers save colossally on work and the requirement for dependable spatial information in danger decrease. This is owing to the way that brilliant cultivating empowers the utilization of innovation in site-explicit climate conjectures, likelihood planning of fiascos and infections, and yield projections. Data innovation doesn't tally like obstacles to the reception and the usage of savvy cultivating. What the vast majority should embrace is the information and comprehension of how this idea functions. Shrewd cultivating has a great deal of potential in making horticulture beneficial and reasonable, boosting purchaser acknowledgment, diminishing asset sources of info and cost.

Review of the literature
Smart-Agriculture Based on IoT

In 2018 Rahul Dagar, Subhranil Som, Sunil Kumar Khatri proposing poly house is fully enclosed, there is virtually no effect from outside elements such as bugs, which do not penetrate and cannot damage the harvest, reducing the need for bug sprays. A suitable option can be made by using sensors in the harvest field that is connected to the internet. Finally, we believe that we need to develop an ideal IoT design for agribusiness in order to improve the quality of production, conserve resources such as water and energy, and produce economically efficient harvests that cost less and yield more profit, as ranchers contribute a significant portion of GDP in countries such as India, and thus the overall GDP can be improved. In 2019 Mahalakshmi, J., Kuppusamy, K., Kaleeswari, C., & Maheswari, Presents the current utilization of PA, and another farming Web of Things, i.e., PAIoT, is proposed with the blend of both PA and IoT innovation. Through the investigation of central points of interest that worry practicality of PAIoT (i.e., photovoltaic board cleaning and far reaching use of water assets, hub sending and cost advancement for sensor networks for multi-work and multi-observing principles, transmission enhancement of picture information securing, impact of photovoltaic board power age on the natural environment, and issue finding of photovoltaic module.), we can realize how to all the more likely understand the PAIoT, further improving the degree of farming informatization furthermore, advancing the persistent updating of the horticulture, which is likewise the ordinary utilization of "keen cultivating".

in 2020 CHING-JU CHEN1 YA-YU HUANG2YUAN-SHUO LI2 CHUAN-YU CHANG (Senior Member, IEEE), AND YUEH-MIN HUANG 2 For trouble distinguishing evidence, examiners, computerised reasoning, and image recognition advances are combined with natural sensors and the Internet of Things (IoT). To acquire the region of Tessaratomapapillosa, we used deep learning YOLOv3 for picture recognition and analysed natural data from climate stations using Long Short-Term Memory (LSTM) to predict the occurrence of bugs. The frustration identifiable evidence exactness was found to be 90% in the trial results. of multiple irritants before they become widespread. It increases overall rural financial opportunity by providing appropriate nuisance management strategies that reduce crop losses and reduce the environmental harm caused by excessive pesticide use. Jiale proposed deals in 2020 using a hybrid technique (HISTIF)FCSM, we looked at the effect of point spread capability and geo-enlistment errors in fine and coarse target images. In order to measure the fleeting transition between reference and expectation dates without picture characterization, whether the information was reenacted or real. STARFM had predicted that the images would display articulated blocky antiques. Although both HISTIF and Fit-images FC's displayed consistent inside field fluctuation patterns, HISTIF had the ability to reduce the unearthly bending more effectively than Fit-FC. Furthermore, HISTIF had the most consistent execution across all sensors. The findings suggest that HISTIF may be useful for testing yield growth at the subfield level on a daily and point-by-point basis.

In 2017, Alahi, M. E. E., Xie, L., Mukhopadhyay, S., and Burkitt, L. published a paper on the design and development of a sensitive nitrate sensor for monitoring nitrate concentration in surface and groundwater. A planar interdigital sensor, related gadgets, instrumentation, and electrochemical impedance spectroscopy-based analysis make up the established flexible detecting system. The framework is capable of estimating nitrate fixations in ground and surface water in the range of 0.01-0.5 mg/L. The temperature remuneration limit inside the sensor is included in this paper, which extends our previous work. It has been incorporated with the Internet of Things (IoT), rendering it a linked detection device. The device will send data directly to an IoT-based web worker, which will be useful in the development of potential conveyed checking frameworks. The developed system may be able to monitor the effect of mechanical, agricultural, or urban operation on water quality in real time. A detailed analysis of the ideas associated with Edge processing and Agrarian IoT in 2020 is presented byONG. In the horticultural area, edge registering applications have been upgraded to the exploration status of Edge processing combined with AI, blockchain, and VR/AR. For AI, edge figuring will preprocess data and share cloud worker and capacity model registration. The shortage of processing resources and usable energy for terminal devices linked to the blockchain was addressed by

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edge registering for blockchain advancement. The information stored in the edge worker would be more reliable and safe thanks to the use of blockchain technology. In virtual reality and augmented reality, edge registering decreases response time. A few terminal projects can be assigned to the edge worker, allowing VR/AR devices to be lighter and have a wider range of applications. Four unsolved analysis issues were discovered and investigated. This investigation offers information to potential experts in order to learn more about the use of Edge processing in the rural sector and to help the investigation into the unresolved issues move forward. As two essential pillars of advanced business change, edge processing and distributed computing will work together to propel the Agriultural IoT to greater prominence in the areas of organisation, business, application, and information.

Smart-Agriculture Based on Cloud-IoT

In papers [2][3][4], a rural use of a remote sensor network for crop field checking was proposed. These frameworks are fully equipped with two sort sensor hubs for measuring mugginess and temperature, as well as a picture detecting hub for analysing data by photographing yields. Boundaries are important for achieving a good dynamic for sound cropping within a time. Temperature, dampness, and, of course, pictures are the limits. Following these techniques, high sensor intensity can be achieved with minimal force use. It has a long stretch of checking out the farming field area. A cloud-based nursery monitoring system based on agribusiness IoT was proposed in the paper [5]. Light sensors, temperature sensors, relative stickiness sensors, and soil dampness sensors can all be used to track different ecological boundaries in a nursery. Using distributed computing and the Internet of Things, the sensors collect data from the agribusiness field area every 30 seconds and log and store it on the network.

[6] The papers present a system for mechanised based on a worker's decision based on detected information. The detected information is sent to the web worker data set via remote transmission. If the water system is mechanised, the dampness and temperature fields will fall below the predicted range. With the help of use, which provides a web interface to the client, the client can monitor and manage the framework remotely. A brilliant dribble water system structure was proposed in [7]. In this case, an Android mobile application is used to reduce human involvement and to manage and track the harvest area from afar. Water wastage can be reduced with the Drip Irrigation system, which is based on data from water level sensors. To track the environmental conditions, more sensors are used. [8][9][11] Proposed Web of Things-based genius water system frameworks. Some remote sensors are necessary to determine soil stickiness and water levels. These discovered data is sent through a brilliant passageway called Generic IoT Border Router Wireless Br 1000 to a brilliant passageway through an organisation. The information is then sent via a network from the door to a web administration. [12] Conducted research on Smart Agriculture Water System Frameworks to gain a better understanding of IoT-based farming improvements using distributed computing. IoT-based keen farming system using temperature and climate sensors to conduct various horticultural tasks such as weeding, splashing, dampness detection, and bird and creature terrorization [13]as well as a knowledge base administration framework [14].

To store the gathered data, the executives would need one data set that contains all dirt data. They also mainly focused on naturally regulating the water flow to the rural field due to the temperature sensor values. Predicting the likelihood of a downpour should be possible with the aid of a sensor that detects the climate condition; this information will be sent to the rancher's cell phone via GSM for his reference. Remote sensor networks analyse sensed data from agribusiness zone fields using clever programming applications and make a decision, which is then sent to the rancher for a healthy crop. (15) Centered on novel eco-friendly and energy-efficient sensor technology, the author of this paper proposed a low-maintenance, high-yield agriculture. This paper discusses computerised ranch observing and water system techniques, which involve a wide range of sensors to detect and screen different boundaries of the dirt from afar, such as temperature, dampness, and fruitfulness, while also monitoring the supply of water and compost to the land.

[16] GSM suggested a method for tracking Pest Insect Traps using Image Sensors and Aspic. GSM relied on custom imaging devices that were operated by a remote sensor network. GSM is used to secure the catching area and relay

images to a remote host station. With respect to bother, amassing is sent via call/message to the rancher's portable data. This method only identifies annoyances and makes no suggestions for vermin control. To track yield expirations when using pesticides, a single splash system is required [17]. Paper [18] discusses the weed detection and smart herbicide sprayer robot. It is possible to detect proof of perishes in a crop using a picture handling calculation. It is not difficult to recognise weeds in a crop as a stretch way to take pictures of a harvest. In his paper [19], A variety of sensors were placed inside and outside a living bee colony to track multidimensional conditions including oxygen, carbon dioxide, poison levels, temperature, and mugginess [19]. They've devised a formula based on the findings for deciding the honey bee province's natural state [20]. Buildings profit from green rooftops in a number of ways. Green rooftop harvesting has been shown to balance solar radiation and consistent breezes. This paper presents a Green Roofs for Smart Irrigation Controlling System that is focused on projected evapotranspiration. When calculating the amount of water to be flooded, this method is designed to predict evapotranspiration. Data Security and Task Management in Sensor Networks for Smart Farming Decision Support [21].

The development of a Smartphone Irrigation Sensor [22] is suggested. They created and implemented a computerised water system sensor for use in rural yield fields, which we can capture and analyse with a Smartphone, as shown by the advanced images that can be used to discover and screen the crop region and easily gauge water levels. For control, a clever farming testing method is used, which can increase the yield creation value [23]. Without the use of humans, they may recognise mice, expire yields, and send update notices. This is where the investigation data and handling is kept. Python content is used to combine sensors and electronic devices. Because of their efforts, they were able to advance in 84.8 percent of the experiments. An inquiry into IoT and image processing implementation has been carried out. A method for combining IoT and image processing to decide whether a natural or man-made feature (pesticides/manures) is impeding the plant's growth is depicted in Savvy Agriculture [24]. It is created using MATLAB programming and histogram analysis to extract the best investigated indicator from data collected from a problematic climate system and an image of a leaf cross section.

In the paper [25]is encouraged to display one-of-a-kind invention is being used to track the rural climate. That serves as the door (FPGA relative moisture sensors, a microcontroller, a sequential convention, and a field programmable door exhibit with a presentation section, as well as a microcontroller, a sequential convention, and a field programmable door exhibit with a presentation portion. In a horticultural environment, data is sensed and fed into a microcontroller, which is then interfaced with a remote Bluetooth module. Communication and data collection are aided by a remote transmitter collector module pair, which is then routed to the FPGA via a UART serial communication protocol. They used Microbial Energy components to create a brilliant, ultralow power, modest, and energy unbiased device to screen the level of prelatic springs [26]. The Lora TM radio chip is used to transmit acquired data over long distances, frequently in noisy environments, while keeping the complexity of the organisation minimal. Using methods for an earthly Microbial Fuel cell, the gadget power supply is built in an environmentally sustainable and zero-outflow manner.

In paper [27], traditional agricultural techniques are transformed into Smart Agricultural Solutions for end clients to achieve high yields by using IoT innovation. With the help of distributed computing and horticulture IoT, the checking cycle has become extremely fast and easy to maintain, assisting with recognising the smart solution for agribusiness and effectively resolving rancher issues. Agri-Systems are dampness forecast, and temperature of the apiculture area sector, among other things. The proposed model is useful for increasing horticultural production and controlling Agro-item costs. With IOT sensors, a computerised irrigation system is proposed [30]: this technique is easy to maintain without the involvement of people. At any point where there is a temperature change, the sensor is able to detect the change in temperature and stickiness.

CONCLUSION

Internet of Things: Smart Agriculture Cloud Platform System

The Smart Agriculture Cloud Platform can be broadly utilized in enormous and medium-sized horticultural ventures, logical examination organizations, current farming show parks and rural science and innovation stops at home and abroad to help the normalization, scale and modernization of rural creation. The clever agrarian cloud stage gathers information, for example, air temperature, air moistness, carbon dioxide, light, soil dampness, soil temperature, open air temperature and wind speed in the farming climate through detecting gadgets progressively; sends information to the assistance the board stage through the versatile correspondence organization, the help the executives stage breaks down and measures the information. Makers can take convenient avoidance and control measures to diminish creation hazards. Simultaneously, cloud stage, makers can distantly and consequently control the water system, ventilation, cooling, and warming offices at the creation site to accomplish exact activities and decrease work costs. Accept the shrewd nursery for instance: the controller work is focused on the nursery with better conditions, outfitted with electric move drape, exhaust fan, electric water system framework and other mechanical and electrical gear, which can understand the controller work. Ranchers can sign in to the framework through cell phone or PC to control the switch of water valve, exhaust fan and roller daze in the nursery. The control rationale can likewise be set. The framework will consequently open or close mechanical and electrical gear, for example, window ornament rollers, water valves, fans, etc as per inner and outside conditions.

Use the IoT cloud stage to rapidly produce proficient remote sensor framework arrangements, nursery canny control arrangements, farming exhibit park arrangements, terminal control arrangements, soil dampness content arrangements, Daejeon natural checking arrangements, domesticated animals houses Environmental observing arrangements, green mechanization control arrangement, research establishment arrangements, keen water-saving water system arrangements, hydroponics the board arrangements, video observation framework arrangements, meteorological ecological checking arrangements. The cloud stage can alter and build up a normalized creation the executives cycle as indicated by the requirements of horticultural creation. When the cycle is begun, the stage will consequently make, dole out and track assignments. The staff can get the errand guidelines gave by the stage on the cell phone, and play out the rural activity and work report as indicated by the undertaking necessities. Simultaneously, the administrator can likewise perform task and work effectiveness management on the stage in the stage, and comprehend the creation circumstance of the recreation center whenever and anyplace.

The Smart Agriculture Cloud Platform can assist clients with dealing with their image of agrarian items and fabricate a rich recognizability document for each farming item. Through the cloud stage, Producers can make creation inputs merchandise, and record the executives of data on agrarian item testing, accreditation, preparing, and appropriation, and pertinent data can be consequently added to the rural item discernibility document. Simultaneously, brilliant sensors, cameras, and so forth sent at the creation site Networked gear, the stage can naturally gather rural item development climate information, development period picture data, ongoing video, and so on, advance the agrarian item documents. The stage utilizes the coordinated code innovation to create one of a kind two-dimensional code, standardized tag and 14-piece code for autonomous enemy of falsifying discernibility data. The client utilizes the cell phone to check the QR code, standardized tag, or sign in to the Huiyun Agricultural Products Traceability Platform to enter the 14-digit code. Rapidly follow the discernibility of rural items from field creation, preparing examination to bundling coordinations through pictures, messages, constant recordings, and so on Utilizing one-thing-one-code innovation, it will be invalid after one scope, which can understand powerful enemy of falsifying.

① Software framework: checking focus, announcing focus, and follow to the source place.
② Transmission gear: authorities, sensors, wise doors.
③ Monitoring gear: soil testing hardware or water quality testing hardware; gear for enormous temperature and stickiness checking, air observing, wind speed, wind heading checking, illuminance observing, video gear.

Smart-Agriculture Cloud Platform System Function

After the rancher utilizes the cell phone or PC to sign in to the framework, he can question the ecological boundaries, verifiable temperature and stickiness bend, authentic electromechanical hardware activity record, chronicled photographs and other data in the (nursery) continuously; subsequent to signing in the framework, you can likewise inquiry the neighborhood agrarian approach. Market citation, market interest data, master sees, and so on, to accomplish focused on thorough data administrations. The admonition work should be pre-set to the upper and lower cutoff points of the suitable conditions, which can be adjusted by changes in harvest types, development cycles and seasons. At the point when specific information surpasses the cutoff, the framework quickly sends an admonition message to the relating rancher, inciting the rancher to take convenient measures.

Smart-Agriculture Cloud Platform System Application

As of now, the keen rural cloud stage framework has incorporated 10 applicable business assets like farming web of things, biological cycle and rural industrialization, shaping a shrewd horticultural huge server farm.

1. Rural Internet of Things: concentrated presentation and bound together control of the application purposes of the Internet of Things, ongoing handle of the development of the Internet of Things.

2. Biological cycle: Uninterrupted constant checking, visual administration and incorporated presentation of farming natural observing focuses, dominating the environmental climate and acknowledging unusual admonition.

3. Planting the board: Analyze and show the general advancement status and plant security of the main ventures, for example, all out planting territory, absolute yield, mechanical appropriation, economic situations, and business elements.

4. Creature cultivation the board: Integrate the territory's domesticated animals creation, course, butchering and handling and innocuous treatment business frameworks to accomplish asset mix, information sharing and business joint effort in creature farming.

5. Quality and security: The agrarian creation primary body, the farming material administration principle body and the "Sanpinyibiao" horticultural items will be placed into oversight, and the positive management and converse detectability of rural items will be figured it out.

6. Farming apparatus the board: Integrate rural hardware related business and information to give logical premise to horticultural hardware planning and choice administration.

7. Farming industrialization: Integrate and examine the mechanical information of the circulation of attributes and beneficial enterprises, the quantity of working substances, and the yearly yield estimation of the entire mechanical chain, mirroring the general degree of rural modernization.

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Table 1. Smart Agriculture Cloud Platform System

Author	Year	Technology	Application
Rahul Dagar, SubhranilSom, Sunil Kumar Khatri	2018	IOT	-poly house
Mahalakshmi, J., Kuppusamy, K., Kaleeswari, C., & Maheswari	2019	Iot	horticulture
ching-ju chen1 ya-yu huang2yuan-shuo li2 chuan-yuchang (and yueh-min huang	2020	IOT image processing with natural sensors	
JialeJiang ,Qiaofeng Zhang, Xia Yao	2020	Image processing sensors yield development	
Alahi, M. E. E., Xie, L., Mukhopadhyay, S., & Burkitt, L.	2017	nitrate sensor	surface and groundwater
xihaizhang ,zhanyuancao, and wenbin dong	2020	Edge processing and Agrarian IoT AI, blockchain, and VR/AR.	Review
Zhao Liqiang, Yin Shouyi, Liu Leibo, Zhang Zhen, Wei Shaojun	2011	Cloud iot	Crop field monitoring
Yingli	2011	WSN-cloud	Environment monitoring
Shruti	2016	Cloud -IOT	agricultural field monitoring
Keerthi.v ,	2015	Cloud -sensors	nursery Monitoring
Rajalakshmi.	2017	IoT-cloud	Crop-Field Monitoring

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			Irrigation Mechanization
BaltejKaur ,	2016	IOt-cloud	Review
G. Parameswaran,	2016	IoT-cloud	Smart Drip Irrigation System
Bouzekri	2015	IOT-cloud	Irrigation System
S.Reshma	2016	IOT-cloud -sensor	Automatic Irrigation System
R.Hemalatha,	2016	IoT-cloud	Irrigation System
MilošBrajovi	2015	IOT-cloud	Smart Irrigation Software-review
Nikesh Gondchawar	2016	IOT-cloud -sensor	Temperature
Gayathri.R,	2016	IOT-cloud	Conservation of Water in Agricultural Fields□
] Srisruthi.S, N.Swarna, G.M.Susmitha Ros, Edna Elizabeth	2016	IoT-cloud	□Sustainable Agriculture
C.Thulasi Priya, K.Praveen, A.Srividya	2013	IoT-cloud	monitoring Pest Insect Traps
Shalini D V ,	2016	IOT-cloud -sensor	Automatic Pesticide Sprayer
Aravind R, Daman M, Kariyappa B S	2015	IOT-cloud -sensor	Automatic Weed Detection
Fiona Edwards Murphy_, Michele Magnoz	2019	IOT-cloud-sensor	Smart Beehive
SinungSuakanto	2016	IOT-cloud-sensor	Smart Irrigation Controlling System for Green Roofs
Joaquín Gutiérrez,	2016	IOT-cloud-sensor	Irrigation Sensor
Tanmay Baranwal ,Nitika , Pushpendra Kumar Pateriya	2016	IOT	Smart Security and Monitoring Devices
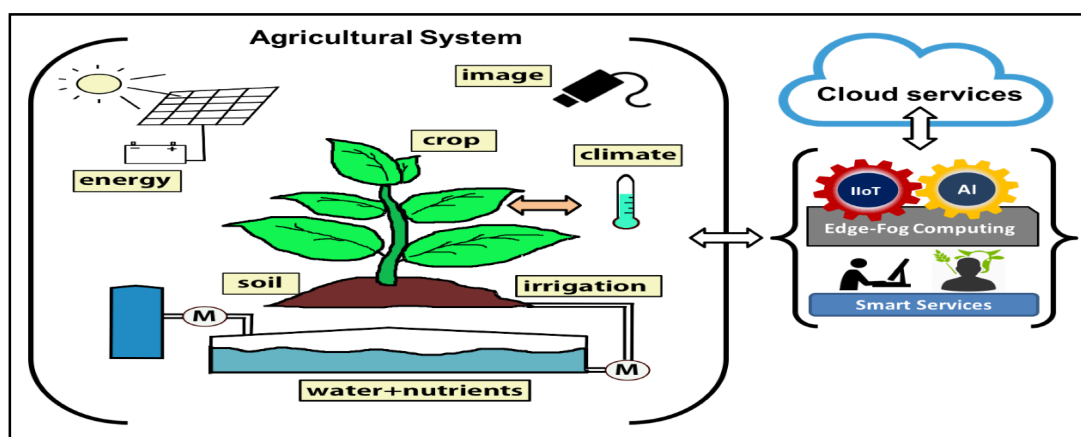
Fig.1. Agriculture System

RESEARCH ARTICLE

Detection and Classification of Diseased and Healthy Citrus Fruit using kNN

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ABSTRACT

In agricultural field timely identification of diseased and healthy Citrus fruit is importantand it is difficult for an unpracticed farmer. The controlling of diseases at field level is missed because of the traditional approach and it may take more time to evaluate. Because an expert need to visit frequently for the identification of the diseases, it is time consuming and expensive for the farmers as well. In this work detection of healthy and diseased Citrus fruit is done by using geometrical feature. Global thresholding Otsu segmentation method is used for the segmentation and classification of data is done by using kNN classifier, and obtained a success rate of 90 % accuracy. Saturation component of HSV is used for the segmentation.

Keywords: Geometrical feature, kNN classifier, Disease, Segmentation.

INTRODUCTION

In agricultural field even the plants are prone to diseases like animals. The [1] Citrus is a small tree which is one of the major crop grown in the tropical, sub-tropical and temperate regions. Citrus fruits play a major role in rendering phytochemicals which are beneficial for the humans. These citrus fruits contain vitamins like vitamin B, Vitamin C, Potassium, phosphorous and other elements, several active compounds extracted from these citrus fruits can be used for the treatment of heart diseases. The citrus fruits are also used for inflammation,anticancer, antibacterial, antifungal and antiviral action.

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LITERATURE REVIEW

Literature survey has been conducted to associate with citrus fruit diseases and significant research works have been carried out by the researchers. In [2] classification of citrus fruit and leaves diseases identification has been conducted by machine learning technique, author proposed work by image enhancement has been done by using filer like Top-hat and Gaussian function to improve the contrast of the image, segmentation is done by using weighted and saliency map method, after segmentation features like geometric, color and texture are extracted, by selecting above features using PCA, skewness and Entropy method. Finally, the classification has been done. In [3] Citrus fruit diseases are spotted by phenotyping is done by using machine learning technique, author proposed fruits are the substance of a healthy diet and occurrence of disease on fruit can cause a significant reduction in production and quality of fruits in agricultural field. Using physical attributes of diseased fruit author proposed a method for the identification of diseases by using methods like K-Means clustering technique, these are used for the segmentation. The classification of diseases is done by using SVM and ANN classifier. In [4] Author proposed a method for the estimation of citrus fruit drop count and mass using machine vision technique, author proposed image enhancement which is done by using retinex algorithm. Segmentation of image has been done by using watershed algorithm, logistic regression, kNN classifier. Bayesian classifier has been used for the classification and obtained 88.1%, 83.6% and 82.9% of accuracy respectively. In [5] identification and classification of citrus fruit diseases are carried out by using two methods, identification of lesion spots on the surface of citrus leaves and fruit. Optimized weighted segmentation has been used, features like color, geometric and texture features are bonded in a code book. Selecting the finest features by hybrid feature selection method like PCA score, entropy and skewness based covariance vector M-SVM classifier are used for the classification and obtained results is 97% for image gallery data set, for combined data sets obtained accuracy is 89% and for local data sets 90.4% of accuracy.

Proposed Work

In this work, global Otsu segmentation method is used for the segmentation process. The feature extraction has been done by Geometrical features like Minor Axis, Major Axis, Area and Perimeter of diseased part of citrus fruit. kNN classifier has been used for classification of healthy and diseased citrus fruit. A typical step for the proposed methodology is shown in figure 1.

Image Acquision

Images have been taken under controlled environment with white background so that the fruit object is fills the camera view clearly and the images are shown in figure 2 and 3. The images were taken with Sony digital camera with 18.1 megapixels.

Image Pre-Processing

Pre-processing is the most preliminary step before segmentation. In this proposed work images are resized to 300 X 300 to improve the accuracy of an algorithm. Images are converted into RGB to HSV component, individual HSV components are extracted for an image.

Image segmentation

In image processing and pattern recognition segmentation is the most important task, separating of an images into group of pixels based on similarity measurement is called as segmentation. It helps to extract the features from segmented image based on the interested area which is considered for the experiment. In this proposed methodology Saturation (S) component is used for the segmentation and global Otsu segmentation method is used for the segmentation, binary segmented images of healthy and diseased citrus fruit. Images are shown in figure 4 and 5 respectively.

Feature Extraction

Feature extraction is done by using connected component. The image data reduced by measuring certain properties of each segmented region. for classification of healthy and diseased citrus fruits below mentioned geometrical features are extracted.

Area: The number of pixels in the shape of the diseased area [6]. In proposed feature extracted attribute, area which calculates the area of infected region that area will differentiate from healthy and diseased segmented images.

Minor Axis Length: The minor axis is drawn perpendicular to the major axis wherethis line has the maximum length. Once the end points of the minor axis have been found, its length is given by the same equation as the major axis length. It is also called the object width [6]. In proposed attribute the length of the diseased segmented part will be considered, because the diseased images have round or circle shape or sometimes in diamond shape. In an healthy fruit there is no spot like diseases so that When compared to healhy images are shorter in length compared to diseased segmented images length, so weconsidered Minor Axis as one of the attributes.

Major Axis Length: Extended two points in the segmented object where the straightline drawn in between these two points is the longest is called as major axis. Major axis iscalculated by all possible groupings of perimeter pixels, where the line is the extended. Themajor axis is length calculated by eq. (1).

$$\text{Major Axis Length} = \sqrt{(ma_2 - ma_1)^2 + (mb_2 - mb_1)^2} \qquad (1)$$

Where (ma_1, mb_1) and (ma_2, mb_2) are the coordinates of the two end points of the majoraxis [6]. In proposed attribute the width with respect to the segmented image is the difference in healthy and diseased segmented image. Centre part of the diseased images are more widen, so Major Axis can be considered as one of the attribute.

Perimeter: Perimeter is an important feature of an object. Contour based features which ignore the interior of a shape, depend on finding the perimeter or boundary points of the object [6]. The perimeter of an object is given by the integral as follows:

$$T = x(t) + y(t)dt \qquad \textbf{(2)}$$

Classification

Authors have used supervised classifier for classification of healthy and diseased citrus fruit. [7,8] Training data set has a pair of order set of features and corresponding labels. Let's say hx is a feature vector and yi is the corresponding label vector. In training data set label is known where as in testing set label in unknown. kNN classifier at first determines k nearest neighbors and then determines labels for the sample based on neighbor weight. Let us say a training set D is having xi training samples. The training and testing features are normalized to [0,1]. The training samples are labeled with the class label y_0. The objective is to classify testing sample q for each $xi \ \varepsilon \ D$ and the distance between q and xi iscalculated using equation (3).

$$d(q, x_i) = \sum_{f \varepsilon F} w_f \delta(q_f, x_{if}) \qquad (3)$$

The equation for finding k nearest neighbors is selected for continuous and discreteattributes is given below.

$$\delta(q_r, xi_r) = \begin{cases} 0 & f \quad discrete \ and \ q_r = x_{if} \\ 1 & discrete \ and \ q_f \neq x_{if} \\ |q_f - x_{if}| & f \quad continuous \end{cases}$$

(4)

These are variety of methods for identifying *k* nearest neighbors to determine the class. The most popular method is majority rule for assigning a label to unknown sample

EXPERIMENTAL RESULTS

In this proposed method, the healthy and diseased citrus fruits images are gathered by 18.1-megapixel digital camera, original images are resized to 300 X 300-pixel resolution to improve the accuracy of a proposed algorithm. Primarily images are converted into RGB to HSV component, using saturation component of HSV segmentation is carried out for the segmentation Otsu segmentation method has been used. Geometrical features are extracted and using kNN classifier classification has been done and obtained accuracy is 90%. In [8] author proposed a method for detection and classification of Blast and Brown Spot diseases on the surface of paddy leaves. Global Otsu segmentation method has been used and kNN classifier used for the classification and obtained result is 76.59% accuracy.

CONCLUSION

In this paper detection and classification of healthy and diseased citrus fruit is done. RGB images were converted into HSV images, saturation component of HSV is used for the segmentation. For the detection of healthy and diseased citrus fruit geometrical features like Minor Axis, Major Axis, Area and perimeter features were extracted and using kNN classifier classification has been done. The plant disease may be broadly classified into three types. They are bacterial, fungal and viral diseases [9]. In this paper healthy and diseased fruit detection have been done. The future work can be done considering the above mentioned three types of diseases.

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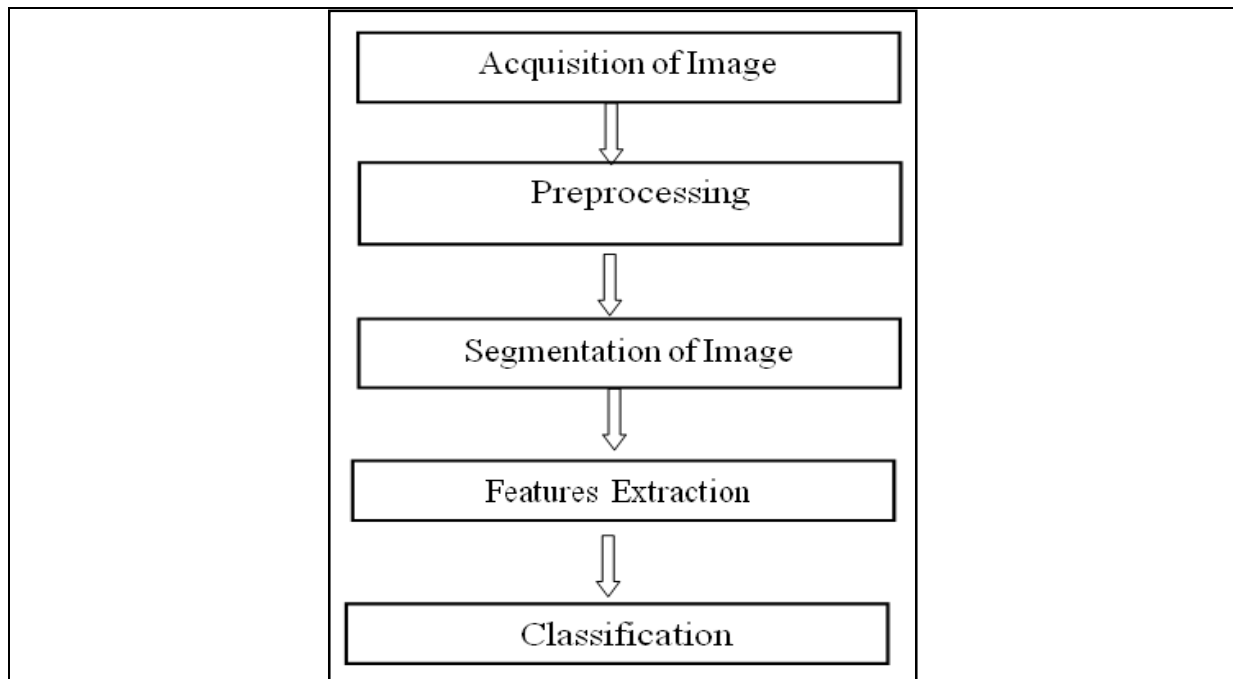
Fig. 1. Typical work flow for proposed methodology
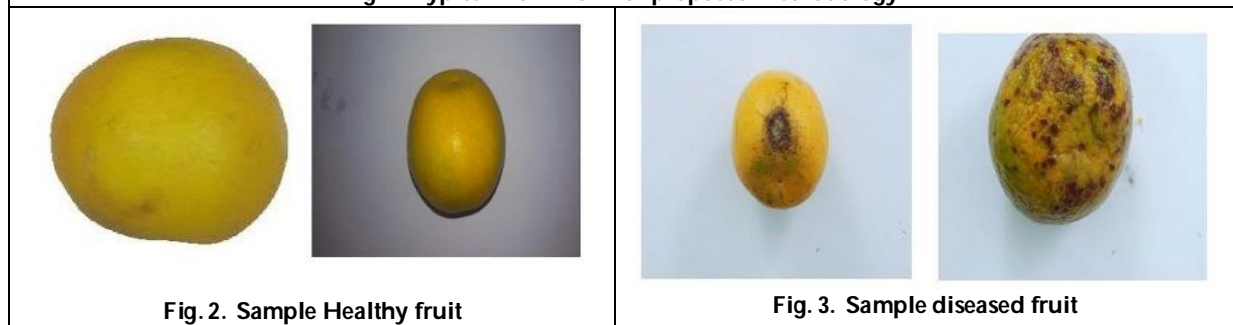
Fig. 2. Sample Healthy fruit

Fig. 3. Sample diseased fruit
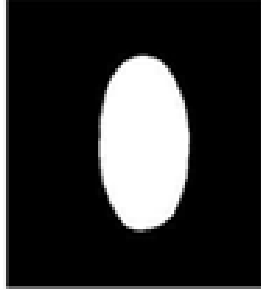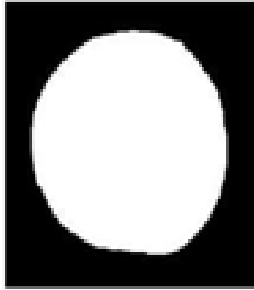
Fig.4. Binary Segmentation Results of healthy citrus fruit
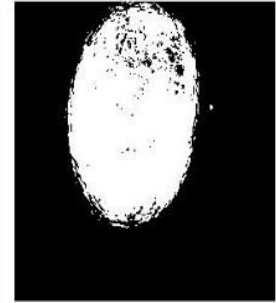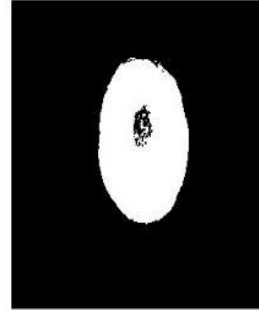
Fig. 5. Binary Segmentation Results of Diseased citrus fruit

RESEARCH ARTICLE

Core Level Spectra Prediction of Zinc Oxide using First Principles Method

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ABSTRACT

We have reported the core level spectra of zinc oxide using density functional theory simulation using CASTEP module in BIOVIA Material studio. A supercell of 32 atoms of ZnO is being considered for the core level spectra simulation. For Zn 1s, at nearly 10eV the satellite peak is detected and at 22eV and 40eV the peak broadening occurs. But for O 1s, at 10eV a satellite peak is detected whereas at 25eV we obtain a small peak and the peak broadening happens at 40eV again. The variation in the two peaks is owing to the spin orbit interaction.

Keywords: Zinc Oxide, Core Level Spectra, Density Functional Theory

INTRODUCTION

Density Functional theory [1] based on first principles method provides a strong and dependable basis for calculations of core-level spectra [2]. Recently Bethe Salpter equation [3] has been found very significant in this kind of calculation. In this kind of simulation due to the electron-hole lifetime spectra broadening has been considered an important impact on the simulation. Still experimental results are found to be successful in the prediction of theoretical results based on a solid density functional theory base. For this, we need methodical observations of core-level effects. Quantitatively the strength of the core hole can be predicted in various materials which can help us in the simulation of core-level spectra. The significant experimental results with an explanation for the spectrum can be accurately using Density Functional theory with ground state energy calculation [4]. But sometimes the core hole is necessary to be included with the simulation process.

Simulation Details

We have used the CASTEP [5] module in BIOVIA Material studio to calculate the spectroscopic properties of various materials which is due to the transition of electrons from the core level in the conduction band. We can also predict the properties due to the electronic transition from the valance band to a core level. Both types of transitions are

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designated as x-ray absorption and x-ray emission respectively. Several experiments can be performed and their results can be analyzed properly. If core level spectra can be included in the simulation. The core level spectroscopic method can present a complete picture of a localized electronic structure the nucleus of an atom. The experiments which are dependent on angles provide the different state in the state which involves orbitals. From all these simulation data the completely symmetric states can be well studied in which the direct consequence is from the chemical bonding. This simulation process is based on the Quantum mechanical method. Here we have used a conventional unit cell of Zinc oxide which contains 8 atoms showing the FCC structure of the crystal lattice. For easier calculations, we have used the primitive lattice which entirely uses the full symmetry. Here we have used on the fly ultra-soft pseudopotential [6] for the calculation of the core level spectroscopy. We have set the energy range to 30eV which indicates that it allows the energy levels up to 30ev above the Fermi level. The core hole contribution can be simulated when we create a supercell of a very large size. In this case, we have used a supercell of 32 atoms. The large size supercell is a benefit of reducing the artificial interactions between periodic images of the atoms which contain the core holes. We have created 2 different core holes both using Zinc and Oxygen imposing the proper symmetry. The 1s spectrum corresponding to the core level spectrum [7] of a core electron in the 1s orbitals. The required energy observed during the creation of the core hole is simulated by an absorption spectrum. Similarly, an emission spectrum will reflect the energy of an x-ray photon emitted during the relaxation of the core hole back to the ground state. The smearing applied by CASTEP is the Gaussian broadening of the results. For this kind of system unpolarised incident radiation will produce the same core level spectrum.

RESULT AND DISCUSSION

This analysis of the core level spectroscopic properties of ZnO [8] with and without considerations of core hole effects has provided us with two spectra. Fig 3 indicates the variation between intensity and the energy (eV) for ZnO [9]. At nearly 10eV the satellite peak is observed and at 22eV and 40eV the peak broadening happens. In fig 3 both the curves have a similar representation. Similarly, Fig 4 has shown core-level spectra for oxygen 1s. In the Red curve the core-hole effect has been considered where at 10eV a satellite peak has been obtained. At 25eV we obtain a small peak and the peak broadening happens at 40eV. It also indicated the division at two different binding energy because of the spin-orbit coupling. There is an additional increment in the intensity whenever we consider the curve without a core level spectrum.

CONCLUSION

We have successfully simulated the core level spectra in ZnO using the CASTEP module in the BIOVIA material studio. We have achieved a difference in the intensity spectrum in the core level in oxygen 1s. Two different peaks are obtained in each of the curves in the presence of the spin-orbit interaction.

ACKNOWLEDGMENTS

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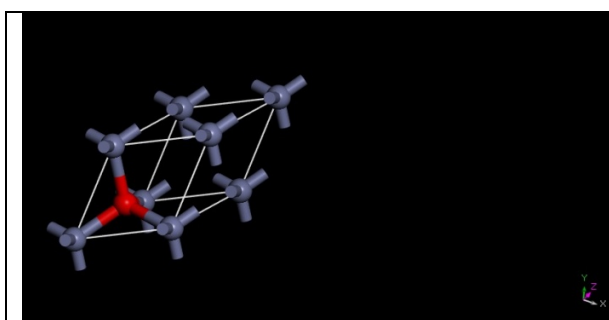
Fig. 1 Primitive lattice of the crystal structure of ZnO (Red dots are showing Oxygen atoms, and Blue dots represents Zinc atoms).
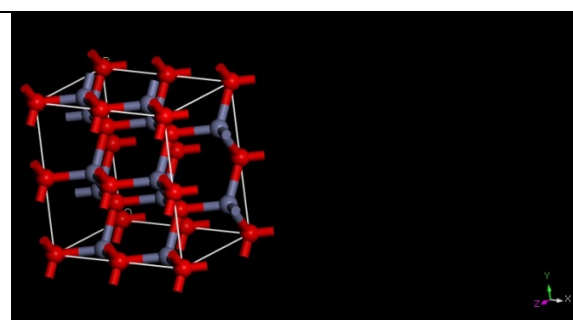
Fig. 2 A supercell of 32 atoms of ZnO (Red dots indicating Oxygen atoms and Blue dots representing Zinc atoms)
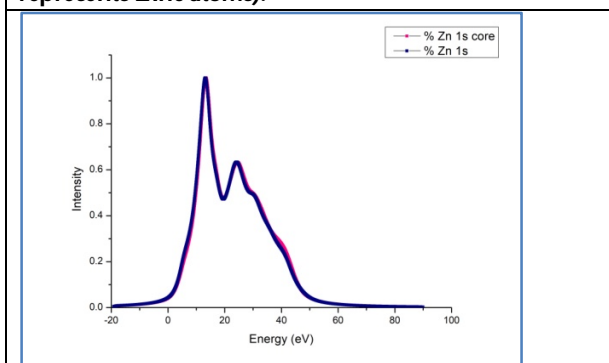
Fig. 3 Core level spectra of Zinc (Red curve representing the spectrum with consideration of core hole effects and the Blue curve representing the spectrum without consideration of core hall effect)
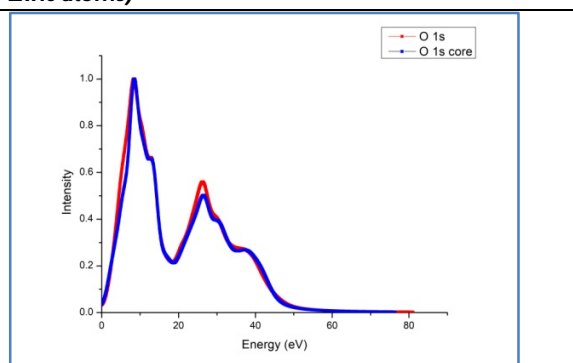
Fig 4 Core level spectra of Oxygen [10] (Red curve representing the spectrum with consideration of core hole effects and the Blue curve representing the spectrum without consideration of core hall effect)

RESEARCH ARTICLE

Biomedical Image Compression using Convolutional Recurrent Neural Network & Long Short-Term Memory

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ABSTRACT

Biomedical image compression is an extremely important part of modern computing. As scanners produce higher-resolution and more densely sampled images, this raises the challenge of data storage, transmission and communication within healthcare systems. Since the quality of medical images plays a crucial role in diagnosis accuracy, medical imaging compression techniques are desired to reduce scan bitrate while guaranteeing lossless reconstruction. In this work a robust image compression method is proposed based on a Convolutional Recurrent Neural Networks (CRNN) & Long Short-Term Memory (LSTM). Recently Machine learning has achieved tremendous success in various domain of image processing. Further due to large increase in image data, the research activities in image compression continue to preserve bandwidth or storage resources. This paper focuses on research on the combination of traditional compression algorithms and machine learning techniques. Both compression and learning algorithms are discussed, providing background and reasoning for their combination. This help to understand the current trends and future scope in image compression using machine learning.

Keywords: Image compression, Machine Learning, PCA, SVM, CNN

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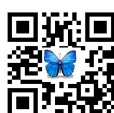
INTRODUCTION

Big data is not only limited to size of the data, the properties such as volume, velocity, and kind are to be considered [1]. In medical application, high resolution medical image are required with huge size in high resolution. For example, 600 MB to a gigabyte (GB) of data is required by a latest CT scanner which generate a sub-millimeter slice thickness with enhanced in plane resolution [2]. The problem is the very large amount of data contained in an image can quickly saturate conventional systems. In modern computing, image compression is important. The compression enables a reduction in the required storage space for computer memory during image saves. This provides easier transmission and is less time-consuming. The creation of a novel technology that strikes a balance between image quality and compression ratio is a difficult task. In fact, the authors of [3] provide a novel notion and method for all these processes. In this paper, we look at the compression stage and propose a machine learning-based image compression strategy for vector quantization. There are two types of compression: lossless compression (reconstructed data is identical to the original) and lossy compression (reconstructed data is not like the original) (loss of data). However, because compression rates are so low, lossless compression has limited value [4]. The lossy compression approach has a high compression ratio. Lossy compression algorithms are often based on orthogonal transformation [5-11]. Orthogonal transformation, vector quantization, and entropy encoding are three phases in many lossy compression techniques [12]. Quantization is a crucial stage in image compression. Scalar quantization and vector quantization are two methods for performing the quantization step. The optimum performance can be attained by employing vectors rather than scalars, according to Shannon's distortion factor calculations [4,6]. As a result, codebook design affects the efficiency and performance of vector quantization (VQ)-based processing systems. In image compression, the quality of the reconstructed images depends on the codebooks used [13]. In this work a robust image compression method is proposed based on a Convolutional Recurrent Neural Networks (CRNN) & Long Short-Term Memory (LSTM).

Literature Review

Medical images are becoming increasingly crucial in proper diagnosis by physicians, thanks to the rapid development of the modern medical sector [14]. Many hospitals, on the other hand, are now dealing with massive amounts of data imagery. They relied on organised data in the past. They employ both organised and unstructured data nowadays. To operate efficiently, these hospitals must employ new methods and technologies such as virtualization, big data, parallel processing, compression, artificial intelligence, and so on, the most successful of which is compression. The purpose of a medical image is to keep the diagnostics-related information compressed at a high compression ratio.It's worth noting that various articles have been published demonstrating that the techniques used to compress data are becoming more effective. As a result, Lu and Chang offered a glimpse of recently developed systems in [15]. Mean distance ordered partial codebook search (MPS), improve LBG (Linde, Buzo, and Gray), and several intelligent algorithms are among the approaches mentioned.

Recurrent Neural Network (RNN)-based architectures have also been employed for full-resolution image compression [16], which was partially adapted by [17] using a non-recurrent framework to compress mammography pictures of 256 x 256 resolution. On the Kodak dataset, Toderici et al. [16] demonstrated that their RNN-Conv based algorithms outperform JPEG compression over a range of bit rates, outperforming JPEG compression in terms of compression rate, loss, and similarity. In this paper, we present a deep learning architecture based on RNN-Conv that beats Toderici et al. [16] in a medical picture compression test. We draw comparison with the best performing LSTM one-shot framework proposed by [16] in terms of similarity and signal to noise ratio.

Many more approaches have recently been presented to attain a higher compression ratio by merging Neural Networks (NN) with other methodologies [18-20]. However, none of these methods have been able to achieve the needed ideal compression ratio. [21] proposes a new image compression method that combines bipolar coding with NN. The fundamental goal of bipolar coding in this case is to obtain greatest similarity between the original and

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reconstructed image pixel values. Through bipolar coding, the image's decimal values are turned into binary code words. This method yielded a high compression ratio while maintaining image quality. A comparable methodology for Genetic Algorithm (GA) with NN is described in [22]. The focus of this method is on GA, which is used to classify and map tiny data.

Performance Evaluation Metrics

There are eight parameters to evaluate the performance of the Image Compression algorithms are Mean Square Error (MSE), Maximum Absolute Error (MAE), Peak Signal to Noise Ratio (PSNR), Mean Structural Similarity (MSSIM) Index, Universal Image Quality (UIQ) Index, the Compression Rate (CR), the compression time (CT) and decompression time (DT).

The MSE and PSNR are defined [23,24] in eq. (1).

$$MSE = \frac{1}{M*N} \sum_{i=0}^{M-1} \sum_{J=0}^{N-1} \left(I_0(i,j) - I_r(i,j) \right)^2 \tag{1}$$

With I_0 the image to compress and I_r the reconstructed image and (*M, N*) the size of the image. The PSNR is given in eq. (2).

$$PSNR = 10\log_{10}\left(\frac{255^2}{MSE} \right) \tag{2}$$

The MSE represents the mean error into energy. It shows the energy of the difference between the original image and the reconstructed image. PSNR gives an objective measure of the distortion introduced by the compression. It is expressed in deciBels (dB). Maximum Absolute Error (MAE) defined by (3) shows the worst-case error occurring in the compressed image [25].

$$MAE = \max \left| I_0(i,j) - I_r(i,j) \right| \tag{3}$$

Usually, in practice, MSSIM index allows evaluating the overall image quality. MSSIM is defined [26,27] in eq. (4).

$$MSSIM(I_0, I_r) = \frac{1}{M} \sum_{J=1}^{M} SSIM(X_J, Y_J) \tag{4}$$

Where *xj* and *yj* are the image contents at the *j*-th local window; and *M* is the number of local windows in the image and $SSIM(x,y) = \left[1(x,y) \right]^{\alpha} . \left[c(x,y) \right]^{\beta} . \left[s(x,y) \right]^{\gamma}$ with $\alpha > 0$, $\beta > 0$ and $\gamma > 0$ are parameters used to adjust the relative importance of the three components. The UIQ Index models any distortion as a combination of three different factors: loss of correlation, luminance distortion, and contrast distortion [28]. It is defined by in eq. (5).

$$Q = \frac{4\sigma_{I_0,I_r} \overline{I_0 I_r}}{\left(\sigma_{I_0}^2 + \sigma_{I_r}^2 \right)\left[\left(\overline{I_0}\right)^2 + \left(\overline{I_r}\right)^2 \right]} \tag{5}$$

In equation (4) and (5) the best value 1 is achieved if and only *Io= Ir*.

The MSSIM, SSIM and UIQ as define above, are the practical index use to evaluate the overall image quality.

The Compression rate (CR) is defined as the ratio between the uncompressed size and compressed size. The CR is given by Sayood K and Salomon D et al., [4,6] in (6) and (7).
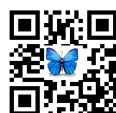
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$$CR = \frac{size\ of\ compressed\ image}{size\ of\ original\ image} \qquad\qquad (6)$$

In percentage form, the CR is given by (16).

$$CR(100\%) = 100 - \frac{size\ of\ compressed\ image}{size\ of\ original\ image} \times 100 \qquad\qquad (7)$$

The compression time and decompression time are evaluated when we start the program in MATLAB. CT and DT depending on the computer used to simulate the program. For the medical image, the goal of the introduced method in this paper is to maintain the diagnostic-related information at a high compression ratio. The medical applications require saving many images taken by different devices for patients in large numbers and for a long time.

Dataset

This NIH Chest X-ray Dataset is comprised of 112,120 X-ray images with disease labels as shown in Figure 1 from 30,805 unique patients and was originally collected for automated lung disease classification tasks. This dataset contains enough data variability and diagnostic complexity, which makes it suitable for performing image compression and reconstruction experiments for the evaluation of the proposed architecture.

Recurrent Neural Networks (RNN)

The RNN is experiential as a group of Feed forward Neural Network (FNN), where the hidden neurons of the preceding time step are connected to the hidden neurons of the subsequent time step. Hidden neurons *Ht* are acquired by combining the weight of the preceding repetition cycle *Wh* with the weight of the current input information *Wx.* And so on, this procedure will prolong the next time repetition cycle. In this way, the RNN can take advance of chronological information but not consider the signal as a combination of secluded points. The output of the existing repetition epoch is based not only on the existing input, but also on the information of the preceding repetition epoch. In Figure 2 the configuration of the many-to-one RNN model is exposed.

X is the input and *H* is the vector of hidden layer:
$$H_t = tanh(W_h H_t - 1 + W_x X_t) \qquad\qquad (1)$$

According to the chain rule, the network loss gradient is
$$\frac{\partial E_k}{\partial W} = \frac{\partial E_k}{\partial H_k}\frac{\partial E_k}{\partial H_{k-1}} \cdots \frac{\partial H_2}{\partial H_1}\frac{\partial H_1}{\partial W} = \frac{\partial E_k}{\partial H_k}\left(\prod_{t=2}^{k}\frac{\partial H_t}{\partial H_{t-1}}\right)\frac{\partial H_1}{\partial W} \qquad\qquad (2)$$

and derivative is
$$\frac{\partial H_t}{\partial H_{t-1}} = tanh'(W_h H_{t-1} + W_x X_t) \cdot \frac{d}{dH_{t-1}}[W_h H_{t-1} + W_x X_t]$$
$$= tanh'(W_h H_{t-1} + W_x X_t) \cdot W_h \qquad\qquad (3)$$

Combining (2) and (3)
$$\frac{\partial E_k}{\partial W} = \frac{\partial E_k}{\partial H_k}\left(\prod_{t=2}^{k} tanh'(W_h H_{t-1} + W_x X_t) \cdot W_h\right)\frac{\partial H_1}{\partial W} \qquad\qquad (4)$$

Concurring to *Wh* and *tanh<1, (tanh'(Wh Ht-1 + WxXt) ·Wh)* may be less than 1 or greater than 1, which will cause the gradient to vanish or detonate. Even if *K* is not large the concluding gradient may rapidly get misshapen due to the multiplication effect, depending on the random weight initialization. This is the reason RNN can be flimsy and vulnerable to initialization. Also, a much smaller or larger gradient can extensively change the weight update of the network, making it hard to unite this problem is called vanishing and exploding gradient.

Long Short-Term Memory (LSTM)

The Long Short-Term Memory is a type of a Recurrent Neural Network (RNN). Normally, recurrent neural networks have 'short term memory' in that they use persistent preceding information to be used in the existing neural

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network. Basically, the *preceding information is used in the current task*. If the quandary requires long term dependencies, RNN will struggle to represent it. The LSTM was deliberated to learn long term dependencies. It remembers the information for long periods. However, Nowadays, LSTMs are practical in many learning problems, which vary considerably in range and the environment from the tribulations that these enhancements were initially tested. The fundamental idea behind the LSTM architecture is a memory cell that can preserve its state over time and non-linear gating units that standardize the information flow in and out of the cell [30]. Most contemporary studies integrate many enhancements made to the LSTM architecture since its innovative formulation [31]. The LSTM setup generally used in previous works, was initially been described by Graves and Schmidhuber [31, 33], which uses full gradient training. The structure of a LSTM unit is shown in Figure 3.LSTM, on the other hand, replaces the *tanh* activation with sophisticated gate control in the gradient flow and hence can achieve better stability and performance. LSTM network was proposed to improve the RNN structure [31]. Compared to traditional RNN, LSTM introduces a specially designed LSTM unit to sophisticatedly control the flow of hidden state information from a one-time step to the next.

In LSTM, X_t and H_t are the input vector and the network is hidden state vector at the time repetition epoch*t*, correspondingly. C_t is a vector which is accumulated in the external memory unit. The communication among the unit state vector, the input vector, and the hidden state vector is attained through the forgetting gate (f_t), input gate (i_t) and output gate (o_t). The calculation of forgetting a gate vector is:

$$ft = \sigma(W_f \cdot [H_{t-1}, X_t] + b_f) \qquad (5)$$

where, $[H_{t-1}, X_t]$ is the concatenated vector of the other hidden state vector H_{t-1} and the existing input vector X_t, W_f and b_f are the weight and bias of f_t which are determined by network training, σ is the sigmoid activation function.

The flow of information in the vector C_t is controlled by dot multiplication of elements. The provisional state vector $\widetilde{C}_t$ is computed by:

$$\widetilde{C}_t = \tanh(W_c \cdot [H_{t-1}, X_t] + b_c) \qquad (6)$$

where W_c and b_c are the weight and deviation of f_c, *tanh* is the *tanh* activation function.

The calculation of input gate vector is

$$i_t = \sigma(W_i \cdot (H_{t-1}, X_t) + b_i) \qquad (7)$$

where W_i and b_i are the weight and deviation of I_t. They are determined by network training.

The state of new cell state C_t in the time step t is updated by both forget gate and input gate via pointwise multiplication,

$$C_t = f_t * C_{t-1} + i_t * \tilde{C}_t \qquad (8)$$

The current hidden state is determined by the new state and the write gate O_t. comparable to f_t and i_t , O_t can be written as

$$O_t = \sigma(W_o[H_{t-1}, X_t] + b_o) \qquad (9)$$

Then, hidden state H_t at the current time step t is computed by pointwise multiplying by O_t by *tanh* (C_t):

$$H_t = O_t * tanh(C_t) \qquad (10)$$

The current hidden state H_t is computed with the use of C_{t-1} and H_{t-1} from the preceding time step as well as the existing input $X_t H_t$ is then used by the neural network to compute the output at the existing time step. LSTM neural network inherits the advantages of RNN in dealing with sequential forecast problems and solves the vanishing gradient problem. Therefore, it is chosen as the ideal mathematical model to analyze PD feature variations between various time steps within a cycle.

Convolutional Recurrent Neural Network (CRNN)

Convolutional neural networks are inspired by the interconnectivity of biological neurons in the visual cortex of animals. It is widely deployed in competitive engineering solutions that compare favourably with other methods [33]. On the other hand, Long Short-Term Memory (LSTM) units- a variant of RNNs- has been commonly used in time-series modelling since its inception [31]. Our network consists of 2D Convolutional Recurrent Neural Networks (RNN-Conv) with LSTM units, detailed in [34]. The front-end of the compression sub-network has two branches; one that performs 2 x 2 stride convolution with a 3 x 3 kernel, while the other performs a 2 x 2 pooling operation prior to convolution with a 1 x 1 kernel. The pooling operation prior to convolution ensures that higher level features encapsulating salient properties of the medical images are learned. The outputs of these two branches are then averaged and passed through 3 RNN-Conv layers with kernel size of 3 x 3 and stride 2 x 2 each. The final CNN layer of the encoder is the bottleneck layer that controls the compression ratio (r) via its number of kernels β where, r = 256/ β. The decompression sub-network takes a tensor of shape P x Q x β as input. It starts off by performing a linear combination operation along the depth with a Convolutional layer of 512, 1 x 1 kernels, creating a P x Q x 512 tensor. The tensor is subsequently passed through 4 deconvolution modules each with two input branches. Each branch contains an RNN-Conv layer with kernel size 2 x 2 and 1 x 1 stride. The output from each branch is averaged, following which a depth-to-space (D2S) operation is performed to spatially up sample the data by a factor of 4, while reducing the depth (i.e., an input tensor of size 8 x 8 x 512 is rearranged to an output of size16 x 16 x 128). The output from the final deconvolution module undergoes another linear combination operation to form the final reconstructed image.

RESULTS & DISCUSSION

A successive 2D LSTM convolutions is used to perform compression, and a binarize is used to convert the information. A decompression subnetwork is also used in 2D LSTM convolutions. There is no consensus in the image compression literature on which performance metric best correlates with human perception. In this work Mean Square Error (MSE), Structural Similarity Index Metric (SSIM) and Peak Signal to Noise Ratio (PSNR) is used to evaluate the performance of the system. Based on the performance evaluation metrics the results are compared with the performance of JPEG, JPEG 2000 for a compression ratio of 2, 4 & 8 on both 128 x 128 and 256 x 256 test sets in Table 1 & 2. It is observed that MSE, PSNR & SSIM is increased for the proposed method.

CONCLUSION

In this work a robust image compression method is proposed based on a Convolutional Recurrent Neural Networks (CRNN) & Long Short-Term Memory (LSTM). NIH Chest X-ray Dataset is used in this work. The performance evaluation metrics such as Mean Square Error (MSE), Structural Similarity Index Metric (SSIM) and Peak Signal to Noise Ratio (PSNR) is used to evaluate the performance of the system. Based on the performance evaluation metrics the results are compared with the performance of JPEG, JPEG 2000 and it is observed that the quality metrics of MSE, PSNR and SSIM illustrates an improvement for the compressed data.

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Table 1. Performance Evaluation for Image Segment of size 128 x 128

Iteration	JPEG			JPEG 2000			CRNN			LSTM			CRNN+LSTM		
	MSE	PSRN	SSIM	MSE	PSRN	SSIM	MSE	PSRN	SSIM	MSE	PSRN	SSIM	MSE	PSRN	SSIM
10	0.69	38.71	1.21	0.69	38.94	1.28	0.67	39.03	1.34	0.62	39.51	1.54	0.59	39.83	1.64
30	0.65	36.06	1.15	0.64	37.31	1.42	0.61	38.73	1.82	0.52	38.91	1.91	0.49	38.94	2.02
50	0.53	37.11	1.31	0.49	37.89	1.57	0.44	38.03	1.77	0.41	38.71	1.91	0.39	38.69	2.31
70	0.71	38.03	1.71	0.67	38.41	2.21	0.64	38.91	2.91	0.59	39.03	3.02	0.54	39.84	3.45
90	0.74	38.08	1.51	0.58	38.98	2.28	0.53	39.04	2.98	0.45	39.56	3.05	0.41	39.83	3.68

Table 2. Performance Evaluation for Image Segment of size 256 x 256

Iteration	JPEG			JPEG 2000			CRNN			LSTM			CRNN+LSTM		
	MSE	PSRN	SSIM	MSE	PSRN	SSIM	MSE	PSRN	SSIM	MSE	PSRN	SSIM	MSE	PSRN	SSIM
10	0.67	38.91	1.28	0.68	39.02	1.34	0.62	39.51	1.54	0.59	39.83	1.64	0.58	40.02	1.75
30	0.63	36.84	1.42	0.65	39.04	1.82	0.52	38.91	1.91	0.49	38.94	2.02	0.47	39.25	2.85
50	0.55	37.61	1.57	0.52	37.56	1.77	0.41	38.71	1.91	0.39	38.69	2.31	0.37	39.85	2.55
70	0.69	38.52	2.21	0.71	38.41	2.91	0.59	39.03	3.02	0.54	39.84	3.45	0.51	40.68	2.68
90	0.71	38.72	2.28	0.61	39.35	2.98	0.45	39.56	3.05	0.41	39.83	3.68	0.39	40.75	3.95

Figure 1. Sample X ray image in the Dataset	**Figure 2. The configuration of the many-to-one RNN model.**
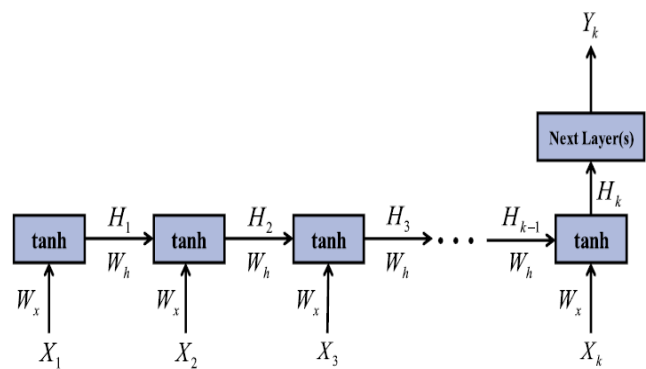
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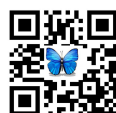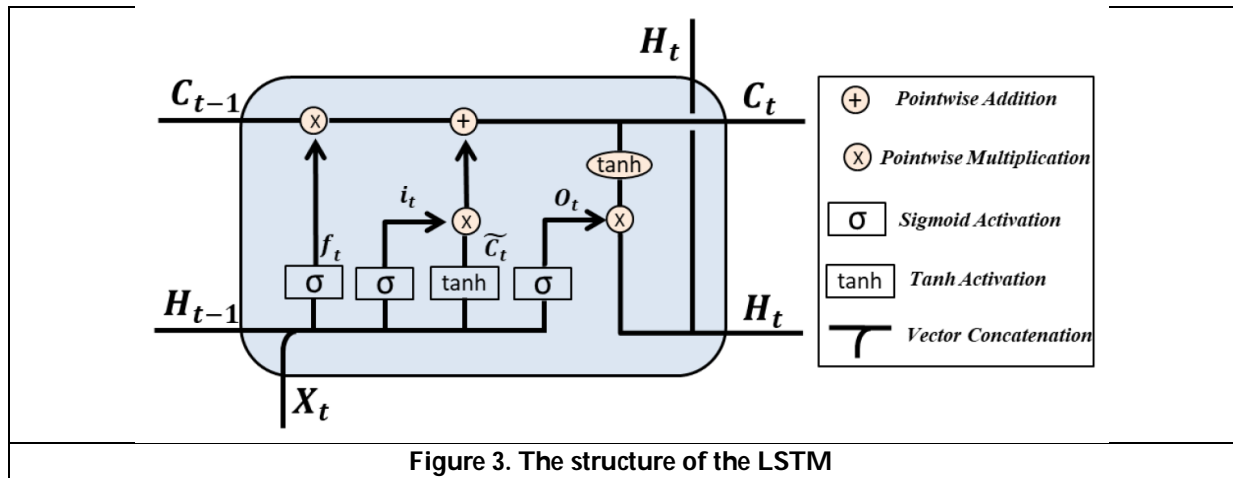
Figure 3. The structure of the LSTM

RESEARCH ARTICLE

Synthesis, Characterization and Biological Applications of 4-(4 hydrazino-phenyl-diazenyl)-4h-(1, 2, 4) triazole-3, 5-dithiol and its Metal Complexes

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ABSTRACT

Azo compounds are important groups of compounds synthesized using diazonium salts as intermediates. The present study involves the synthesis of the ligand by carrying out the diazotization of 4 - amino - 3, 5 - dimercapto - 1, 2, 4 - triazole and coupled by the phenyl hydrazine at freezing temperature. The first row transition metal complexes like Co (II), Ni (II), Cu (II), and Zn (II) were reacted with a novel ligand 4-(4-hydrazino-phenyl diazenyl) - 4H - (1,2,4) – triazole - 3, 5 - dithiol and characterized by using various spectro-analytical techniques like elemental analysis, FTIR, NMR, Mass and UV-visible spectral studies. The spectral data suggest the octahedral geometry for the metal complexes and metal to ligand stoichiometry was 1: 2 in all complexes. The newly synthesized ligand and complexes have been assessed for their growth-inhibiting potencies against fungal (*Candida albicans* and *Aspergillus niger*) and bacterial strains (*Escherichia coli* and *Staphylococcus aureus*).

Keywords: Azo compounds, Diazotization, Phenyl diazenyl, Triazole, Metal complexes

INTRODUCTION

The azo coupling reactions of arene diazonium ions are among the oldest and most widely studied reactions in organic chemistry. But heterocyclic diazonium compounds have only become known in more details fairly recently [1]. Azo compounds are important groups of compounds synthesized using diazonium salts as intermediates. Different azo compounds and their metal complexes have shown notable bioactivity as chelating therapeutics, drugs, inhibitors of enzymes, etc, [2]. Azo compounds are widely used in textile, cosmetics, fiber, and paper printing

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industries [3, 4]. Diazotization of aromatic amines depend upon the nature and position of substituent's in the nucleus as affecting the basicity of the amine.

Heterocyclic diazonium salts play as synthetic intermediates for the preparation of compounds with pharmaceutical value. The nitrogen containing heterocyclic compounds are triazole, pyrazole, and imidazoles, etc, [5, 6]. The chemistry of Triazoles and its derivatives have great interest due to their biological importance. The present work includes the synthesis, and characterization of metal complexes with new ligand 4-(4-hydrazino-phenyl diazenyl) - 4H - (1, 2, 4) – triazole - 3, 5 - dithiol from the diazotization of the 4-amino-3, 5-dimercapto-1, 2, 4-triazole.

MATERIAL AND METHODS

General Information

The chemicals used in synthesis which were AR grade and used as supplied from the Sigma-Aldrich, Merck, and SD Fine Chemicals without any further purification. Melting points were determined on an electro thermal capillary melting point apparatus and were uncorrected. The Completion of the reaction as well as purity of the compounds was tested by Thin Layer Chromatography (TLC). The characterizations of the synthesized compounds were done by Elemental analysis, Infra Red (IR), Ultra Violet (UV), Nuclear Magnetic Resonance (NMR) and Mass Spectrometry (MS). The elemental analysis obtained from the Unicube CHNS analyzer and the IR spectra of the ligands & complexes were obtained by the KBr pellet method on a Perkin Elmer-Fourier transmission infra red (FTIR) spectrometer and Electronic spectra were recorded using the Ocean Optics USB UV-visible Spectrometer. The ^{1}H NMR spectrum was recorded using CDCl$_3$ as a solvent on Bruker 400 MHz spectrometer with Tetra Methyl Silane (TMS) as internal standard (Chemical Shift in δ ppm). A mass spectrum was recorded on LCMS on Shimadzu Mass Spectrometer.

General Procedure
Synthesis of 4-Amino-3, 5-Dimercapto-1, 2, 4-Triazole (2.2a)
A mixture of thiocarbohydrazide (1mmol) and carbon disulfide (2mmol) was refluxed in pyridine (75-100ml) for 1 h, yellow-colored solid separated was filtered and dissolved in 20ml of hot water followed by the drop by drop addition of concentrated hydrochloric acid (3ml), and the solid was separated and recrystallized using distilled water [7].

Synthesis of Azo dyes (4-(4- hydrazine-phenyl-diazenyl)-4H-[1, 2, 4] triazole-3, 5-dithiol
The 4 - amino - 3, 5 - dimercapto - 1, 2, 4 - triazole (2mmol) was dissolved in concentrated hydrochloric acid (5 - 6ml). The solution was cooled in the freezing mixture and to this, a cold solution of NaNO$_2$ (2 mmol) was added drop - wise with stirring and the reaction was stirred for 3 h at 0 – 5^{0}C. The cold diazonium salt solution was then added to the coupling agent phenyl hydrazine (2mmol) and the stirring was continued for another 2 h. Thus, obtained colored solid was filtered off, washed with distilled water, dried, and recrystallized using absolute ethanol.

Synthesis of Complex
The ligand 4-(4- hydrazine-phenyl-diazenyl)-4H-[1, 2, 4] triazole-3, 5-dithiol (2mmol) was dissolved in 20ml methanol in a dry round bottom flask. The metal salts (Co (II), Ni (II), Cu (II) & Zn (II) acetates) were dissolved in a minimum amount of methanol. To this methanolic solution of metal salt (1mmol), the hot solution of ligand was added drop wise. The reaction mixture was refluxed for 4 h. The solid separated was filtered off, washed with cold methanol, and dried.

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RESULTS AND DISCUSSION

Scheme of the Present Work
Present scheme of the work has shown in the Figure 1.

Elemental Analysis
All the compounds were analyzed for carbon, hydrogen, nitrogen, and sulphur on a CHNS analyzer. The estimation of metal in complex was carried out by a standard method [8]. The Elemental analysis of the synthesized ligand and its complexes as follows in the Table.1

Infrared Spectra
The important bands, and their assignments of 4-(4- hydrazine-phenyl-diazenyl)-4H-[1, 2, 4] triazole-3, 5-dithiol ligand and their complexes are summarized in the Table 2 and the IR spectrum was presented in the Figure 2. The band appears at 3344 cm^{-1} is due to the N-H group, at 3134 cm^{-1} is due to aromatic C-H, S-H group observed at 2822 cm^{-1}, and 758 cm^{-1} for the C-S bond present in the compound [9]. The band at 1594 cm^{-1} observed due to N=N (azo group) vibrations, in complexes this vibration band is slightly moved to lower wave number [10] at 1586 – 1530 cm^{-1}. New peaks were observed in metal complexes around 443 - 494 cm^{-1} and, 403 – 414 cm^{-1} due to the formation of M-N and M-S groups respectively [11, 12].

NMR Spectrum
The exhibited signal of all protons of the ligand was due to hetero aromatic/aromatic groups are found to be in their expected regions [13] (Figure 3). The NMR Spectrum of the ligand shows the peaks at δ 1.235 ppm (singlet) is due to S-H, δ 3.304 ppm (singlet) is due to N-H, and at δ2.50 ppm is due to amine group present in the ligand and the aromatic protons in the region of δ 6.67 - 7.76 ppm [14].

Mass Spectrum
The mass spectrum of the ligand shows (Figure 4) the molecular weight of the ligand. In this mass spectrum the M^{+1} peak value is 268.64 and the fragmentation takes place at 250.67, 159.22, 131.54 and 97.7 due to loss of amine, phenyl, thionyl, and azo group respectively. Whereas calculated molecular weight of the ligand is 267.31.

Electronic Spectra of the Ligand and Complexes
The electronic spectrum of the ligand and complexes were recorded in DMF solvent. The absorption band in the range of 276 nm is ascribed to intra ligand π -π * transitions. The n -π * transition of azomethine functionality is observed at 338 nm and has suffered bathochromic shift upon complexation. This is an indication of coordination of imine nitrogen to the metal ions. The faint pink colored complex (Co complex) has a broad electronic transition centered at 622 nm. This is assigned to $4T_{1g}$ (F) →$4A_{2g}$ octahedral transition [15]. The absorption spectrum of the copper complex has given a d –d electronic band at 696 nm. Absorptions in this region can be ascribed to $2E_g$→$2T_{2g}$ and is octahedral geometry but due to john teller effect the complex showing distorted octahedral geometry [16]. The nickel complex shows absorption bands at the region of 276, 340, 726 nm respectively due to π –π *; n -π *; $3A2g$→$3T1g$ (F) transitions, which in support to octahedral geometry of the complex [17]. And finally, the zinc complex shows two absorption bands at 280, 343 nm these are assigned as π -π *; n -π * transitions. In this there is no d-d transition because Zn has d^{10} electronic configuration [18].

Biological Activities
Antibacterial Activity
The inhibition zone of bacteria was measured by a concentration of the antibiotics to be examined with known concentration of standard drug [19]. The purified synthesized products were screened for their antibacterial activity

by using agar disc diffusion method. The common bacteria's *Escherichia coli* and *Staphylococcus aureus* was used in this method with the concentrations 5μg, 10 μg, 25μg, 50 μg and 75μg. The agar media were prepared in distilled water, and   known concentrations of antibiotics are placed on these agar plates and inoculated uniformly at 37ºC for 18-24 h. In the prepared agar plates the wells were made for sample filling, and these wells were filled with different volumes of samples. All the plates were incubated at 37ºC for 48 h and the diameter of inhibition zone were noted. The results of the ligand and complexes were moderately active against the bacteria. Between the gram positive and gram negative strains the synthesized compounds shown good susceptible growth inhibition activity against *S. aureus.* (Gram positive bacterial strain). These are as follows in the Table 4.

Antifungal Activity

Antifungal activity of the synthesized compounds was done by agar disc diffusion methods using *Candida albicans* and *Aspergillus niger*. The concentrations of the compounds were 5μg, 10 μg, 25μg, 50 μg, and 75μg per millilitre. Initially, the stock cultures of fungi were revived by inoculating in broth media and grown at 37 ^{0}C for 18-24 h. In these prepared agar plates the wells were made for sample filling. These plates were inoculated 24 h with old cultures (100 μl 10^4 CFU) and spread evenly on the plate [20]. After 20 minutes, the wells were filled with different volumes of samples. All the plates were incubated at 37^0 C for 48 h and the diameter of inhibition zone were noted. The synthesized complexes and ligands both exhibited inhibition activity against the fungal strains. The results were shown in the Table 5.

CONCLUSION

The present work describes the synthesis of 4 - (4 – hydrazine – phenyl - diazenyl) - 4H - (1, 2, 4) triazole - 3, 5 - dithiol azo compound and its Metal Complexes. The synthesized compounds were characterized by various spectro analytical techniques. The ratio of metal to ligand is 1:2, is confirmed by the elemental analysis of metal complexes. The electronic absorption spectrum gives the octahedral geometry around metal ion. The synthesized compounds were screened for their biological activity. The ligand and its complexes show good antibacterial and antifungal activities.

ACKNOWLEDGMENT

Conflict of Interest
The authors declare no conflict of interest.

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Table 1: Elemental analysis of ligand and its metal complexes

$S_L.$ No.	Ligand/Complex	C (%) (calculate)	H (%) (calculate)	N (%) (calculate)	S (%) (calculated)	M (%) (calculated)
1.	$C_8H_9N_7S_2$	34.70 (35.95)	3.68 (3.39)	35.96 (36.69)	23.12 (23.95)	-
2.	$(C_8H_9N_7S_2)_2$ Co	31.74 (32.38)	3.41 (3.05)	32.82 (33.04)	20.09 (21.57)	9.16 (9.93)
3.	$(C_8H_9N_7S_2)_2$ Ni	32.06 (32.39)	2.97 (3.05)	32.65 (33.06)	20.89 (21.58)	9.12 (9.89)
4.	$(C_8H_9N_7S_2)_2$ Cu	31.67 (32.13)	3.36 (3.03)	31.58 (32.79)	21.03 (21.41)	9.94 (10.62)
5.	$(C_8H_9N_7S_2)_2$ Zn	32.16 (32.03)	2.83 (3.02)	32.02 (32.69)	20.77 (21.34)	10.21 (10.90)

Table 2: IR stretching vibrations in cm^{-1}

Sl. No.	Ligand/Complex	N-H	C-H	S-H	N=N	C-S	M-N	M-S
1.	Ligand	3344	3134	2822	1594	758	-	-
2.	Co Complex	3236	3120	2801	1530	731	458	403
3.	Cu Complex	3251	3108	2809	1586	737	472	410
4.	Ni Complex	3230	3123	2816	1544	708	423	406
5.	Zn Complex	3216	3116	2814	1580	715	437	414

Table 3: Absorption bands and their assigned transitions

Sl. No.	Ligand/Complex	Absorptions (nm)	Assigned transitions
1.	Ligand	276, 338	π -π *, n -π *
2.	Co complex	269, 342, 622	π -π *; n -π *; $4T_{1g}(F) \rightarrow 4A_{2g}$;
3.	Ni complex	276, 340, 726	π –π *; n -π * ; $3A2g \rightarrow 3T1g$ (F)
4.	Cu complex	278, 344, 696	π –π *; n –π *; $2E_g \rightarrow 2T_{2g}$
5.	Zn complex	280, 343	π -π *; n -π *

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Table 4: Antibacterial activity of the ligand and complexes (in mm)

SI. No.	Ligand/complex	*S. aureus* (µg/ml)					*E. coli* (µg/ml)				
		5	10	25	50	75	5	10	25	50	75
1.	Ligand	R	R	18	30	35	R	R	R	13	18
2.	C1	R	R	R	R	13	R	R	R	R	12
3.	C2	R	R	R	R	15	R	R	R	R	10
4.	Standard (Ciprofloxacin)	26					32				

Where, R - Resistant

Table 5: Antifungal activity of the ligand and its metal complexes (in mm)

SI.No.	Ligand/complex	*C. albicans* (µg/ml)					*A. niger* (µg/ml)				
		5	10	25	50	75	5	10	25	50	75
1.	Ligand	R	R	23	38	40	R	R	R	38	40
2.	C1	R	R	R	R	13	R	R	R	R	25
3.	C2	R	R	R	18	30	R	R	R	18	20
4.	Standard (Flucanozole)	24					26				

Where, R- Resistant

Figure 1: Scheme of the present work (M= Co, Ni, Cu, & Zn metals)

Figure 2: Infrared spectrum of the ligand and complex
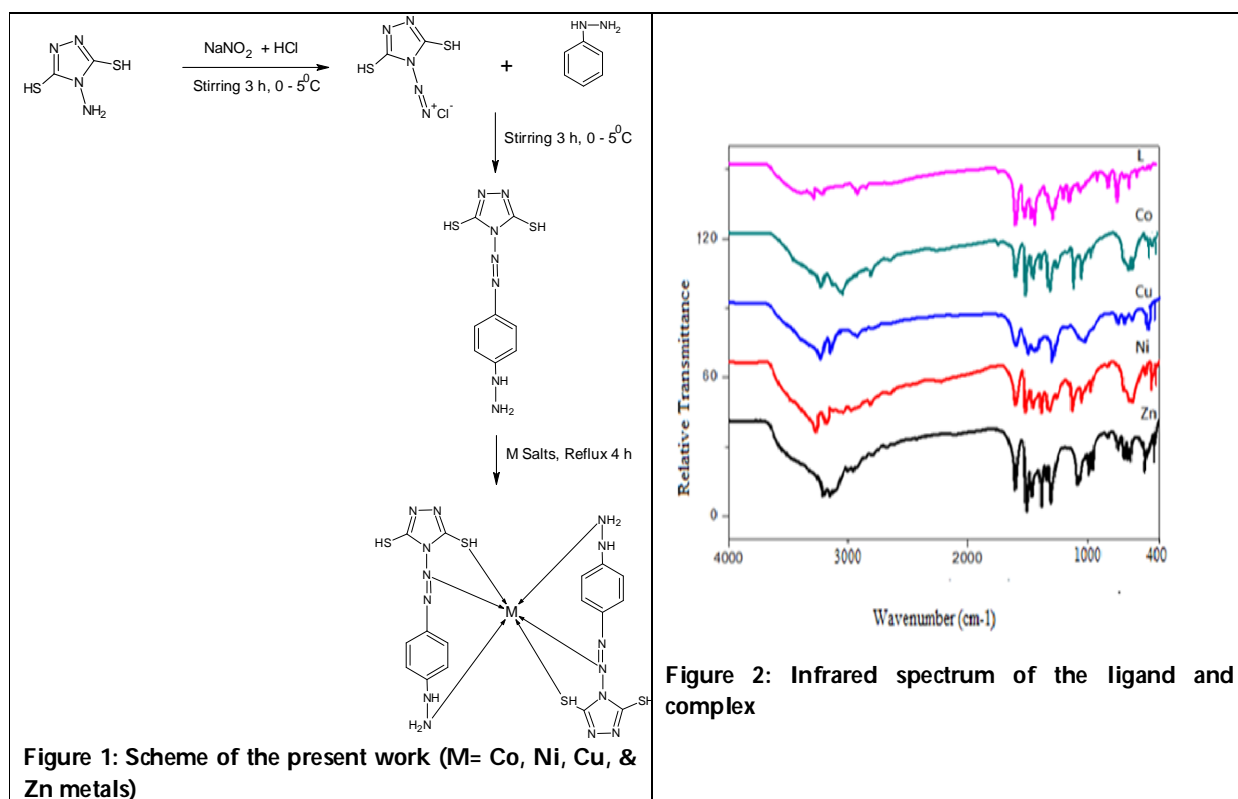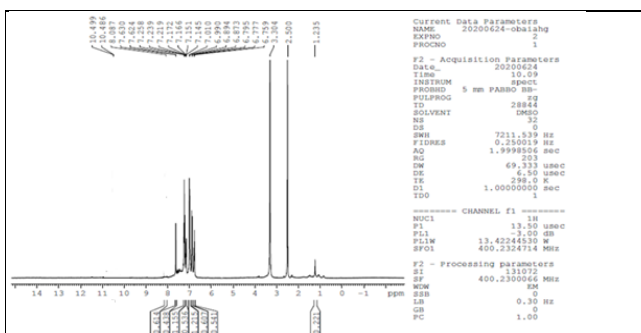
Figure 3: NMR spectrum of the ligand
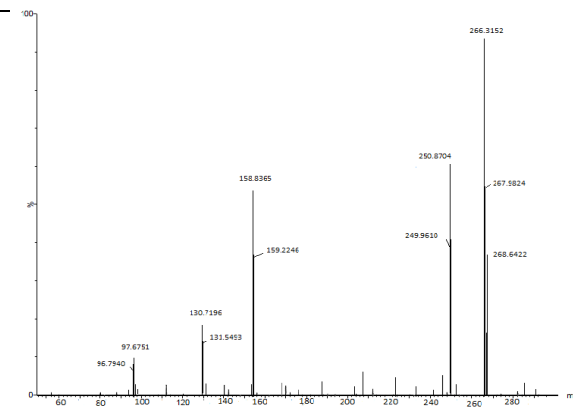
Figure 4: Mass spectrum of the ligand
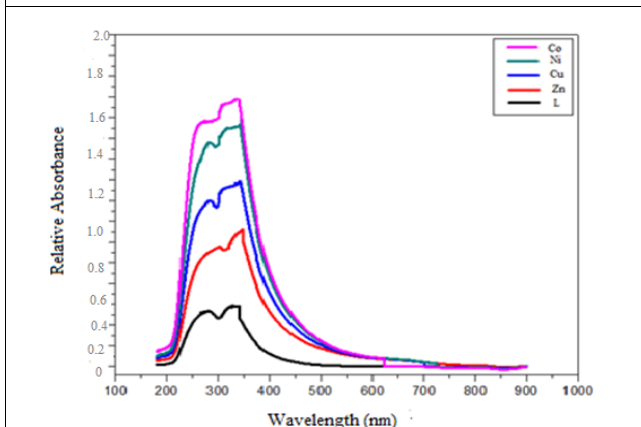
Figure 5: Electronic absorption spectrum of the ligand and its metal complexes
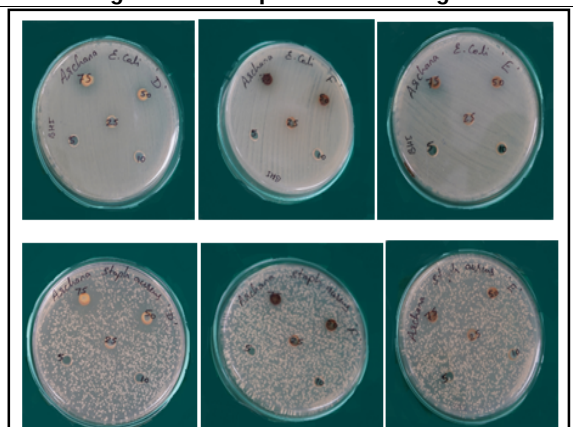
Figure 6: Antibacterial activity of ligand and its metal complexes
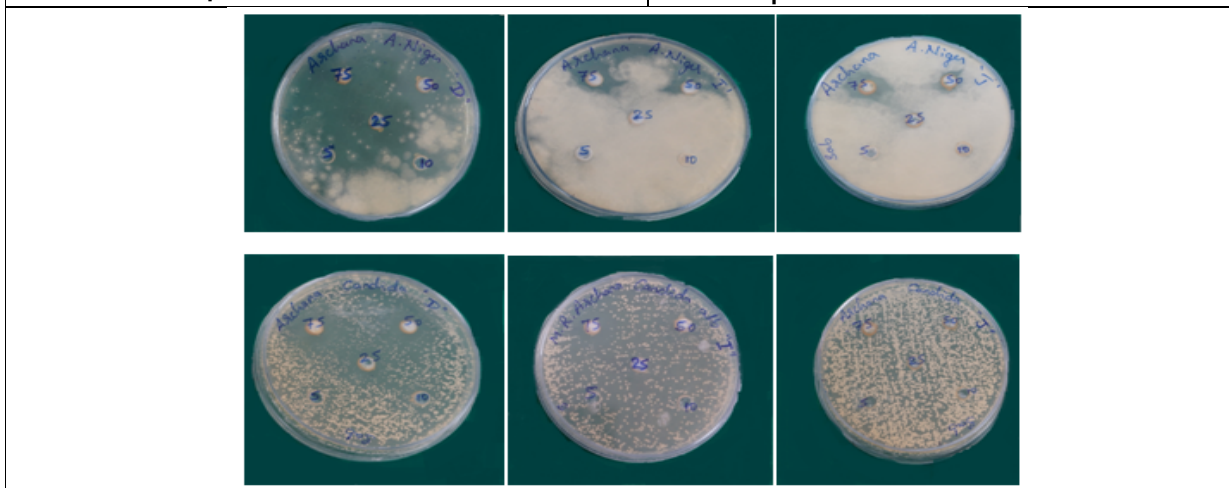
Figure 7: Antifungal activity of the ligand and complexes

RESEARCH ARTICLE

Electron Transport Simulation for Hydrogen Electrodes in a Rubidium Island

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ABSTRACT

Non-equilibrium Green's function formalism is always being fascinated to calculate the electronic transport properties of a particular material. In the present framework, we attempt to study the electron transmission function and current-voltage characteristics of Sodium Island by performing a DMol3 simulation in Biovia material studio. The current sensitivity, in this case, is helpful for the fabrication of a device with sodium.

Keywords: Rubidium Island, Electronic transport, Energy transmission.

INTRODUCTION

The simulation for the electron transport between two hydrogen-based electrodes in a Rubidium island will be highly significant for the generation of Rubidium-based device fabrication. To simulate the electron transport the non-equilibrium Green's function (NEGF) formalism [1] has been always effective. The simulation process will be Fruitful if the accurate transmission function [2] and V-I characteristics are simulated properly. Here we have utilized BIOIA Material Studio using the DMol3 package.

Simulation Details

We have used two different Hydrogen chain-based electrodes in an Rb [3] island for the analysis of the Electron transport properties. The design of the device structure was imported directly from the sample data that is accessible from the library files in the BIOVIA Material Studio [4] package. In the structure, there is two Hydrogen chain and four Rb atoms are arranged in a centralized fashion. This design is revealed in Fig.1. Here the white dots represent the H atom whereas the purple dots represent rubidium atoms. We have simulated [5] the electron transport with the transmission function [6] between two Hydrogen chain electrodes. The range and the no of steps we have fixed as 1001 for the calculation of transmission functions between two Hydrogen based electrodes. The range of the energy is also given to put the Fermi energy as lowest as possible for the efficient working of the Electronic devices. During the SCF cycles, the charge is not fixed in a transport device. Hence it leads to a large number of device fluctuations. To offset the fluctuations we have used a mixing amplitude parameter of 0.015. The electrodes have

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been such a way that the Fermi level can be accurately calculated. Then total no of k-points is considered very large such that we can predict precisely the Fermi level.   Sometimes during the simulation process, several problems arise because of the convergence of the SCF cycle. To avoid the discrepancies we choose to raise the maximum number of SCF cycles. In this case, we have set it to 500. The potential is ranging from 0 to 1.5 and the number of steps is taken as 16.We can improvise the accuracy of the calculation by reducing the spacing between the grids.

RESULT AND DISCUSSION

Wherever the Rubidium states are present, the electronic transmission for the device shows the different peaks at those points. At nearly 2.5eV we have observed the broadening of the peaks whose principal cause is the delocalization of the states on Hydrogen and Rubidium. But wherever we have found the satellite sharp peaks then this indicates the states are strongly localized. Here we have plotted the energy of the transmission function versus the lowest chemical potential of Hydrogen electrodes [7]. Figure 4 reveals that in the island there is a larger probability in the electron density and the electron decreases when we go towards the electrode region [9,10,11].So over the Rubidium island section of the device.

CONCLUSION

We have successfully simulated the electronic device having Hydrogen electrodes in the rubidium islands using the DMol3 package of BIOVIA Material Studio. We have achieved the transport characteristics and current-voltage characteristics successfully. Nearly at 1.2 ev the current becomes saturated.

ACKNOWLEDGMENTS

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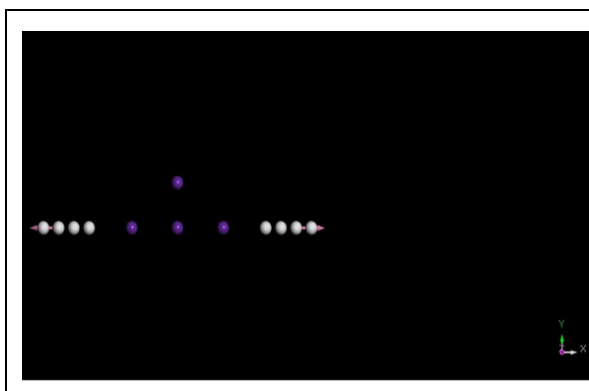
Fig. 1. The Device structure showing the H chain (White-colored balls) with rubidium atoms (Purple colored balls) located centrally.
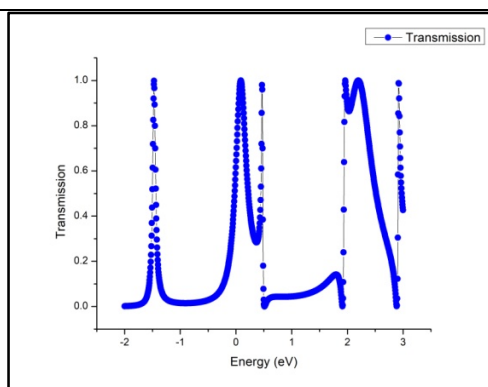
Fig. 2. Transmission function for the device characteristics
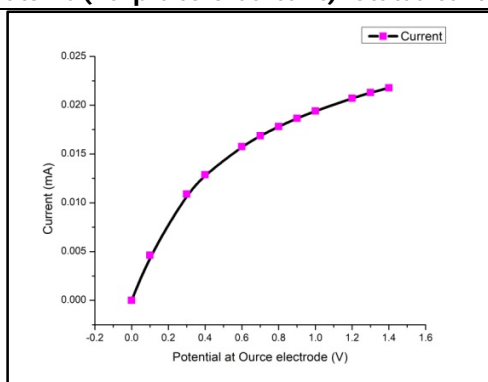
Fig. 3. V-I characteristics [8] of the simulated device
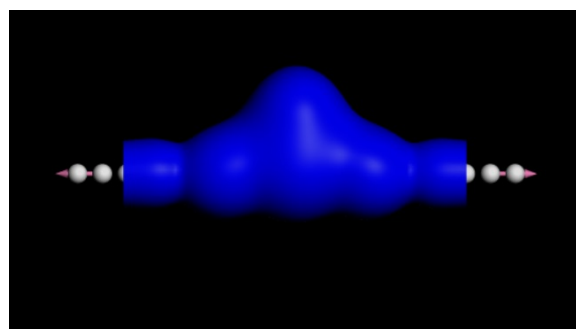
Fig .4. Electron density in the device

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RESEARCH ARTICLE

Finger Knuckle Print as a Biometrics Trait for Personal Authentication

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ABSTRACT

Biometric identification technology has become increasingly common in our daily lives as the demand for information security and security legislation has grown throughout the world. Finger knuckle print (FKP) identification has become a popular study area in biometric applications in recent years. This is because the outside surface of the finger rear knuckle area has persistent and distinct innate patterns. Furthermore, this finger knuckle has a significant potential for accurately classifying persons. We give a survey of several system models used for personal identification employing finger knuckle biometrics in this research. In addition, the difficulties that may develop during the installation of a large-scale real-time biometric system with finger knuckle print are investigated.

Keywords: Biometrics, Finger Knuckle Print, Authentication, Identification

INTRODUCTION

Biometrics is a term derived from the Greek words "bio" which means "life" and "metrics" which means "measurement." Biometrics is the study of measuring human attributes in order to authenticate or identify an individual's identity. A biometrics system is used to recognise a person automatically. Biometrics is utilised as a kind of identity access management and access control in information systems, in particular. It's also utilised to track down individuals in groups that are being watched.

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Biometrics are mainly classified into two major categories; Physiological Characteristics are related to the shape of the body. Examples Such as Palmprint, fingerprint, face recognition, DNA, iris recognition is not limited, but largely replaces retina & Odour. Behavioural Characteristics are traits that describe a person's behaviour. Examples Such as Gait, voice, keystroke, Signature and are not limited.

Biometric technologies can be compared using parameters such as universality, uniqueness, permanence, collectability, performance, acceptability and circumvention.

Universality: Every individual using the biometric system should have the same biometric characteristics.

Uniqueness: The biometric features must be distinctive from one individual to another in the biometric system.

Permanence: The biometric features should be resistance to aging. It should not change much across a period of time.

Collectability: The biometric features should be easy to collect, using acquisition devices or sensors, and measurable.

Performance: How the biometric system performs in term of accuracy, speed and robustness.

Acceptability: How the public or private users receive the biometric technology and willingness of using the biometric system.

Circumvention: How easy the biometric features being imitated, substituted or mimicked. For example, fake finger in fingerprint identification.

Biometrics Traits for Personal Authentication

A biometric system is a technology that is used to identify a person by measuring one or more physiological or behavioural characteristics. Biometric modality refers to the physiological or behavioural measurements taken from a person for authentication purposes [1]. The physiological modalities currently exploited by various real-time access control applications are shown in Figure 1.

Fingerprint: Fingerprint biometric trait refers to the flow-like patterns of ridges and valleys present in the dermal region on palm-side surface of a human hand. The features of fingerprint include friction edges, singular points, minutiae, ridge path derivation, ridge width, shape, pores and edge contour. The advantages of fingerprint are: i) it provides high level of recognition rate and ii) it requires only least expensive, small-sized acquisition devices in contrast to the other biometric traits such as iris, hand-vein patterns etc., which require complex user-system interface [2].

Palmprint: Palmprint refers to the unique dermal patterns present in the inner surface between the wrist and finger regions of the human hand. The unique feature patterns of palmprint include principle lines, wrinkles and ridges. Some of the beneficial aspects of the palmprint are i) palm patterns are more stable over lifetime, ii) palm imaging is found to be much easier when compared to other biometric traits such as iris, retina [3] etc.

Hand Geometry: Hand geometry-based biometrics is an ensemble of various measurements taken from the human hand, including its shape, size of palm, lengths and widths of the fingers. Hand geometry systems have certain advantages such as it captures hand images using low-resolution camera or inexpensive scanners in a user convenient manner, it is highly acceptable since it has less criminal connotation and the verification accuracy of the system is not influenced by environmental factors like dry weather or individual anomalies like dry skin [4]etc.

Hand-Vein Pattern: Hand-vein pattern is defined as the subcutaneous vascular pattern present in the dorsal region of the human hand. The major advantages of hand-vein biometric system are that it offers high-level of security by utilizing unique internal features present under the skin layer and also captures hand-vein patterns in a non-intrusive manner which ensures high degree of user convenience [5].

Finger Knuckle Print (FKP): Finger knuckle print refers to the texture pattern present in the outer bend surface of the finger phalangeal joint. The key advantages of finger knuckle surface modality are its rich texture features, acquired in a non-intrusive manner and high user acceptability [6].

Face: Face recognition is the most commonly used biometric trait that identifies a specific individual in a digital image by analysing and comparing pattern of the face image. Facial trait is highly collectable with high level of user cooperation and it has high user acceptability [7].

Iris: Iris refers to the pattern present in the thin, circular area surrounding the pupil region of a human eye. Iris pattern has complex structures such as corona, crypts, filaments, freckles, pits, furrows, striations and rings which are highly distinctive enough to identify an individual. Moreover, the key advantage of iris modality lies in its rich texture pattern which results in accurate and high-speed matching templates [8].

Retina: Retina refers to the blood vessel patterns present in the interior layer of a human eye. The main advantage of retina is that, it is impractical to forge human eye's retina structure. Hence providing fake input to the retina-based biometric authentication system is impossible. Retina has lowest error rate when compared to the hand traits such as fingerprint, palmprint, hand geometry [9] etc.

Ear: Human ear possess uniquely distinguishable and stable features, viz., curves, surfaces, unique shape and cartilaginous tissue of pinna. The key advantages of ear biometrics are, i) structure of the ear remains stable irrespective of aging and even the growth from childhood remains linear, ii) it is a part of face biometric modality but, it has minimal impact with facial expression and iii) it has high user acceptability as its image acquisition is done in a non-intrusive manner [10]. Apart from these traits, there are some other physiological characteristics of humans which can be used as biometric modalities and also referred to as bio-logical modalities. The biological biometric modalities include Deoxyribo Nucleic Acid (DNA), Electrocardiogram (ECG), Electro Encephalogram (EEG) and skin spectroscopy [11] illustrated in the Figure 2. Similarly, some of the behavioural characteristics that are currently used in various real time access control applications are as shown in Figure 3.

Voice: Voice recognition based biometric authentication relies on features of the physical structure of a person's vocal track and behaviour characteristics viz., speaking style and modulation of an individual's speech. Voice based personal recognition systems are highly reliable and possess greater level of user acceptance rate. In addition, these systems are highly usable, since the speech processing device used for implementation are inexpensive and provides ease of integration with the recognition system [12].

Signature: Signature of a person depicts his/her name/nickname in a handwritten pattern in order to show his/her unique identity. This biometric modality is a socially accepted modality for authentication. The signature-based authentication system is highly suitable for government, legal and commercial transactions [13].

Keystroke Dynamics: The keystroke dynamics refer to the behavioural patterns and rhythmical characteristics exhibited by an individual while typing on a keyboard. These behavioural rhythmical patterns are governed by a person's neurophysiologic mechanism similar to that of handwriting and signatures. This biometric modality possesses certain advantages, such as i) high user convenient rate as it makes use of user's natural behaviour. ii) This biometric modality can be utilized for forensic applications as the data collection does not require user cooperation or awareness [14].

Gait: Gait biometric quantities the pattern of motion generated by the limbs of humans when they move on solid surface. The feature information of gait behaviour includes velocity of the movement, forces applied, kinetic and potential energy cycles. The main advantages of this biometric trait are: i) it captures the details of features from

distance without the knowledge of the user and it is also very difficult to conceal [15]. The implementation in real time of the biometric system demands the highest biometric properties, viz., uniqueness, permanence and user acceptability. The following conclusions can be found in the research of numerous qualities. Compartmental biometrics are highly acceptable to users than their physiological characteristics. However, their biometric features are quite poor in character and stability. Moreover, among the physiological modality's iris trait is found to be more significant as it has high distinctiveness and permanence. However, the degree of user approval and iris collection are quite low [16]. In addition, fingerprint and other manual modalities, such as palmprints, hand geometry, hand-vein patterns and finger knuckle print, have considerable distinguishing characteristics, stability and acceptance of the users in terms of facial, ear and retina characteristics. This analysis infers that the hand oriented biometric traits have high user acceptable rates.

Hand-Based Biometrics

The complete modelling for personal recognition is promising to use extremely distinct models on the inner or outer surface of the hand and is generally regarded as a biometric hand-based system [17]. In addition, in most applications for access control hand-based biometric authentication systems are commonly employed, because of cheap cost data collection devices, strong identification potential, high acceptance of users, significant speed performance. [18]. For hand-based personal verification the patterns of hands comprise fingerprint, palmprint, palm geometry and a hand vein pattern. [19-23]. These hand patterns include the growing hand-based bio-metric features for personal identification that are more universal, unique, more stable over time, better capacity for distinguishing individuals, high user acceptance and stronger capacity to mitigate spoof attacks[24]. Table 1 shows several features of the surface of the finger knuckle compared with other biometric hand features.

The high level of consumption is especially popular with manual biometrics like palmprint, fingerprint and hand geometry. More and more common are other manual methods like the vein and finger knuckle. Researchers are continuously seeking more innovative approaches. Biometric researchers have discovered the print of the finger knuckle as a biometric feature with particular properties. The photographic patterns of skin folds and creases on the outer finger knuckle are uniqueness and can be a distinctive biometric identification [27]. This document explores new aspects for a valid personal authentication from the dorsal side of the hand area (finger knuckle surface).Finger knuckle surface has favourable characteristics such as i) The biometric feature of the finger knuckle comprises most discriminating texture models easily obtained with a low-resolution camera. ii) Finger knuckle prints are quite acceptable to users since they may be recorded using a contact less imaging configuration. iii) Each finger's knuckle structure patterns are particularly different; thus a combination of these finger knuckle patterns should be equal to the multi-modal biometric system.

Description of Finger Knuckle Surface

Basically, finger knuckle surface refers to the skin patterns of the finger dorsal/back region of a human hand. Each finger dorsal region of the human hand has three phalangeal joints, viz., i) Metacarpo Inter Phalangeal (MIP) joint which connects the finger with the hand surface, ii) Proximal Inter Phalangeal (PIP) joint formed in the middle surface of the finger and iii) Distal Inter Phalangeal (DIP) joint present in the tip surface of finger dorsal region as shown in the Figure 4. These joints establish the bending of the skin at the external surface of the finger dorsal area, creating dermal patterns consisting of curved curves, contours and wrinkles. Finger knuckle print (FKP) and skin pattern formed through finger region dorsal joints PIP and DIP refer to finger back knuckles surface as illustrated in Figure 5. PIP joint design is a finger knuckle pattern in finger area dorsal region. Figure 6 displays the finger knuckle print capture equipment and the finger knuckle print obtained image.

Approaches to FKP Recognition

The FKP is an interesting and challenging problem due to noisy sensor data and variations in illumination. Feature extraction is a significant problem in FKP recognition. That is why FKP identification has become a widely

researched subject, in which scientists try to develop a system that is able to recognise a person effectively. The extraction of features, which led to more study in this field, is a significant problem in FKP biometric recognition. Most literature research explores the FKP access control recognition systems, and the patterns of the PIP joint that is easy to access are chosen for the investigation.

Subspace analysis feature extraction method

New subspace methods and feature descriptors are key components that have drawn researchers' interest. In order to identify discrimination, and to make classification easier, the subspace methodologies mentioned in the literature were created. Representative work includes principal component analysis (PCA), linear discriminant analysis (LDA), and independent component analysis as regards subspace methods to FKP recognition (ICA). Subspace algorithms are used to extract relevant characteristics from the FKP picture and finally recognise it. They can also be utilised for decrease of dimensionality.

Coding-based approaches

A series of research projects have been undertaken over the past decade to explore various feature extractions for the correspondences of biometric pictures, including fingerprints, pliers and iris, with lines, structures such curves as the primary characteristics. These approaches are extensively utilised for extracting characteristics from biometric pictures through coding-based function extraction. The coding approach produces fast speeds and exact matching templates, as do other approaches for extraction based on texture analysis.

Fusion approaches

In the development of fusion systems FKP recognition systems such as multi-sensor, multi-modal, multi-sample, and multiple algorithms, researchers have given substantial attention. The goal of employing fusion is to make personal recognition more accurate. Several studies suggested new personal recognition algorithms based on the fusion of multi-FKPs.

Finger Knuckle Print Database
PolyU3D Finger Knuckle Images Database

The pattern of the finger knuckle is basically a biometrical 3D identification. The PolyU 3D Finger Knuckles database sample photos are seen in Figure 7. However, the ability to identify biometrics from such 3D characteristics has never been studied. This two-session database was made public to promote future study and development for applications in the real world. This version of the database has been obtained from 228 people utilising fingers and fingers and also offers segmented and rebuilt pictures using photometric stereos.

PolyU Contactless Finger Knuckle Images Database (Version 3.0)

The Hong Kong Polytechnic University contactless finger knuckle images database (Version 3.0) is contributed from the male and female volunteers. Figure 8 shows the sample Images of PolyU Contactless Finger Knuckle Images Database. This database has been largely acquired in The Hong Kong Polytechnic University campus and IIT Delhi Campus during 2006-2013 using a contactless setup that simply uses a handheld camera. This database has 1950 finger knuckle images from the index finger of 221 subjects, all the images are in .JPG format. This database also provides two session finger knuckle images acquired after very long interval (4 to 7 years) to ascertain stability of knuckle crease and curved lines. Besides, this database also includes segmented finger knuckle images, contrast-enhanced images and center point information of every finger knuckle images used for segmentation to extract a normalized region.

PolyU Contactless Finger Knuckle Images Database (Version 1.0)

The database of contactless finger knuckles (Version 1.0) at the University of Hong Kong Polytechnic is provided by men and women volunteers as illustrated in Figure 9. During 2006-2013, this database was mostly obtained at the

Polytechnic University of Hong Kong and IIT Delhi Campus by a contactless installation employing a handheld camera. There are 2515 finger back pictures in this database, all of which are bitmap (*.bmp) formats from the middle finger of 503 people. About 88% of the people are under 30 years in this sample. This database also provides two session finger knuckle images acquired after very long interval (4 to 7 years) to ascertain stability of knuckle crease and curved lines.

IIT Delhi Finger Knuckle Database (Version 1.0)

Figure 10 shows that the IIT Delhi finger knuckle picture consists of pictures from the students and employees of IIT Delhi, New Delhi, India. During August 2006 - June 2007 the database was obtained on the campus of IIT Delhi with a digital camera. The public database presently consists of 158 users, all photographs in bitmap format (*.bmp). In the database, all subjects are between 16-55 years of age. For each user with an integer identification/number, this database of 790 photos was numbered consecutively. The photos are 80x100 pixels in resolution, and all of these photos are bitmaps accessible.

Performance Measure

The performance of a biometric system is based on the error rates. Three types of error rates are classified as False Acceptance Rate (FAR) and False Rejection Rate (FRR) & Equal Error Rate (ERR) and the Receiver Operating Curve (ROC) is used for the effective comparison of the different biometrics systems.

False Accept Rate (FAR)

The FAR is the frequency of acceptance of an unauthorized individual. Due to the fact that false acceptance often leads to harm, FAR is usually a safety strategy. The FAR is a non-stationary statistical measure which shows, for each particular attribute, not just personal association.

$$FAR(\lambda) = \frac{\text{Number of False Attempts}}{\text{Total No of Attempts}} \quad\quad (1)$$

False Reject Rate (FRR)

The FRR is the frequency of rejection of an authorised individual. FRR is usually seen as a criterion of comfort since a false rejection is especially irritating. FRR is a non-stationary statistical number, which is not only very personal, but can even be identified for each specific characteristic.

$$FRR(\lambda) = \frac{\text{Number of False Reject}}{\text{Total No of Attempts}} \quad\quad (2)$$

Both these elements depend closely on the acceptability threshold chosen to reach the required safety level. If the threshold of the false acceptance ratio of the system is placed on a very high level, then the false acceptance ratio could be set to decline, but the false acceptance ratio could be increased and the low threshold might lead to a reduction. Thus, whether low FAR or low FRR is necessary, the threshold is set as required.

Equal Error Rate (EER)

It is the point where False Accept Rate and False Reject Rate are equal. This is the value where both the FAR and FRR are kept as low as possible at the same time. A low EER value indicates a high accuracy of the system. The relation between FAR, FRR and ERR can be seen in the Figure 11. Aim is to reduce the area obtained by these two curves along the x-axis so it is better choice to set the threshold according to the value of EER but this is not always preferred. Depending upon the application of biometric system, value of the threshold is set. For example, in a high security application like access to secret government documents, a few rejection of genuine user can be tolerated but it is not desired to give access to any unauthorized user. Therefore, in this case, the threshold is set to a high value to minimize the value of FRR. For another example in an ATM, it is better to risk few false accepts rather than the annoyance of the customers if the system rejects authorized users.

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Receiver Operating Curve (ROC)

The receiver operating characteristics or receiver operating curve (ROC), since they independently of the threshold, is used to effectively compare the various biometrics systems. ROC is the graphing of the ratio of true positive Vs true negative in relation to the signal theory. The chart showing the true acceptance rate in relation to biometrics is displayed in Figure 12, as opposed to fake acceptation. The ideal ROC curve is a spot in the top-left corner in the ROC rooms - 100% genuine acceptance and no false acceptance.

Accuracy

A generic phrase used to describe the exact functioning of a biometric device. False Acceptance and False Reject Rate are based on many verification factors, including extra norms of biometrics.

$$\text{Accuracy (\%)} = 100 - \frac{\text{FAR+FRR}}{100} \tag{3}$$

CONCLUSION

Biometric information-based authentication provides various benefits over password-based systems, leading to increased interest in biometric systems for industry and the public sector. In this article we introduce approaches of human authentication utilising FKP image. A person's finger knuckle printing (FKP) is a novel biometrical feature that is easily obtainable from anyone. FKP's biometric research has produced encouraging results but there is still tremendous scope for improvements in several dimensions, for instance the development of bigger and more demanding datasets, model interpretation, the merger of several biometrics and concerns relating to security and privacy. In addition, the performance may be significantly improved in both precision and computing complexity. In addition, developing a biometric multimodal system that incorporates finger cuffs and other modes like finger impressions, and iris patterns, might lead to a high degree of precision.

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Table 1: Comparison of finger knuckle surface with other hand-based biometric traits

Hand-based Modalities	Mode of Application	Robustness	Uniqueness	Intrusiveness
Fingerprint	Identification and Verification	High	High	Intrusive
Hand Geometry	Verification	Medium	Medium	Intrusive
Palmprint	Identification and Verification	High	Medium	Intrusive
Hand-vein Pattern	Verification	Medium	Medium	Non Intrusive
Finger Knuckle Surface	Identification and Verification	High	High	Non Intrusive
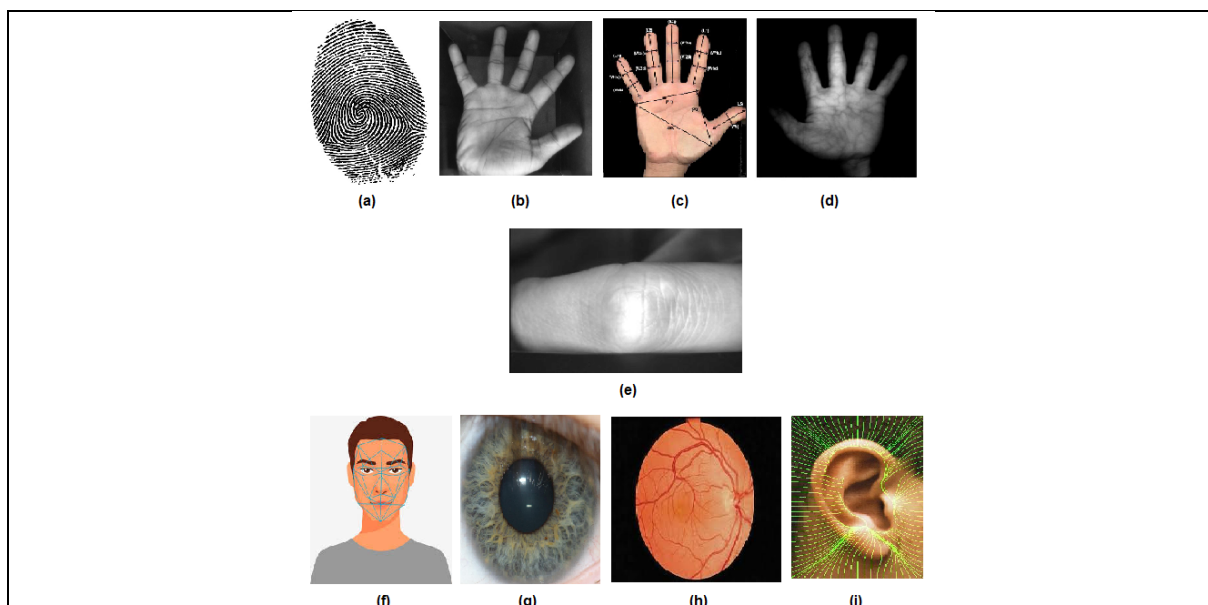
Figure 1. Physiological Traits (a) Fingerprint (b) Palmprint (c) Hand geometry (d) Hand-vein patterns (e) Finger Knuckle Print (f) Face (g) Iris (h) Retina (i) Ear

Figure 2: Biological Traits (a) DNA (b) ECG (c) EEG (d) Skin spectroscopy

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(a)   (b)   (c)   (d)
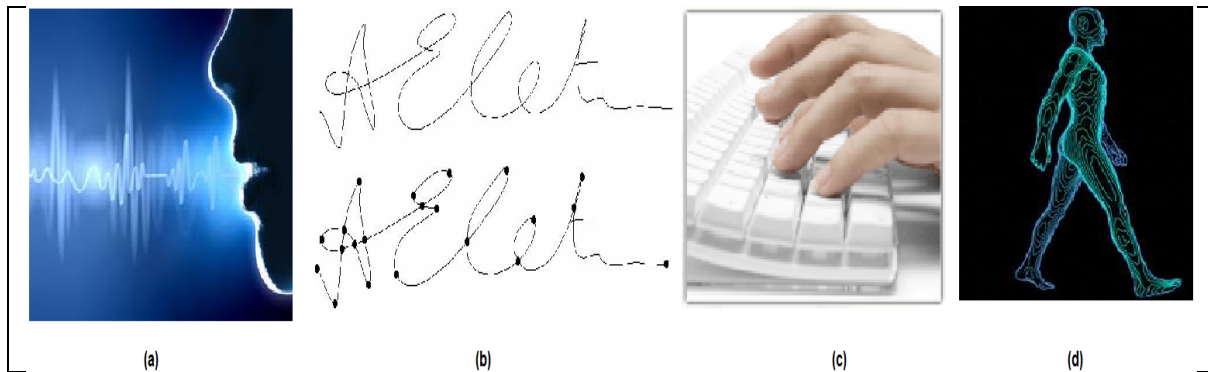
Figure 3: Behavioural Traits (a) Voice (b) Signature (c) Keystroke Dynamics (d) Gait
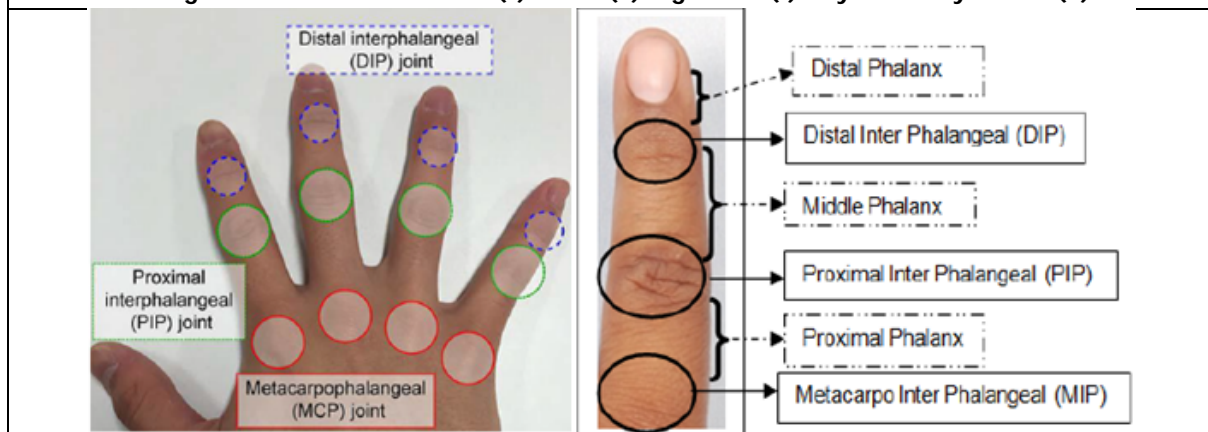
Figure 4: Physiological Characteristics of Finger Knuckle Surface
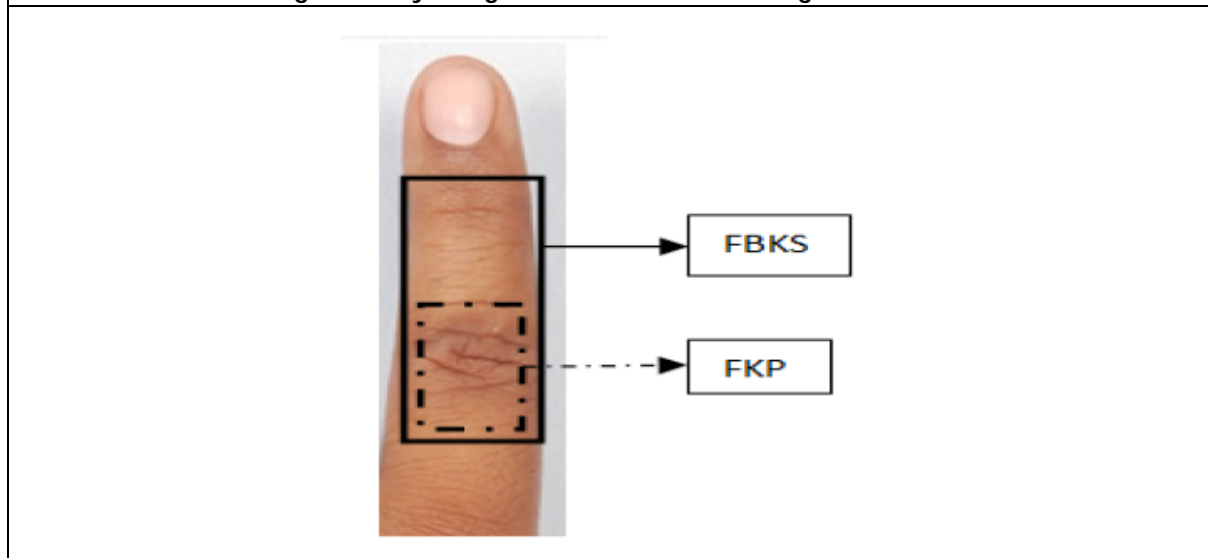
Figure 5 FKBS& FKP of a Finger

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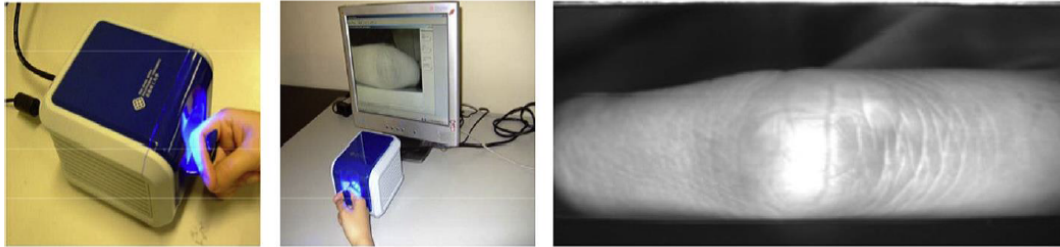
Figure 6: The FKP system: (a) the outlook provided by the FKP image acquisition device; (b) a sample FKP image acquired by the system developed.
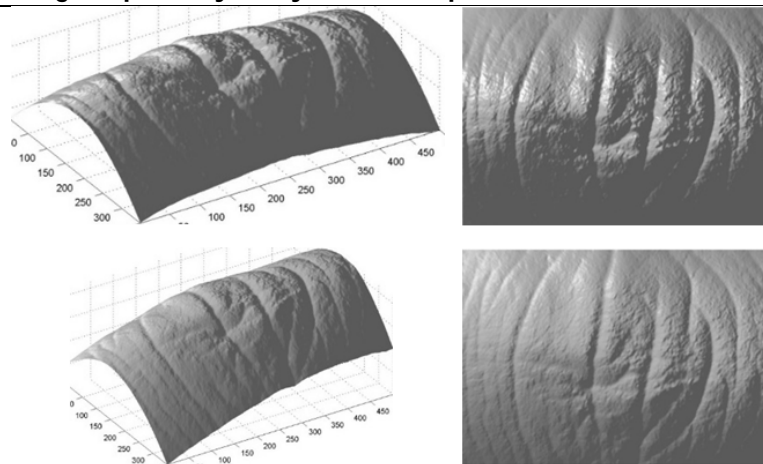
Figure 7: Sample Images of PolyU 3D Finger Knuckle Images Database [28]

Figure 8: Sample Images of PolyU Contactless Finger Knuckle Images Database [29]
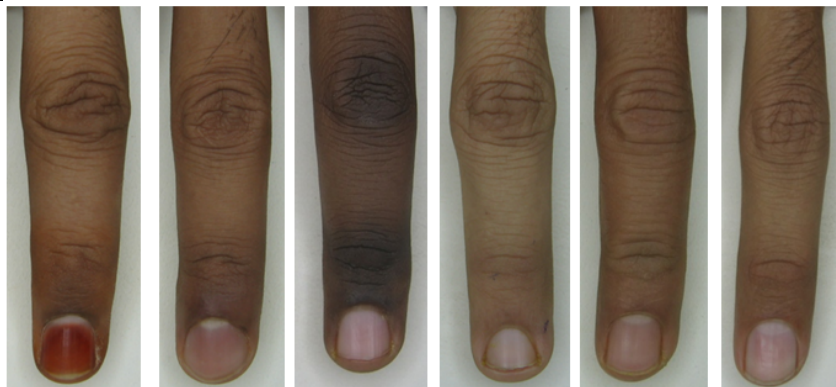
Figure 9: Sample Images of PolyU Contactless Finger Knuckle Images (Version 1.0) [30]

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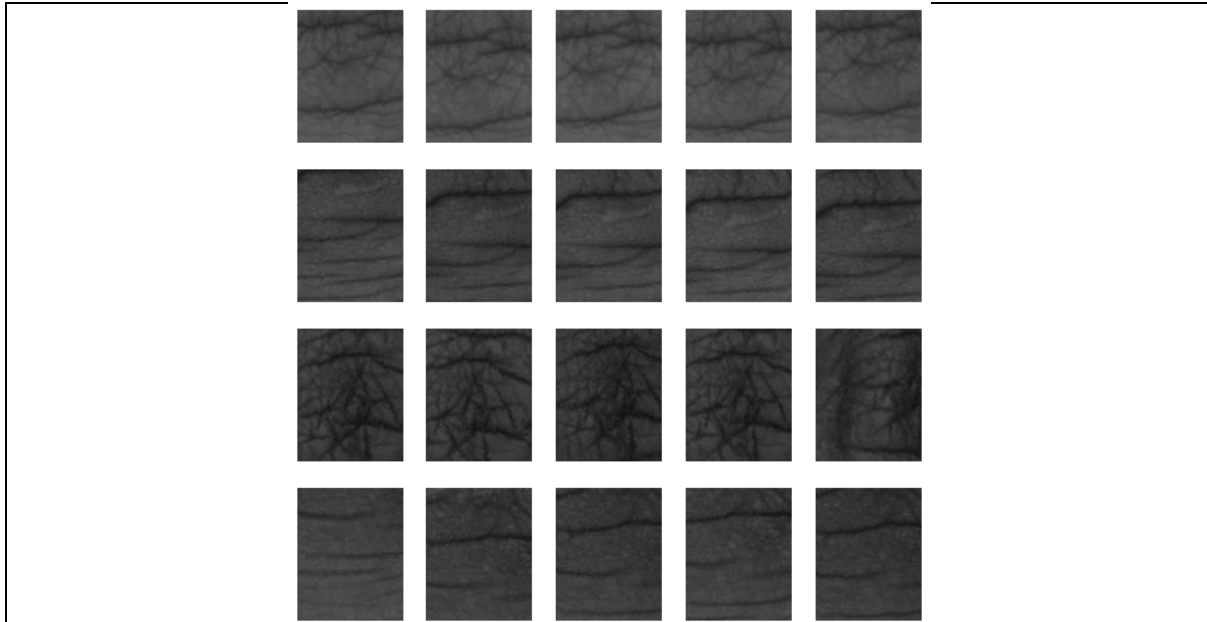
Figure 10: Sample Images of IIT Delhi Finger Knuckle Database (Version 1.0) [31]
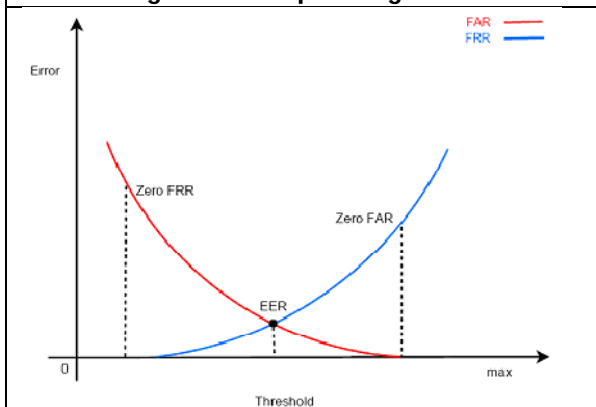
Figure 11: A Typical Performance Curve

Figure 12: Receiver Operating Characteristics

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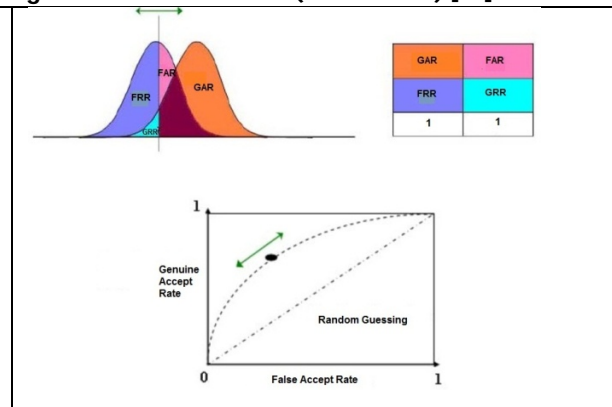
Prediction of Thermodynamic Properties of Cadmium Selenide using Density Functional Theory

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ABSTRACT

We have testified the simulation results for cadmium selenide using density functional perturbation theory and linear response theory using the CASTEP package from BIOVIA Material Studio. simulation. The phonon dispersion curve along with vibrational frequencies have been predicted in this paper. Along with this, we have also reported the thermodynamic behavior like Debye temperature and heat capacity concerning temperature which was found to be similar to experimental data.

Keywords: Cadmium Selenide, Density Functional Theory

INTRODUCTION

Cadmium selenide, an n-type II-VI semiconductor is a highly luminescent material. CdSeis a potent material that is generally transparent to infra-red and hence has been used in photoresistors [1]. It has also been used in various pigments [2]. But a wide amount of research on CdSe is being carried out on CdSe nanoparticles. Here, we have attempted to understand the thermodynamic properties of CdSe,[3,4,5] using the first principles approximation technique [6,7] , in the CASTEP package of BIOVIA Material Studio.

Simulation Details

We have simulated using the CASTEP module to perform a linear response calculation to calculate phonon dispersion and density of states as well as predict thermodynamic properties such as enthalpy and free energy. We have imported the structure directly from the libraries available. For geometry optimization, we have chosen the exchange-correlation functional as local density approximation with ultra-fine quality which is generally recommended to calculate the phonon properties of semiconductor materials. The pseudopotentials we have put the Non conserving potential [8]. For the phonon properties, we have used the Linear response method including interpolation, where the q-vector grid spacing for interpolation is 0.05 1/A0. Phonon dispersion curves show how phonon energy depends on the q-vector, along with high symmetry directions in the Brillouin zone. This information

can be obtained experimentally from neutron scattering experiments on single crystals. Such experimental data are available for only a small number of materials, so theoretical dispersion curves are useful for establishing the validity of a modeling approach to demonstrate the predictive power of ab initio calculations. In certain circumstances, it is possible to measure the density of states (DOS) rather than the phonon dispersion. Furthermore, the electron-phonon interaction function, which is directly related to the phonon DOS can be measured directly in the tunneling experiments. It is therefore important to be able to calculate phonon DOS from first principles.

The frequencies for every q-point and every branch (Longitudinal Optical or Acoustical(LO/LA), Transverse Optical or Acoustical (TO/TA)) are given in cm-1, as well as the positions of the q-points, in the reciprocal space. The high symmetry points Γ, L and X are at reciprocal space positions (0 0 0), (0.5 0.5 0.5) and (0.5 0 0.5)respectively. A better agreement with the experimental results may be obtained by running the calculation with a better SCF k-point grid.

Thermodynamic Properties

Phonon calculations in CASTEP can be used to evaluate the temperature dependence of the enthalpy, entropy, free energy, and lattice heat capacity of a crystal in a quasi-harmonic approximation. These results can be compared with experimental data (for example heat capacity measurements) or used to predict phase stability of different structural modifications or phase transitions. The exact shape of the curve at very low temperatures is not accurate with the calculation settings used. A better sampling of low-frequency acoustic modes is required, and this can be achieved by using a finer Monkhorst-Pack grid in the phonon density of states calculation.

Figure 1.4 revealed CdSe's highest normal mode of vibrationie. The Debye temperature [9], i.e., the largest temperature that can be achieved due to a solo normal vibration. The Debye temperature that is simulated about 280 K, which lies is in the experimental agreement 220 K. There is a dip shown in figure 1.4 at nearly 37 K, having the least value of Debye temperature which is of the order of 140 K, exactly as estimated by CASTEP results.

Figure 1.5 describes the variation of enthalpy, free energy, and entropy concerning temperature. Here, we have observed the entropy increasing exponentially but with slower speed (denoted by blue curve), whereas free energy (denoted by red curve) is exponentially decreasing which shows obvious results. The blue curve shows the alteration of enthalpy concerning the temperature that shows the slow alteration concerning temperature. The variation between these three quantities is very small at room temperature.

Figure 1.4 revealed the variation of heat capacity of CdSe concerning temperature. Experimentally the specific heat capacity at room temperature is nearly 0.49 J/gK [10]. Here we have obtained as temperature rises, the heat capacity increases faster from 0 to 11.5 cal/cell.K and then achieves a saturation value. At Room temperature, the heat capacity is simulated as 11.3 cal/cell. K.

CONCLUSION

We have testified the computational prediction of CdSe using the CASTEP module of BIOVIA Material studio. We have derived the phonon density of states(vibrational properties) of CdSe using this computational technique. The thermodynamic properties predicted the parameters like Debye temperature and heat capacity with variation to temperature.

ACKNOWLEDGMENTS

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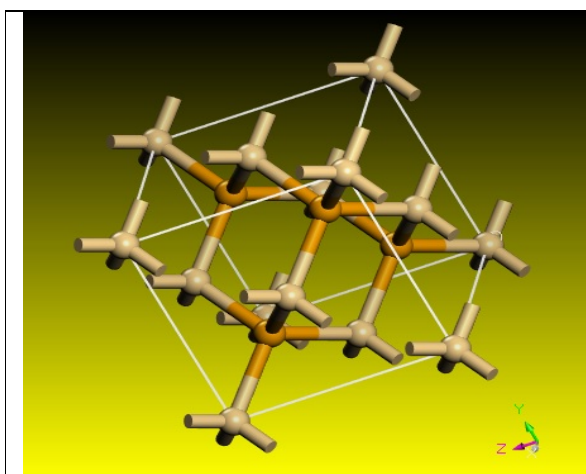
Fig. 1. The conventional unit cell for Cadmium Selenide.
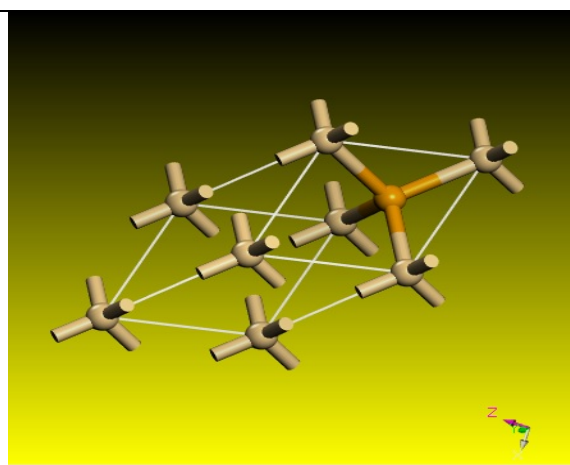
Fig. 2. The primitive unit cell for Cadmium Selenide.

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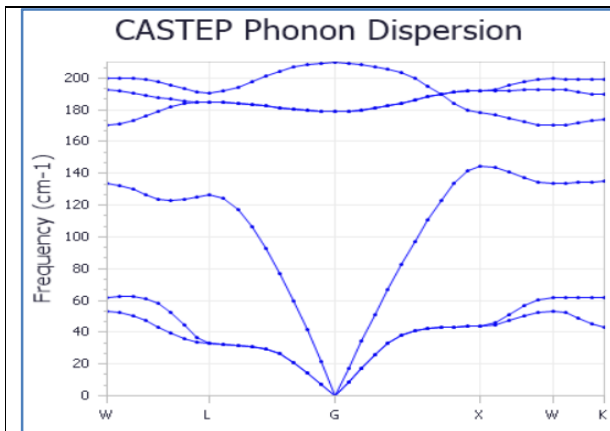
Fig. 3. The phonon dispersion curve for Cadmium Selenide.
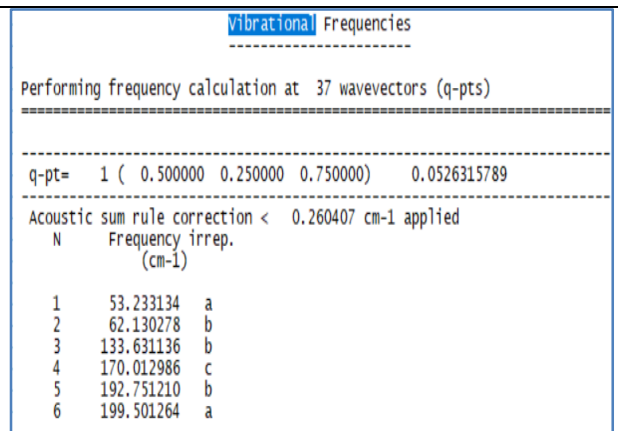
Fig.4. The phonon dispersion curve for Cadmium Selenide.
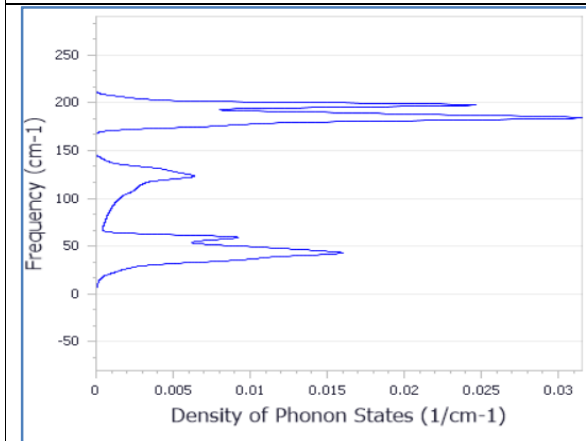
Fig.5. The Density of Phonon States curve for Cadmium Selenide
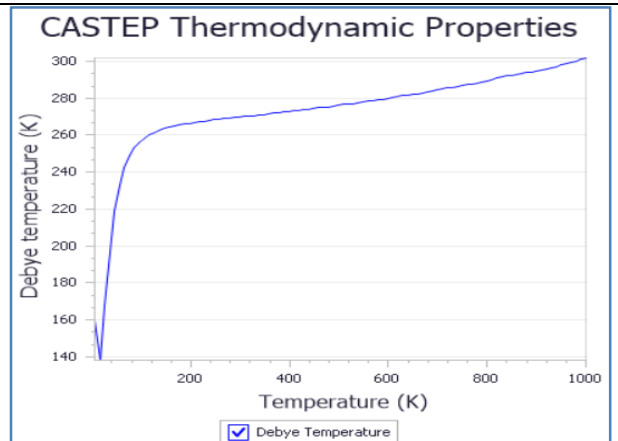
Fig .6. The Debye Temperature simulated for Cadmium Selenide.
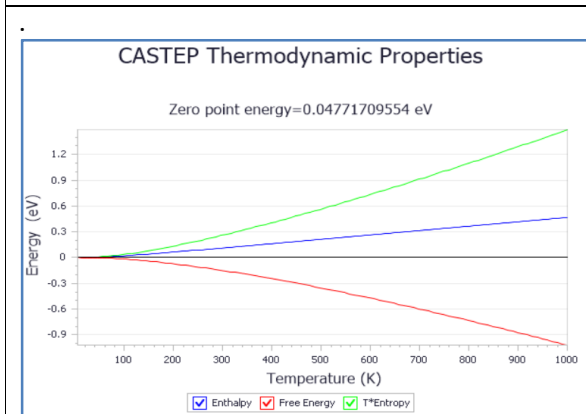
Fig. 7. The Debye Temperature simulated for Cadmium Selenide.
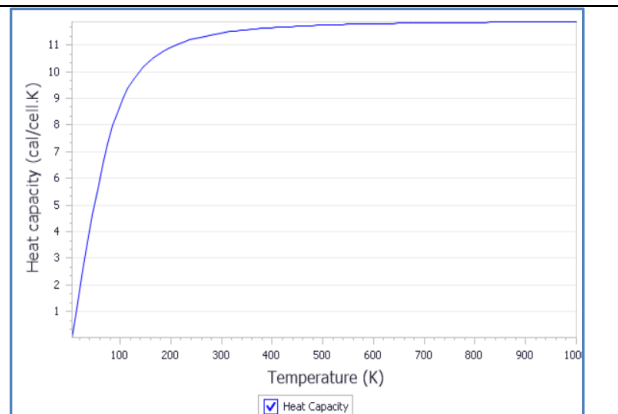
Fig.8. revealed the variation of heat capacity of CdSe concerning temperature.

RESEARCH ARTICLE

Synthesis, Characterization and Antimicrobial Studies of some Novel Azo Schiff Base Metal Complexes Derived from the Drug, Trimethoprim

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ABSTRACT

The treatment of infectious diseases is becoming a growing global issue for which new therapies or drugs are needed to be prepared in order to solve the problem of clinical resistance more aggressively. The Azo Schiff base metal complexes show promising pharmacological application and may offer unique therapeutic opportunities. So the present paper involves the synthesis of a series of Schiff base complexes of Cu(II), Co(II), Ni(II) and Zn(II) by modifying the drug, Trimethoprim using diazotization method. The ligand and all the complexes were characterized by elemental analysis, molar conductance and spectroscopic techniques like FTIR, ^{1}HNMR, and Mass. The original drug, Schiff base ligand and metal complexes were also screened for antimicrobial activities against different bacterial and fungal strains. A comparative study of inhibition values indicates that metal complexes possess good activity than that of Schiff base ligand.

Keywords: Trimethoprim drug, Azo Schiff base ligand, Metal complexes, Antimicrobial activity.

INTRODUCTION

Coordination compounds form the basis for the evolution of vast areas of chemistry. There has been a great exploration due to coordination compounds especially in the field of bioinorganic chemistry. Transition metals occupy an important place in inorganic chemistry as they offer an extremely versatile and reliable tool for the development of improved medicinal compounds [1]. Transition metals exhibit different oxidation states and can interact with a number of negatively charged molecules. This activity of transition metals led to the recent development of drugs which are based on metals and are considered to be potential candidates for pharmacological and therapeutic applications [2, 3]. Schiff bases are prepared by the reaction of a primary amine with an aldehyde or

a ketone under specific conditions of pH and temperature. Structurally, Schiff bases also known as imine or azomethine are the nitrogen analogue of an aldehyde or ketone in which the carbonyl group has been replaced by an imine or azomethine group (C=N) [4-6]. Schiff bases represent a versatile class of compounds with vast choice of biological applications along with various other applications. Due to this reason, Schiff base and its complexes find a reflective and imperative place in both organic and inorganic chemistry [7-10]. Azo Schiff base compounds are widely used substances in textile, paper, coloring agents for foods and in cosmetics industries. Azo schiff base and their complexes with transition metal ions are also of importance due to their biological properties such as inhibition of DNA, RNA, and protein synthesis, nitrogen fixation, and carcinogenesis [11, 12]. Trimethoprim, systematically named as 2,4-diamine pyrimidine -5-(3, 4,5-Trimethoxybenzyl) is in the list of the World Health Organization's of essential medicines, the most important medications needed in a basic health system. It has both antibacterial and antiprotozoal properties. It was synthesized by Hitchings and his colleagues during the mid 1950's. Trimethoprim is an antifolate antibacterial agent that inhibits bacterial dihydrofolate reductase (DHFR), a critical enzyme that catalyses the formation of tetrahydrofolic acid (THF). In doing so, it prevents the synthesis of bacterial DNA and ultimately leads to bacterial death. Trimethoprim along with sulfamethoxazole is used in combination due to their complementary and synergistic mechanisms but may be used as a monotherapy in the treatment of urinary tract infections [13-17]. In the quest for novel drugs against microbial resistant diseases, the use of metal complexes has received an overwhelming attention [18]. Therefore the present paper involves the synthesis of Cu (II),   Co (II), Ni (II) and Zn (II) complexes with Schiff base as ligand derived from trimethoprim drug, their characterization and antimicrobial activities.

MATERIAL AND METHODS

Experimental
General and Instrumental
All the reagents purchased were from Sigma Aldrich (AR grade) and solvents used were purified by standard methods before usage. The drug, Trimethoprim was purchased from Drugs India Mahaveeray, Hyderabad and was used without any further purification. Melting points were determined in open capillary tube and are uncorrected. The completion of the reaction was tested by TLC (Thin Layer Chromatography). The metal salts Cu^{+2}, Co^{+2}, Ni^{+2} and Zn^{+2} acetates were used for the synthesis of metal complexes. Elemental analysis was carried out using elemental analyser instrument. The molar conductance of the synthesized complexes in 1×10^{-3} mol dm^3 DMF solution was measured using ELICO digital conductivity meter of CM-180 model. The infrared spectra of the ligand and complexes were recorded   using Broker-FTIR spectrometer in the range 4000-300cm^{-1}. The electronic spectra were recorded using Spectronic 20 UV-Visible spectrophotometer. The ^{1}HNMR spectrum was obtained using Bruker 400 MHz High Resolution Multinuclear FT-NMR spectrometer. Mass spectrum was recorded on Micromass UK PLATFORM II LC-MS Spectrometer.

Synthesis of 4-((4-hydrazineylphenyl)diazenyl)-5-(3,4,5-trimethoxybenzyl)pyrimidin-2-amine
The drug Trimethoprim (0.01 M) was dissolved in 25 ml dil H_2SO_4 and this solution was cooled in an ice/salt bath to a temperature of 0°C. To this an aqueous solution of sodium nitrite (0.01 M) was added drop wise with constant stirring maintaining a temperature of 0-5°C and this solution was stirred for about 1 hour. Later the coupling agent, Phenyl hydrazine (0.01 M) dissolved in sodium hydroxide (0.5g in dissolved 20 ml water) was added slowly maintaining the same temperature i.e. 0-5°C. After complete addition, the pH of the solution was adjusted to 7 by adding required amount of sodium bicarbonate solution. This solution was further stirred for about 3 hours. A brown colored dye was formed, it was allowed to settle for some time and then filtered, washed several times with water, dried and recrystallized using ethanol [19-22].

Synthesis of 2-((1Z)-(2-(4-((2-amino-5-(2,3,5-trimethoxybenzyl)pyrimidin-4-yldiazenyl) phenyl) hydrazinyli dene) methy)lphenol

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An ethanolic solution of 4-((4-hydrazineylphenyl) diazenyl)-5-(3,4,5-trimethoxybenzyl) pyrimidin-2-amine and salicylaldehyde were mixed in 1:1 molar ratio, this solution was refluxed for about 5 hours to obtain Schiff base ligand. The obtained ligand was filtered and dried. The recrystallization was carried out by ethanol.

Synthesis of Metal Complexes

The metal complexes were prepared by mixing an ethanolic solution of Schiff base ligand with an ethanolic solution of metal salt [Cu(II), Co(II), Ni(II) and Zn(II)] in 1:2 (metal : ligand) molar ratio. The resulting mixture was refluxed for about 3 hours. The colored product obtained was filtered, washed with water for several times until the filtrate became colorless and finally dried [23].

Representation of Scheme

M = Cu, Co, Ni, Zn

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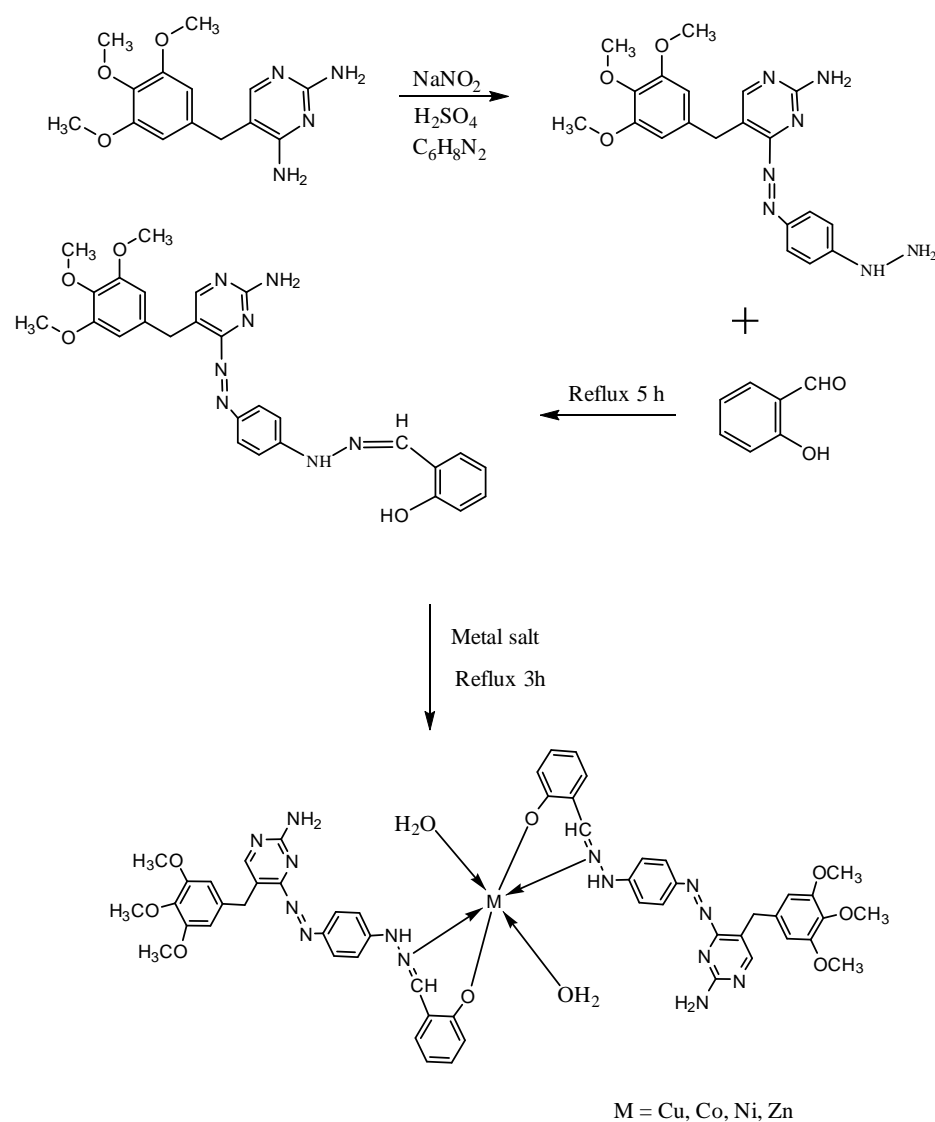
RESULTS AND DISCUSSION

All the metal complexes gave satisfactory elemental measures, conformed to those proposed by the suggested formulae revealing that the metal-ligand stoichiometry ratio is 1:2. The results are shown in Table 1. The complexes are colored stable solids found to be soluble in DMSO and DMF but insoluble in other organic solvents. The low molar conductance values show that the complexes are non-electrolytic in nature [24].

Infrared Spectra

The IR spectra of the ligand and metal complexes are represented in table 2 (Figure 1-5). The IR spectra provides an important information regarding the nature of the functional group present in the compound [25]. In order to study the binding mode of the ligand to metal in the complexes, the IR spectrum of the free ligand is compared with the IR spectrum of metal complexes [26]. These comparative studies indicated that the peaks found in the ligand are shifted or completely absent in the spectra of metal complexes. In the IR spectrum of Schiff ligand, a peak at 3352 cm^{-1} is assignable to phenolic group of salicylaldehyde moiety. In metal complexes, the disappearance of this peak indicates that the -OH group has been deprotonated and coordinated to the central metal ion as –O$^-$. The broad peak in the metal complexes in the range 3341-3526 cm^{-1} is assigned due to existence of water molecule as hydrated and coordinated [27]. The sharp peak at 1617 cm^{-1} arises because of C=N where as in metal complexes this peak has been shifted towards lower wave numbers. This shift is due to the reduction of the double bond character of the C=N group which is caused by the coordination of nitrogen to the metal centre. Further the peaks in the range 611-692 cm^{-1} and 446-467 cm^{-1} in the metal complexes is due to M-O and M-N bonding [28].

Electronic Spectra and Magnetic Susceptibility

The electronic spectra of the Schiff base ligand and metal complexes is presented in table 3 (Figure 6). The electronic spectra of metal complexes were provides important information regarding the stereo chemistry of metal ions in the complexes on the basis of positions and number of d-d transition peaks [29]. The bands at 250 and 296 nm of Schiff base ligand shows $\pi \to \pi^*$, $n \to \pi^*$ ligand centered transitions. The Cu(II) complex shows two bands at 283 and 666nm due to $^2B_{1g} \to {}^2E_g$, $^2B_{1g} \to {}^2A_{1g}$ transitions. The magnetic moment value of Cu(II) complex is 1.79 BM which is expected for one unpaired electron offering a possibility of an octahedral geometry. The Co(II) complex shows three peaks at 285, 331 and 680 nm assignable to $^4T_{1g}(F) \to {}^4T_{1g}(P)$, $^4T_{1g}(F) \to {}^4T_{2g}(F)$, $^4T_{1g}(F) \to {}^4T_{2g}(F)$ transitions. The magnetic moment value 4.81 BM for Co(II) complex suggests an octahedral geometry in the high spin state [30]. The Ni(II) complex exhibits three peaks at 289, 343 and 677 nm due π-π^*, $^3T_{2g}(F) \to {}^3T_{1g}(P)$, $^3T_{2g}(F) \to {}^3T_{1g}(F)$ transitions. The magnetic moment value 3.11 BM for Ni(II) complex offers the possibility of an octahedral geometry [31]. Since Zn(II) belongs to d^{10} configuration, it is diamagnetic and so no d-d transitions were observed in the visible region for Zn(II) complex.

^{1}HNMR Spectra

The ^{1}HNMR spectrum of the Schiff base ligand was recorded in DMSO solvent. The chemical shifts of the different type of protons were shown in Figure 7. The spectrum provides an additional support for the formation of Schiff base ligand. The peak at δ 2.5 ppm is due to DMSO solvent. The peak at δ 3.3 ppm assigned to CH$_2$ appeared as singlet .The nine protons of OCH$_3$ groups appeared as two different peaks; 6(H) appeared as a singlet at δ 3.7ppm while the other 3(H) appeared as a singlet at δ 3.6 ppm. The multiple peaks between δ 6.5-7.8 ppm are assigned to aromatic protons. The peak at δ 7.9 ppm is due to CH of azomethine (C=N) group and it appears as a singlet. The single peak at δ 8.0 ppm is because of NH group attached to aromatic ring. The phenolic OH group appears at δ 8.2 ppm as a singlet [32-35].

Mass Spectra

The mass spectral fragmentation of the Schiff base ligand is shown in figure 8. The ligand shows a molecular ion peak m/z at 514.8, this confirms the proposed formulae (calculated mass is 513.5) as they are in good agreement. The other peaks observed at 314, 280, 113 may be attributed to $C_{15}H_{19}N_5O_3$, $C_{14}H_{17}N_3O_3$, and C_7H_8O fragments respectively [36, 37].

Antibacterial Activity

The original drug (Trimethoprim), Schiff base ligand, Cu(II) complex, and Co(II) complex were screened for antibacterial activity against two bacteria *Escherichia coli* (Gram –ve) and *Staphylococcus aureus* (Gram +ve). The results were tabulated in Table 4 followed by Figure 9 and 10. Agar diffusion method was followed and so activity was performed on nutrient agar medium. The nutrient agar were prepared, autoclaved at 121^0C for 15 Ibs, cooled and poured on sterilized petri plates and was allowed for solidification. After solidification, well were made and samples were introduced. The plates were incubated at 37^0C for 24 hours and then they were observed for diameter of zone of inhibition (mm). A comparative study of the drug, ligand and complexes showed that Cu(II) and Co(II) complexes exhibit better activity than the Schiff base ligand [38-40].

Antifungal Activity

The drug Trimethoprim, Schiff base ligand, Cu(II) and Zn(II) complexes were subjected for antifungal activity. The observed results can be in represented in Table 5 followed by Figure 11, 12. The fungal strains used were *Penicillium brocae* and *Aspergillus terreus*. The activity was performed on czapek dox agar. The plated were incubated at 28^0 for 24 hours. The diameter of zone of inhibition was calculated. From the results, it has been observed that Cu(II) and Zn(II) complexes possess some sort of better activity compared to Schiff base ligand [41-43].

CONCLUSION

Most of the major classes of pharmaceutical agents which are in current clinical use contain a number of coordination compounds. Due to wide range of biological applications of Schiff base metal complexes, recent research mainly focuses on the synthesis of metal complexes using Schiff base as ligand. Therefore the present work involves the modification of functional group of the drug Trimethoprim to obtain a azo Schiff base ligand. From this Schiff base ligand four novel complexes i.e., Cu(II), Co(II), Ni(II) and Zn(II) were synthesized. Elemental analysis, molar conductance and spectroscopic data such as IR, NMR, UV and Mass reveals that the metal to ligand ratio is 1:2 and all the synthesized metal complexes possess octahedral geometry with coordination no. 6. From antimicrobial studies, it can be noted that metal complexes show good activity compared to Schiff base ligand.

ACKNOWLEDGEMENT

Conflict of Interest

We declare that we have no conflict of interest

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Table 1: Elemental analytical data of Schiff base ligand and its metal complexes

SI. No.	Ligand/Complexes	Physical appearance	Elemental analysis observed (Calculated)			
			C	H	N	M (metal)
1	$C_{27}H_{27}N_7O_4$	Yellow	63.20 (63.15)	5.40 (5.30)	19.25 (19.09)	- -
2	$C_{54}H_{56}CuN_{14}O_{10}$	Green	57.75 (57.67)	5.10 (5.02)	17.50 (17.44)	5.75 (5.65)
3	$C_{54}H_{56}CoN_{14}O_{10}$	Red	57.91	5.04	17.51	5.26

			(57.99)	(5.10)	17.70)	(5.32)
4	$C_{54}H_{56}NiN_{14}O_{10}$	Yellow	57.99 (57.92)	5.12 (5.04)	17.60 17.51)	5.30 (5.24)
5	$C_{54}H_{56}ZnN_{14}O_{10}$	Light Yellow	57.72 (57.58)	5.22 (5.01)	17.55 (17.41)	5.77 (5.80)

Table 2: Infrared data of the Schiff base ligand and its metal complexes

SI. No.	Compounds	Wave number (Cm^{-1})						
		υ (O-H)	υ (N-H)	υ (C-H)	υ (C=N)	υ (N=N)	υ (M-O)	υ (M-N)
1	Schiff base ligand	3352	3208	2910	1617	1482	-	-
2	Copper complex	3393	3280	2931	1598	1463	671	455
3	Cobalt complex	3341	3198	2899	1596	1442	611	455
4	Nickel complex	3526	3373	2941	1596	1452	692	446
5	Zinc complex	3341	3208	2920	1586	1482	662	467

Table 3: Electronic spectral data of Schiff base ligand and metal complexes

SI.No.	Compounds	Absorption bands (nm)	Assigned transitions
1	Schiff base ligand	250, 296	$\pi \rightarrow \pi^*$, $n \rightarrow \pi^*$
2	Copper complex	283, 666	$^2B_{1g} \rightarrow {}^2E_g$, $^2B_{1g} \rightarrow {}^2A_{1g}$
3	Cobalt complex	285, 331, 680	$^4T_{1g}(F) \rightarrow {}^4T_{1g}(P)$, $^4T_{1g}(F) \rightarrow {}^4T_{2g}(F)$, $^4T_{1g}(F) \rightarrow {}^4T_{2g}(F)$
4	Nickel complex	289, 343, 677	$\pi \rightarrow \pi^*$ $^3T_{2g}(F) \rightarrow {}^3T_{1g}(P)$, $^3T_{2g}(F) \rightarrow {}^3T_{1g}(F)$
5	Zinc complex	328	$\pi \rightarrow \pi^*$

Table 4: Antibacterial activity of drug, ligand and metal complexes

Compounds	*E. coli* (mm)			*S. aureus* (mm)		
	20 µg/ml	50 µg/ml	100 µg/ml	20 µg/ml	50 µg/ml	100 µg/ml
Trimethoprim	8	0	0	5	0	0
SB Ligand	2	0	0	7	0	0
Cu complex	2	0	0	2	0	0
Co complex	3	0	0	3	0	0
Ciprofloxacin (standard)	20	28	32	20	36	44

Table 5: Antifungal activity of drug, ligand and metal complexes

Compounds	*P. brocae* (mm)			*A. terreus* (mm)		
	20 µg/ml	50 µg/ml	100 µg/ml	20 µg/ml	50 µg/ml	100 µg/ml
Trimethoprim	1	0	0	0	0	0
SB Ligand	0	0	0	1	0	0
Cu complex	1	0	0	0	0	0
Zn complex	1	0	0	1	0	0
Ciprofloxacin (standard)	25	32	43	28	30	48
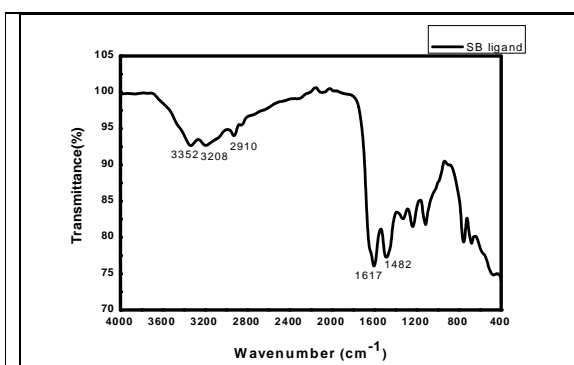
Figure 1: FTIR spectra of Schiff base Ligan
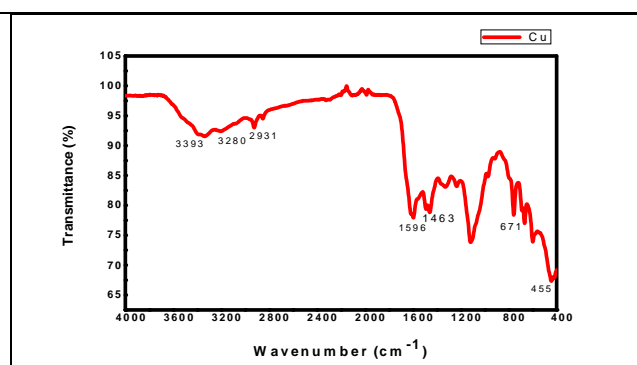
Figure 2: FTIR spectra of Cu (II) complex
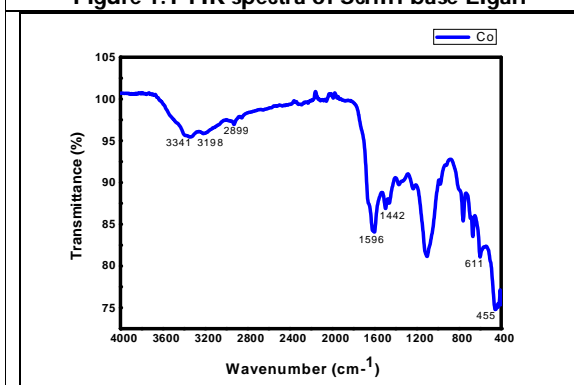
Figure 3: FTIR spectra Co (II) complex
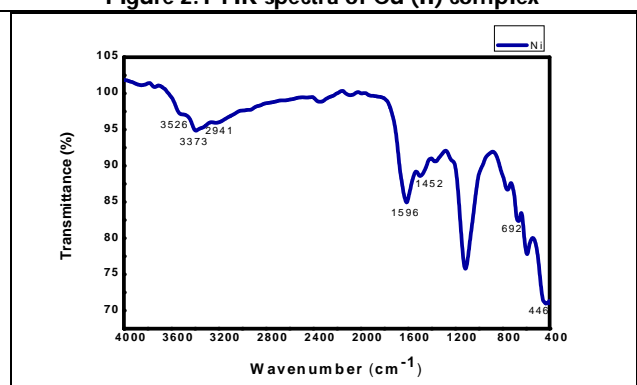
Figure 4: FTIR spectra of Ni (II) complex
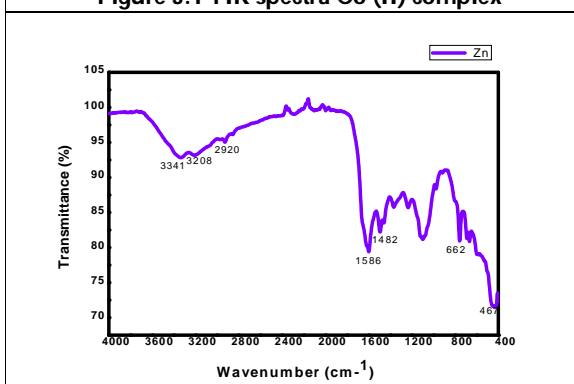
Figure 5: FTIR spectra of Zn(II) complex
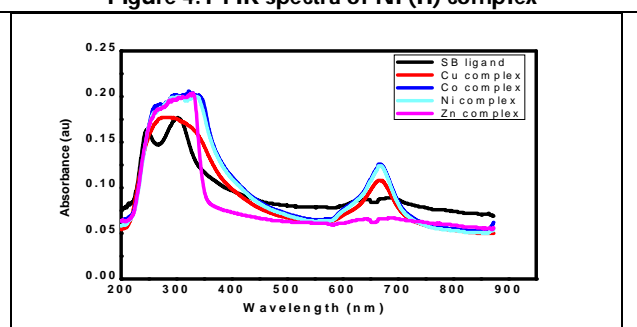
Figure 6: UV spectra of Schiff base ligand, Cu (II) complex, Co (II) complex, Ni (II) complex and Zn (II) complex

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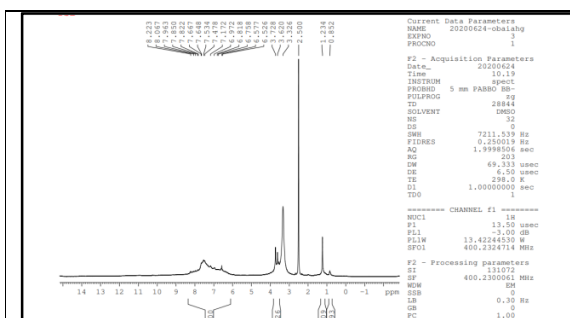
Figure 7: ¹HNMR Spectrum of Schiff base ligand
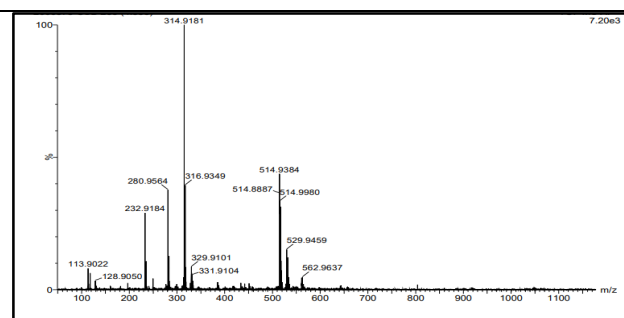
Figure 8: Mass spectrum of the Schiff base ligan
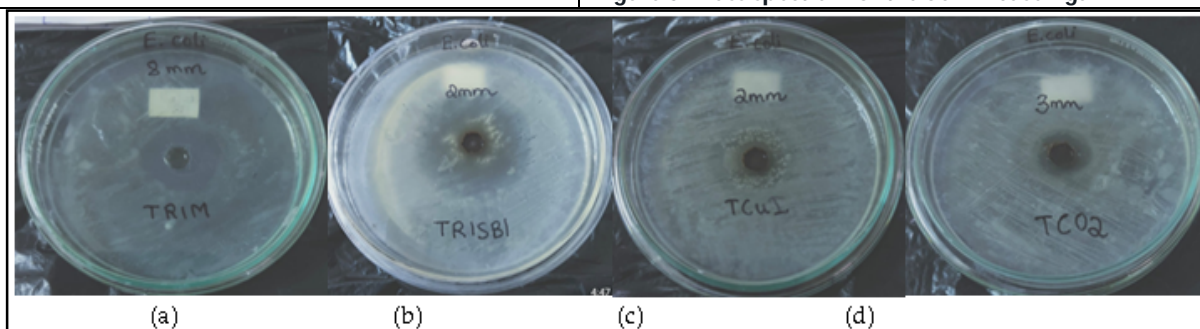
Figure 9: Images showing antibacterial activity against *E. coli* (a) Trimethoprim drug (b) Schiff base (C) Cu(II) complex and (d) Co(II) complex
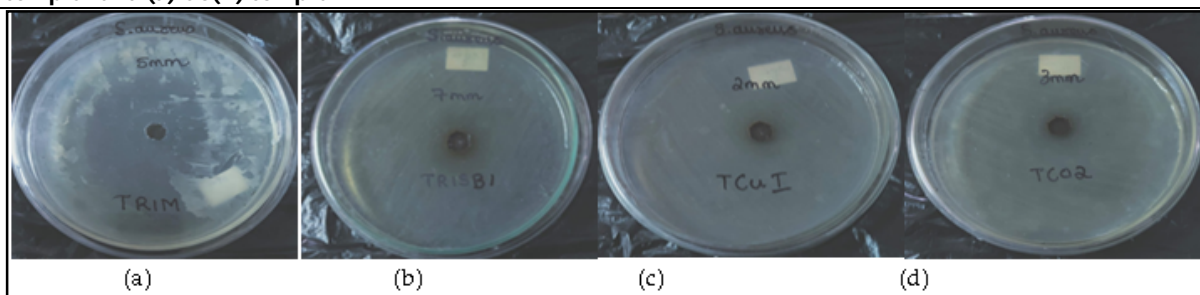
Figure 10: Images showing antibacterial activity against *S. aureus* (a) Trimethoprim drug (b) Schiff base (C) Cu(II) complex and (d) Co(II) complex
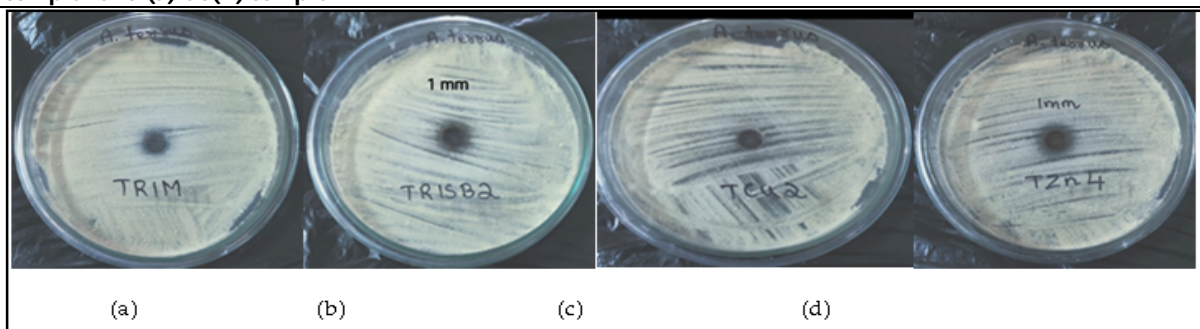
Figure 11: Images showing antifungal activity against *A.terreus* (a) Trimethoprim drug (b) Schiff base ligand (c) Cu (II) complex and (d) Zn (II) complex

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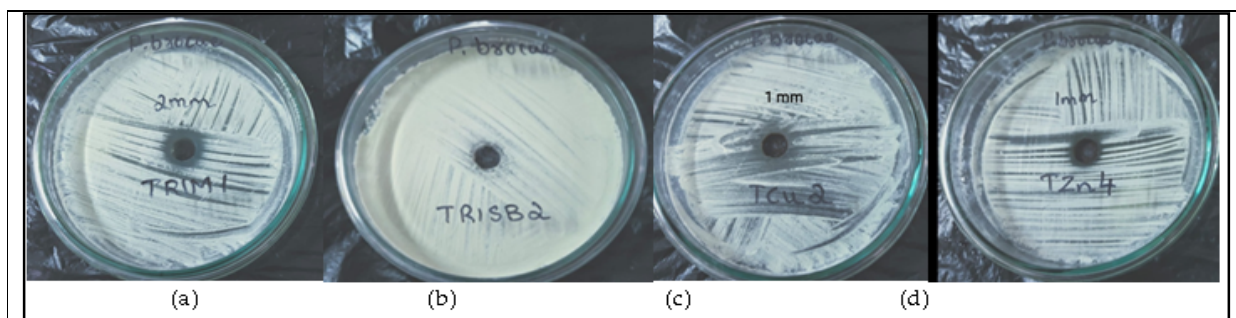
Figure 12: Images showing antifungal activity against *P.brocae* (a) Trimethoprim drug (b) Schiff base ligand (c) Cu (II) complex and (d) Zn (II) complex

RESEARCH ARTICLE

Tongue Print as a Biometrics Trait for Personal Authentication

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ABSTRACT

Biometric identification technology has become increasingly common in our daily lives as the demand for information security and security legislation has grown throughout the world. Tongue print identification has become a popular study area in biometric applications in recent years. This is because tongue print is better biometrics for identifying people because another person does not have immediate access to copy them, and they are less likely to repeat in other family members across generations. These patterns are typical of each person and even differ between identical twins and might be dubbed the "tongue print" altogether. Not only is tongue printing an innovative biometric technology, but also a potent instrument of forensics. This paper highlights the uniqueness of tongue prints and its superiority over other biometric identification systems. In addition, the difficulties that may develop during the installation of a large-scale real-time biometric system with tongue print are investigated.

Keywords: Biometrics, Tongue print, Authentication, Identification

INTRODUCTION

Biometrics is a term derived from the Greek words "bio" which means "life" and "metrics" which means "measurement." Biometrics is the study of measuring human attributes in order to authenticate or identify an individual's identity. A biometrics system is used to recognise a person automatically. Biometrics is utilised as a kind

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of identity access management and access control in information systems, in particular. It's also utilised to track down individuals in groups that are being watched. Biometrics are mainly classified into two major categories; Physiological Characteristics are related to the shape of the body. Examples Such as Palmprint, fingerprint, face recognition, DNA, iris recognition is not limited, but largely replaces retina & Odour. Behavioural Characteristics are traits that describe a person's behaviour. Examples Such as Gait, voice, keystroke, Signature and are not limited.

Biometric technologies can be compared using parameters such as universality, uniqueness, permanence, collectability, performance, acceptability and circumvention.

Universality: Every individual using the biometric system should have the same biometric characteristics.

Uniqueness: The biometric features must be distinctive from one individual to another in the biometric system.

Permanence: The biometric features should be resistance to aging. It should not change much across a period of time.

Collectability: The biometric features should be easy to collect, using acquisition devices or sensors, and measurable.

Performance: How the biometric system performs in term of accuracy, speed and robustness.

Acceptability: How the public or private users receive the biometric technology and willingness of using the biometric system.

Circumvention: How easy the biometric features being imitated, substituted or mimicked. For example, fake finger in fingerprint identification.

Biometrics Traits for Personal Authentication

A biometric system is a technology that is used to identify a person by measuring one or more physiological or behavioural characteristics. Biometric modality refers to the physiological or behavioural measurements taken from a person for authentication purposes [1]. The physiological modalities currently exploited by various real-time access control applications are shown in Figure 1.

Fingerprint: Fingerprint biometric trait refers to the flow-like patterns of ridges and valleys present in the dermal region on palm-side surface of a human hand. The features of fingerprint include friction edges, singular points, minutiae, ridge path derivation, ridge width, shape, pores and edge contour. The advantages of fingerprint are: i) it provides high level of recognition rate and ii) it requires only least expensive, small-sized acquisition devices in contrast to the other biometric traits such as iris, hand-vein patterns etc., which require complex user-system interface [2].

Palmprint: Palmprint refers to the unique dermal patterns present in the inner surface between the wrist and finger regions of the human hand. The unique feature patterns of palmprint include principle lines, wrinkles and ridges. Some of the beneficial aspects of the palmprint are i) palm patterns are more stable over lifetime, ii) palm imaging is found to be much easier when compared to other biometric traits such as iris, retina [3] etc.

Hand Geometry: Hand geometry-based biometrics is an ensemble of various measurements taken from the human hand, including its shape, size of palm, lengths and widths of the fingers. Hand geometry systems have certain advantages such as it captures hand images using low-resolution camera or inexpensive scanners in a user convenient manner, it is highly acceptable since it has less criminal connotation and the verification accuracy of the system is not influenced by environmental factors like dry weather or individual anomalies like dry skin [4] etc.

Hand-Vein Pattern: Hand-vein pattern is defined as the subcutaneous vascular pattern present in the dorsal region of the human hand. The major advantages of hand-vein biometric system are that it offers high-level of

security by utilizing unique internal features present under the skin layer and also captures hand-vein patterns in a non-intrusive manner which ensures high degree of user convenience [5].

Finger Knuckle Print (FKP): Finger knuckle print refers to the texture pattern present in the outer bend surface of the finger phalangeal joint. The key advantages of finger knuckle surface modality are its rich texture features, acquired in a non-intrusive manner and high user acceptability [6].

Face: Face recognition is the most commonly used biometric trait that identifies a specific individual in a digital image by analysing and comparing pattern of the face image. Facial trait is highly collectable with high level of user cooperation and it has high user acceptability [7].

Iris: Iris refers to the pattern present in the thin, circular area surrounding the pupil region of a human eye. Iris pattern has complex structures such as corona, crypts, filaments, freckles, pits, furrows, striations and rings which are highly distinctive enough to identify an individual. Moreover, the key advantage of iris modality lies in its rich texture pattern which results in accurate and high-speed matching templates [8].

Retina: Retina refers to the blood vessel patterns present in the interior layer of a human eye. The main advantage of retina is that, it is impractical to forge human eye's retina structure. Hence providing fake input to the retina-based biometric authentication system is impossible. Retina has lowest error rate when compared to the hand traits such as fingerprint, palmprint, hand geometry [9] etc.

Ear: Human ear possess uniquely distinguishable and stable features, viz., curves, surfaces, unique shape and cartilaginous tissue of pinna. The key advantages of ear biometrics are, i) structure of the ear remains stable irrespective of aging and even the growth from childhood remains linear, ii) it is a part of face biometric modality but, it has minimal impact with facial expression and iii) it has high user acceptability as its image acquisition is done in a non-intrusive manner [10]. Apart from these traits, there are some other physiological characteristics of humans which can be used as biometric modalities and also referred to as bio-logical modalities. The biological biometric modalities include Deoxyribo Nucleic Acid (DNA), Electrocardiogram (ECG), Electro Encephalogram (EEG) and skin spectroscopy [11] illustrated in the Figure 2. Similarly, some of the behavioural characteristics that are currently used in various real time access control applications are as shown in Figure 3.

Voice: Voice recognition based biometric authentication relies on features of the physical structure of a person's vocal track and behaviour characteristics viz., speaking style and modulation of an individual's speech. Voice based personal recognition systems are highly reliable and possess greater level of user acceptance rate. In addition, these systems are highly usable, since the speech processing device used for implementation are inexpensive and provides ease of integration with the recognition system [12].

Signature: Signature of a person depicts his/her name/nickname in a handwritten pattern in order to show his/her unique identity. This biometric modality is a socially accepted modality for authentication. The signature-based authentication system is highly suitable for government, legal and commercial transactions [13].

Keystroke Dynamics: The keystroke dynamics refer to the behavioural patterns and rhythmical characteristics exhibited by an individual while typing on a keyboard. These behavioural rhythmical patterns are governed by a person's neurophysiologic mechanism similar to that of handwriting and signatures. This biometric modality possesses certain advantages, such as i) high user convenient rate as it makes use of user's natural behaviour. ii) This biometric modality can be utilized for forensic applications as the data collection does not require user cooperation or awareness [14].

Gait: Gait biometric quantities the pattern of motion generated by the limbs of humans when they move on solid surface. The feature information of gait behaviour includes velocity of the movement, forces applied, kinetic and potential energy cycles. The main advantages of this biometric trait are: i) it captures the details of features from distance without the knowledge of the user and it is also very difficult to conceal [15]. The implementation in real time of the biometric system demands the highest biometric properties, viz., uniqueness, permanence and user acceptability. The following conclusions can be found in the research of numerous qualities. Compartmental biometrics are highly acceptable to users than their physiological characteristics. However, their biometric features are quite poor in character and stability. Moreover, among the physiological modality's iris trait is found to be more significant as it has high distinctiveness and permanence. However, the degree of user approval and iris collection are quite low [16].

Tongue Print as a Biometric Trait: The many biometric systems used for safety applications comprise the printing of fingers, retinal scanning, skin colour, voice control, palm printing, face scanning, signature control, hand geometry, vein, etc. Each system's inadequacies render it vulnerable to a safety breach and make identifying purposes harder. Injuries and burns can result in fingerprints, changed owing to work, modified by surgery, and unstable, while when voice is taken into account, diseases such as cold and cough, sore throat can impact it. In high emotional conditions, misleading words may occur, and their pronunciation might at times be ambiguous. Retinal scans are quite delicate and dependant on the user. It can be affected by conditions like as cataract, astigmatism or brightness. Skin colour, however, may change according to age, bruises, disease and usage of skin creams and/or drugs, although the measures may vary according to their use [17]. In recent years, academics have developed a strong interest to use tongue print as a means for identifying biometric authentication as an alternative to bypassing the above limitations. In image analysis and in computer vision, a lot of emphasis has been paid to tongue image analysis. Tongue texture offers various benefits in terms of identification and verification of human beings [18,19]. People can be identified based on the textural characteristics. A tongue image contains the following features as a biometric identifier: Tongue images are unique to every. Tongue texture characteristics are specific to each individual. During a person's life the texture characteristics of a individual tongue remain steady and immutable. The tongue of the human body is highly protected and hard to forge.

Description of Tongue: The tongue is the sole organ within the body but can also be inspected. It is a pink, wet, muscular organ called mucosa. It also contains little, very fine papillae lumps. These offer a raw and distinctive texture to your tongue. There are hundreds of taste buds on the surfaces of the papillae. The palms include a group of nerve cells, which transmit messages to the brain. Mucosa and webs of hard tissue hold the tongue to the mouth. The front tether is called the phrase, and the language is attached to the hyoid bone in the back of the mouth. The tongue always works like your heart, making it one of the most tough muscles in the human body. When you eat it helps to combine meals. Even while you are asleep, it helps to drive saliva down your throat. It links and ties in to assist you speak sounds. It also comprises linguistic amber to aid with the removal of dangerous microorganisms. The tongue also provides information about the individual's condition and health, which is why doctors and doctors sometimes ask patients during a physical checkup to put their tongue out. The tongue contains distinct traits which varies from one person to one, not just being a solid sign of existence. Two primary features are measured in a tongue print. The first is the tongue form. Some of them are brief, some long, but that's only the start. There are an incredible amount of tongue shapes. Texture is the second most noteworthy element. There are various creases, crates, markings and seams in the tongues. These are also unique to each person.

Shape of the Tongue: A body, tip and root are formed into a tongue [20]. These sections give the tongue its permanent form, which may vary nonetheless. These alterations are thought to signify distinct diseases in Traditional Chinese Medicine TCM [11]. TCM also offers six more tongue classes: square, rectangle, round, acidic triangular, obtuse triangular and hammer in figure 5. A square tongue is as long as it is wide. A rectangular tongue is long, but equally wide at the root, body, and tip. The round tongue will look round. The hammer tongue is wider at

the tip than at the root while the triangular tongue is the opposite, being wider at the root than the tip. Triangular tongues may be either acute or obtuse triangular.

Texture of the Tongue: The texture of the tongue as shown in Figure 6 is classified as two types based on Physiologic texture is Fissured tongue and various Pathologic textures of tongue are Geographic, Smooth, Hairy, Furrowing and Ulcers.

Methods used to Capture Tongue Prints:
Tongue printing is unique to every person and hence a potentially new biometric instrument. It's incredibly hard to make. This review includes several strategies utilised in prior language printing experiments. The many characteristics of Lingual Morphology were retained in a research conducted by [25] utilising the alginate moulding process, which is believed to be the most reliable method for duplication of complicated features. In the present study, images of the participant's tongues were made from the foreground and from the side, using a professional Nikon D 5100 camera positioned on a tripod, under the identical circumstances of environment and lighting and a specified distance. It has been shown that the scrotal and geographic tongue of the females is more frequent from the sexual dimorphism point of view, and the lingual apex has sharp points while the seven points in males are more widespread. Similar findings about the prevalence of scrotal toguen in women were found in a research similarly conducted by [26], but the presence of geographic tongue indicated a contradiction, more so in males than females. The length and breadth of tongue differentiated between males and females with a higher length and breadth than females were shown in a comparable research by [22]. Three reference points were attached to the tongue's shape. The Hong Kong Polytechnic University conducted a research in 2007 by [27]. It was intended to build a language picture database. It included the geometric shape of both tongues and surface texture of humans, a great resource for examination, comparison and evaluation. A three-dimensional study of the tongue is also a potential choice for evaluation. Digital software can automatically fix colour and hue. Feasible picture matching may be performed using the coloured pixels from the tongue images utilising Mean Squared Error (MSE) detection. The photos are evaluated with various filters for greater accuracy [27].

The positional changes and circumstances of the camera are examined, followed by a colour and texture examination of the tongue. The database is then matched to produce identity. A great deal of study has been examined to create an appropriate tongue image analysis algorithm [24].The tongue is a nonrigid organ and the video of a tongue was taken, and pictures were extracted from it. Another popular approach used for tongue diagnosis is the sublingual venous analysis [28]. The tongue function is also assessed using a different approach consisting of an ultrasonic transducer inserted in the sublingual area [29]. Digital phenomena (front and side view), followed by a visual assessment of the dorsal surface of the tongue and subsequent impressions of alginate and cast dissipation, were obtained during the pilot study [15, 16].Patients with smoking habits and systemic diseases were excluded from the trial. In addition to the images and the castings, two observers studied the complex features of the morphology of surfaces, including the form, presence or absence of the splits and distribution pattern. The tongue section, if out of your mouth, is in contact with the lips commissure, and the tip of your tongue [23,31] are included. The most prevalent morphological trait on the back of the lingual tongue was the presence of central fissures. The males had several vertical, modest cracks, whereas the females displayed a single deep vertical crack. Mostly in both males and females, U-shaped tongue has been noticed. In 25 percent of females [30-32], tongue V-shaped was seen. The limits of scalloping were more frequent in women than in men [30].A tongue image database was produced in a study conducted by D. Zhang et al. utilising sample photos from 134 individuals. The tongue prints qualify as a plausible new biometrics member with a 93.3 percent recognition rate [19].

Performance Measure: The performance of a biometric system is based on the error rates. Three types of error rates are classified as False Acceptance Rate (FAR) and False Rejection Rate (FRR) & Equal Error Rate (ERR) and the Receiver Operating Curve (ROC) is used for the effective comparison of the different biometrics systems.

False Accept Rate (FAR): The FAR is the frequency of acceptance of an unauthorized individual. Due to the fact that false acceptance often leads to harm, FAR is usually a safety strategy. The FAR is a non-stationary statistical measure which shows, for each particular attribute, not just personal association.

$$FAR(\lambda) = \frac{\text{Number of False Attempts}}{\text{Total No of Attempts}} \qquad (1)$$

False Reject Rate (FRR): The FRR is the frequency of rejection of an authorised individual. FRR is usually seen as a criterion of comfort since a false rejection is especially irritating. FRR is a non-stationary statistical number, which is not only very personal, but can even be identified for each specific characteristic.

$$FRR(\lambda) = \frac{\text{Number of False Reject}}{\text{Total No of Attempts}} \qquad (2)$$

Both these elements depend closely on the acceptability threshold chosen to reach the required safety level. If the threshold of the false acceptance ratio of the system is placed on a very high level, then the false acceptance ratio could be set to decline, but the false acceptance ratio could be increased and the low threshold might lead to a reduction. Thus, whether low FAR or low FRR is necessary, the threshold is set as required.

Equal Error Rate (EER): It is the point where False Accept Rate and False Reject Rate are equal. This is the value where both the FAR and FRR are kept as low as possible at the same time. A low EER value indicates a high accuracy of the system. The relation between FAR, FRR and ERR can be seen in the Figure 11. Aim is to reduce the area obtained by these two curves along the x-axis so it is better choice to set the threshold according to the value of EER but this is not always preferred. Depending upon the application of biometric system, value of the threshold is set. For example, in a high security application like access to secret government documents, a few rejection of genuine user can be tolerated but it is not desired to give access to any unauthorized user. Therefore, in this case, the threshold is set to a high value to minimize the value of FRR. For another example in an ATM, it is better to risk few false accepts rather than the annoyance of the customers if the system rejects authorized users.

Receiver Operating Curve (ROC): The receiver operating characteristics or receiver operating curve (ROC), since they independently of the threshold, is used to effectively compare the various biometrics systems. ROC is the graphing of the ratio of true positive Vs true negative in relation to the signal theory. The chart showing the true acceptance rate in relation to biometrics is displayed in Figure 12, as opposed to fake acceptation. The ideal ROC curve is a spot in the top-left corner in the ROC rooms - 100% genuine acceptance and no false acceptance.

Accuracy: A generic phrase used to describe the exact functioning of a biometric device. False Acceptance and False Reject Rate are based on many verification factors, including extra norms of biometrics.

$$\text{Accuracy (\%)} = 100 - \frac{FAR + FRR}{100} \qquad (3)$$

CONCLUSION

Biometric information-based authentication provides various benefits over password-based systems, leading to increased interest in biometric systems for industry and the public sector. In this article we introduce approaches of human authentication utilising tongue images. A tongue image contains the following features as a biometric identifier: Tongue images are unique to every. Tongue texture characteristics are specific to each individual. During a person's life the texture characteristics of a individual tongue remain steady and immutable. The tongue of the human body is highly protected and hard to forge. If the tongue authentication system is actually realised using sensors, this may be the most symbiotic and robust identifying system in our generation.

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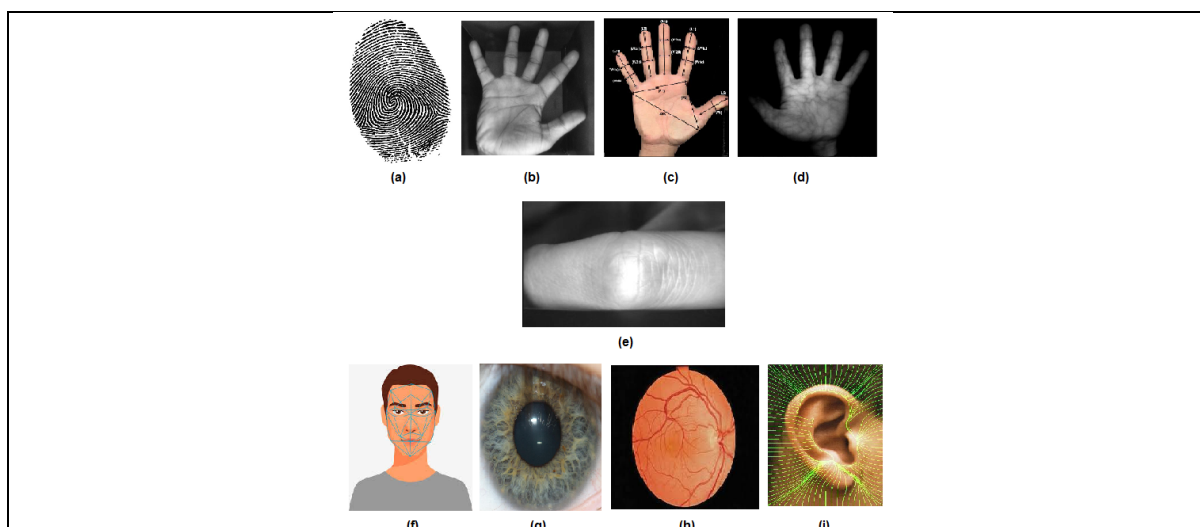
Figure 1: Physiological Traits (a) Fingerprint (b) Palmprint (c) Hand geometry (d) Hand-vein patterns (e) Finger Knuckle Print (f) Face (g) Iris (h) Retina (i) Ear
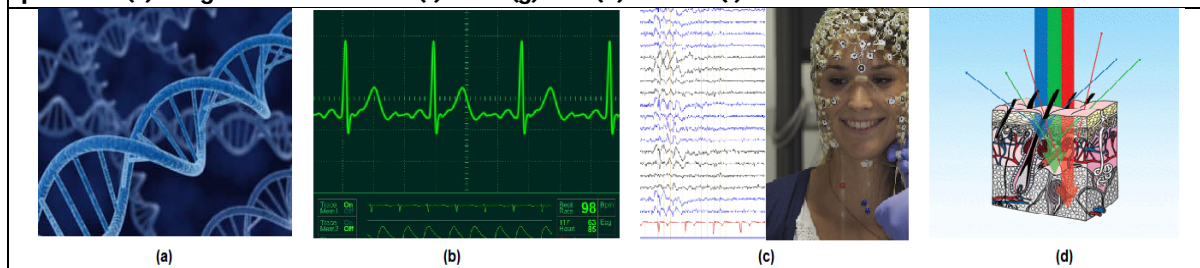
Figure 2: Biological Traits (a) DNA (b) ECG (c) EEG (d) Skin spectroscopy
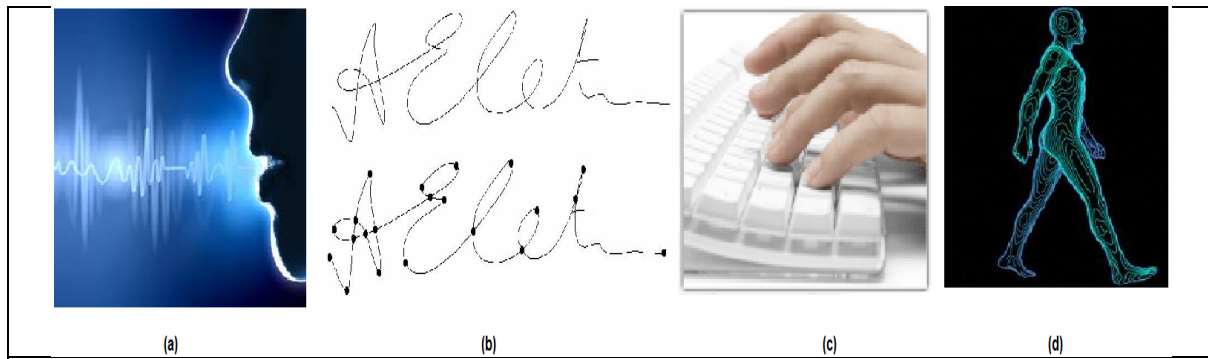
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Figure 3: Behavioural Traits (a) Voice (b) Signature (c) Keystroke Dynamics (d) Gait
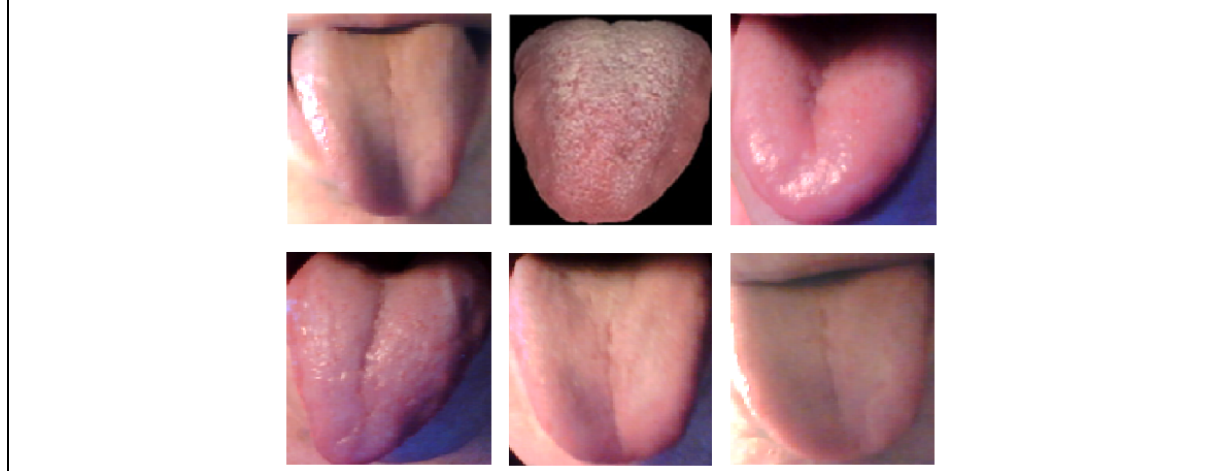
Figure 4: Tongue images
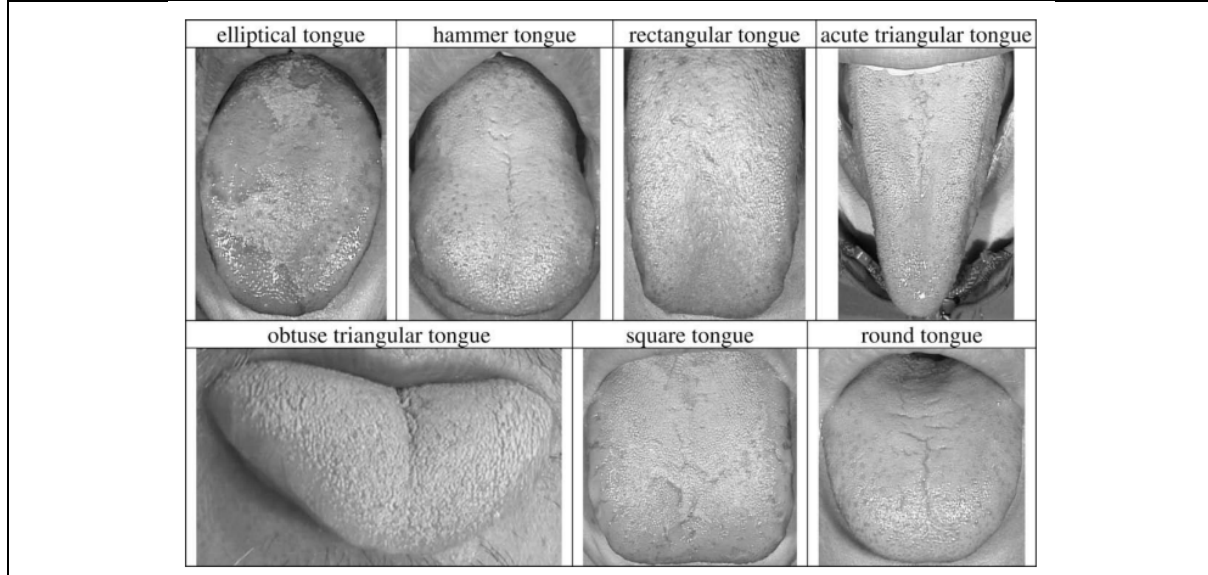
Figure 5: Some typical samples of various tongue shapes.

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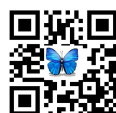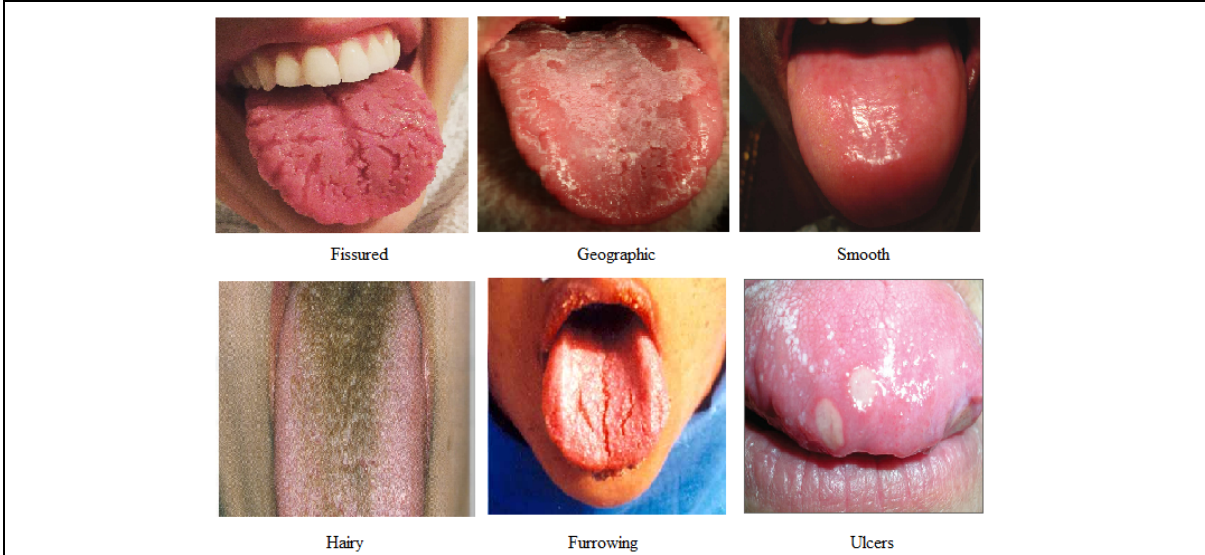
Figure 6: Some typical samples of various tongue textures
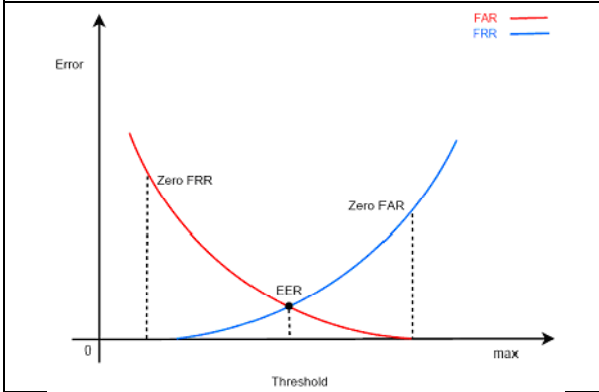
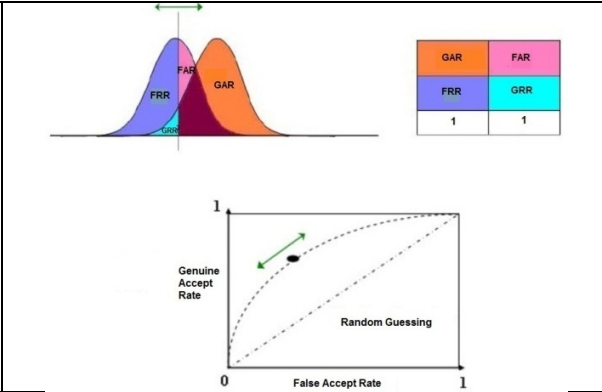**Figure 11: A Typical Performance Curve**

Figure 12: Receiver Operating Characteristics

RESEARCH ARTICLE

Analysis of Shoulder Performance and Physiotherapy Acceptance in Tennis Players: A Qualitative Survey Study

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ABSTRACT

Tennis is the most popular sport played around the globe in which around 20,000 people play tennis recreationally annually and the count continues to grow. Tennis players require optimum balance between power, strength, speed, accuracy and endurance to avoid any injuries which may affect their game and carrier. For this purpose, we surveyed professional & recreational tennis players with the aim to understand difficulties they face while playing tennis and their awareness regarding physiotherapy rehabilitation programs. A web based online questionnaire through Google forms was distributed to the tennis players in an around Ahmedabad and Gandhinagar district of Gujarat, India via various social media platforms and email–id. The results obtained were analyzed using basic statistics (such as total numbers and percentages) through Microsoft excel and inbuilt google form calculation and a subgroup analysis was performed using Kruskal-Wallis test using SPPS version 24 at the level of significance p-value ≤ 0.05 Through this survey we conclude that majority of tennis players are having issues in their shoulder performance during their game especially problems related to power and strength and are aware about physiotherapy but have limited knowledge of advance rehabilitation protocols like advance thrower's ten exercises; thus, there is a strong need to design a strength training protocol addressing the shoulder performance based on fitness & strength parameters of the tennis players which would enhance players performance and thereby improving their game performance.

Keywords: Tennis, Plyometrics, Advance Throwers Ten, Shoulder Performance, Strengthening Exercises

INTRODUCTION

In the Past era, Tennis use to be played through the wooden racquet, crafty points which were based on style and finesse. Now it is one of the most popular sports played globally in which around 20,000 people play tennis recreationally annually and the count continues to grow [1]. Tennis is played as a fast-paced explosive game which requires power, strength, speed and endurance. Commonly for one serve around 210 km/h velocity is required and in that velocity of the ball is around 134 to 201 km/h[1].Attending high level of precision in tennis is much necessary because the time of contact between the ball and racquet is 0.03 to 0.06 seconds[2]. So, the performance of a tennis player needs to be have an optimum balance between power, strength, speed, accuracy and endurance. Tennis athletes should have anaerobic skills, such as speed, agility, and power with high aerobic capabilities. The player needs repeated dynamic movements such as acceleration and deceleration to stroke. The work-to-rest ratios of professional competitive tennis range between 1:3 and 1:5 and hitting accuracy is greatly dependent on level of fatigue[1].If the player does not have proper shoulder training, he is more likely to get a shoulder injury which shall impact his game and carrier. Low shoulder strength, power, stability, and reaction time are responsible for all these injuries. Further research in prevention of injury to the tennis player should focus on fatigue, recovery, and injury levels in order to improve the performance of the player's shoulder so that the speed and velocity of the stroke improves[3].

The most common types of injury in tennis players in the shoulder are muscle sprains, ligament sprains, rotator cuff muscle injury, acromioclavicular joint injury, soft tissue injury, joint instability, muscle soreness, tear, impingement, and tendonitis [4,5].These injuries in younger players are usually not longstanding but chronic problems are seen in older players [4].Some traumatic injuries, including contusions, abrasions, lacerations, and fractures, may occur as a result of aggressive play. To prevent all these shoulder problems and injury while playing the game it is very important to pay attention to the performance of the muscle for injury prevention; thus, teaching tennis skills will help to reduce the incidence of injury in tennis players[4,5].To be successful in tennis a player requires talent, good coaching, equipment and a thorough understanding of sport sciences especially in biomechanics. Biomechanics knowledge is very much essential for a player as it will help in minimising injury and enhance physical performance [5]. In tennis serve there is eccentric stretch and pretension of anterior shoulder muscle whereas in ground strokes internal rotation of upper arm accelerates swing to impact before the external rotator contract eccentrically to decelerate during the follow through phase of action[6].Thus one of the major of shoulder injury in tennis player is imbalance between peak strength / torque in the muscle responsible for acceleration and deceleration[7],so it is very apparent that we should train both eccentric and concentric muscles and should recognise muscle imbalance in order to prevent injury[5].The thrower's ten exercises are designed to exercise the major muscles necessary for throwing and the advanced throwers ten exercises is an expansion of thrower's ten exercises[8]. That incorporates throwing motion-specific exercises and movement patterns performed in a discrete series, utilizing principles of co-activation, high-level neuromuscular control, dynamic stabilization, muscular facilitation, strength, endurance, and coordination, which all serve to restore muscle balance and symmetry in the overhead throwing athlete resulting in excellent results in athletic performance training it providing a higher level of humeral head control that necessary for the overhead throwing athlete's symptom-free return to sports[9,10]. These exercises are for improving the strength, power, and endurance of the muscles of the shoulder joint. Exercises used in advance thrower's ten programs are most effective in activating the muscles important in throwing motion [8]. Whereas, powerful muscular contractions post rapid stretching or dynamic loading of the same muscle group is defined as Plyometric exercises. Plyometric exercises are most frequently used in strength and power exercise programs; the pre-stretch is the most important phase of the plyometric activity because it increases the excitability of the neurological receptors, which enhances the reactivity of the neuromuscular system[11]. The plyometric exercise emphasizes the same concept as some overhead activities such as throwing does; which is elastic loading followed by a maximal concentric muscle contraction[12].

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All these exercises help the player to reduce their difficulty in hitting a stroke and if a player has difficulty hitting a particular stroke, the muscle used in hitting the stroke can also be exercised and its difficulty can be reduced thereby increasing the player performance. To understand in depth, the problems faced by tennis players in playing with respect to shoulder performance; it is very much essential to identify the area of concern from the tennis player's community. Thus, the aim of this study was to analyze problems faced by tennis players in Ahmedabad and Gandhinagar district of Gujarat, India in terms of shoulder performance and their level of understanding regarding physical therapy rehabilitation protocols like conventional physiotherapy, advance thrower's ten and plyometric exercise.

MATERIALS AND METHODS

We surveyed the professional and recreational tennis players around Gandhinagar and Ahmedabad district, Gujarat, India between 1 December 2020 to 31 March 2021through Google e-survey online form which was divided into three sections in first section consent of the participant was taken, in second section demographic details of participants were taken, and third section included questionnaire for tennis players. The survey form was shared on various social media platforms and was also e-mailed to the relevant contacts. The participation in this survey was completely voluntary which was also informed to all the participants and it was made sure that the information shared would be kept confidential. The collected information does not imply any harm, so the Ethical Review Board certification was not needed. In this survey questionnaire as shown in table 1, questions 1 to 6 were designed to get insight knowledge of participants regarding type of player, location where they play tennis, any history of shoulder injury, duration of playing tennis and questions 7 to 12 were related about what kind of difficulty players have during stroking and questions 13 to 18 were related regarding awareness of player related to physiotherapy, and their willingness to take physiotherapy if required. The results obtained were analyzed using basic statistics (such astotal numbers and percentages) through Microsoft excel and inbuilt google form calculation and a subgroup analysis was performed using Kruskal-Wallis test using SPPS version 24 at the level of significance p-value ≤ 0.05

RESULTS AND DISCUSSION

A total of 144 Tennis Players out of 5400 (response rate 2.66%; CI 95%; margin of error 9.64%) completed the survey; In this survey maximum responses were from players aged between 18 to 30 years (59.70%).Through questions3 to 6 it was found that players have been playing tennis without a coach for 2 hours a week without any shoulder injury for the last 2 years. Questions 7 to 12 helped us in identifying what type of difficulties pertaining to shoulder the player has while playing tennis and whether there is any problem in muscle strength, power or reaction time or not. Questions 13 to 18 were aimed to know what player knows about physiotherapy whether he or she is taking any physiotherapy and whether he or she knows about different shoulder strengthening exercises or not. According to this survey majority of the participants 76.20 % were from Gandhinagar and were recreational players (91.50%). Around 89.6% players had no history shoulder injury and were playing tennis since last 2 years (49.3%) for 2 hours a week (49.3%); 91.7% were playing without the help of a coach & 88.90% of players were knowing about physiotherapy and 90.30% have never taken any physiotherapy for the shoulder joint.

In this survey, the players were asked about the difficulty in hitting the stroke while playing the tennis game and different shoulder exercises that can strengthen shoulder muscles. After asking all these questions the results of the survey demonstrate that most of the players have trouble hitting strokes while playing the game. Problems like having lack of strength, power and reaction time were of major concern. Only 89.60% of players had no problem with the shoulder while playing, if we look at this statistically P-value <0.05 which shows the statistical significant difference in history of shoulder injury, years of playing tennis, average duration of play in a week and their professional training with a coach. Questions 7 to 18 had p value >0.05 suggesting no significant difference
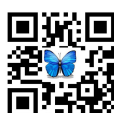
statistically which means that players require flexibility, muscular strength, co-ordination, synchronicity and neuromuscular control of arm strength.

The reason for reduced shoulder performance can be rounded shoulder and forward head posture due to weakness of scapular retractors and deep neck flexor muscles as they change the resting position of the scapula leading to sport specific adaptation. This leads to disturbance in normal scapulohumeral rhythm because of abnormal scapula positon, altered scapular muscle firing and reduced strength of scapular retractor muscles[8].This further leads to internal impingement and increases compression on the labrum and rotator cuff muscles causing abnormal stress over anterior capsule and structures thereby decreasing the shoulder performance in tennis players. Thus, it is important to improve the scapular retractor muscles strength in order to create a stable platform which connects the arm to the torso which leads to effective overhead performance of the athlete and injury prevention. As tennis is combination of aerobic and anaerobic activities tennis players has either predominantly fast or predominantly slow fibre type of muscles [1].

The current survey which was focused on finding problems related to tennis players have suggested the same as most of the tennis players are facing difficulty in power during serving (43.80%), forehand volley (31.90%) & smash (59.70%) whereas players are facing difficulty in strength during forehand ground stroke (45.80%), backhand ground stroke (31.30%) and backhand volley (28.80%). This correlates with the previous studies which states that due to presence of unique musculoskeletal profile of overhead athletes which includes excessive motion around shoulder thereby reducing the glenohumeral joint stability and ultimately leading to instability of glenohumeral joint complex. Thus, there is a strong need to focus on dynamic stabilization of the joint which will help in enhancing the shoulder performance in overhead athletes. One of such exercise is Advanced Throwers Ten exercises; which acts like a bridge between rehabilitation phase to return to competitive phase as it is based on the principles of dynamic stabilization, rotator cuff facilitation, neuro muscular control and coordination of specific throwing activities in very unique and progressive manner [9].

Whereas Plyometric exercises which are more commonly used in lower limb rehabilitation purpose; basically use prestretch of muscle before its concentric contraction to produce quick and powerful movements. To enhance the reactivity of neuromuscular system, the pre stretch component is very important in plyometric exercises as it increases the excitability of neurological receptors. Another principle which is important to consider is recoiling capacity of the elastic tissues; as the stretch (eccentric contraction) which is applied before concentric contraction is stored as elastic energy which will thereby enhance the concentric contraction of the muscle when released as power output. Thus, Plyometric exercises basically works on SAID principle to produce power and strength of the concerned muscle or muscle group.

In throwing athletes, cocking phase increases the distance by which the force is applied to the ball and acceleration phase in which shoulder is in maximum external rotation in the starting position is the explosive phase where shoulder rotates internally. The acceleration phase is followed by deceleration phase where the speed of the throwing arm is reduced leading to rapid internal rotation of arm with horizontal abduction[11]. Thus, it is very important to achieve power, strength and improve reaction time in overhead athletes like tennis players and a rehabilitation protocol focusing the overall strength and power of shoulder complex muscles needs to designed. Our study had certain limitations like the study was focused for tennis players in an around Ahmedabad and Gandhinagar districts of Gujarat, India; thereby relatively less sample size which can have statistical impact on the outcomes of the study. Also, in order to get maximum responses from the known sample area the survey was kept short and simple and we had no control over the participant's responses which can lead to selection bias and majority of the survey participants were recreational tennis players and due to COVID-19 pandemic the response rate was also less. We recommend to have future studies comparing strength training protocols for shoulder performance in tennis players which not only develops muscular strength, power and improves reaction time but also reduces chances of injury thereby enhancing an individual performance.

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Through this survey we came to know that majority of the tennis players are facing issues related to power and strength especially during serving the ball, ground stroke, backhand stroke, forehand volley, backhand volley and smash. Majority of players are aware about the role of physiotherapy in improving the performance but have limited knowledge of advance rehabilitation protocols like advance thrower's ten exercises. Thus, we conclude that there is a strong need to design a strength training protocol addressing the shoulder performance based on fitness & strength parameters of the tennis players which would enhance player's performance and thereby improving their game performance.

ACKNOWLEDGEMENT

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Table 1: Description of Questions and Responses in the Survey

Questions	Responses
Q.1 What kind of tennis player are you?	Professional (District, National, International) Recreational (Club player / Hobby)
Q.2 Where do you play tennis?	Ahmedabad / Gandhinagar
Q.3 Are you having any history of shoulder injury?	Yes / No
Q.4 Since how many years are you playing tennis?	1 Year 2 Year 3 Year More than 3 Year
Q.5 On average, how many hours do you play tennis in a week?	1 Hours 2 Hours 4 Hours More than 4 Hours
Q.6 Are you at present taking any professional training with a coach?	Yes / No
Q.7 Are you having any difficulty in serving the ball during tennis service ?	Difficulty in Power Difficulty in Strength Difficulty in Reaction time No Difficulty
Q.8 Are you having any difficulty during forehand groundstroke ?	Difficulty in Power Difficulty in Strength Difficulty in Reaction time No Difficulty
Q.9 Are you having any difficulty During backhand groundstroke ?	Difficulty in Power Difficulty in Strength Difficulty in Reaction time No Difficulty
Q.10 Are you having any difficulty during forehand volley ?	Difficulty in Power Difficulty in Strength Difficulty in Reaction time No Difficulty
Q.11 Are you having any difficulty during backhand volley ?	Difficulty in Power Difficulty in Strength Difficulty in Reaction time No Difficulty
Q.12 Are you having any difficulty during the overhead smash ?	Difficulty in Power Difficulty in Strength Difficulty in Reaction time No Difficulty
Q.13 Have you ever heard about physiotherapy?	Yes / No
Q.14 Are you taking any or have taken any physiotherapy for the shoulder joint?	Yes / No
Q.15 Have you heard about stretching or strengthening training for shoulder muscles?	Yes / No
Q.16 Have you heard about plyometric training for shoulder muscles?	Yes / No
Q.17 Have you heard about advance thrower's ten training for shoulder muscles?	

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| Q.18 Are you interested in undergoing a specialized physiotherapy training protocol based on evidence to improve strength, power, and reaction time?	Yes / No

Table 2: Subgroup Analysis as per Participants Responses

Questions	p-value
Are you having any history of shoulder injury?	0.04
Since how many years are you playing tennis?	0.04
On average, How many hours do you play tennis in a week?	0.03
Are you at present taking any professional training with a coach?	0.04
Are you having any difficulty in serving the ball during tennis service ?	0.63
Are you having any difficulty during forehand groundstroke ?	0.62
Are you having any difficulty during backhand groundstroke ?	0.54
Are you having any difficulty during forehand volley ?	0.56
Are you having any difficulty during backhand volley ?	0.58
Are you having any difficulty during the overhead smash ?	0.68
Have you ever heard about physiotherapy ?	0.51
Are you taking any or have taken any physiotherapy for the shoulder joint ?	0.82
Have you heard about stretching or strengthening training for shoulder muscles ?	0.89
Have you heard about plyometric training for shoulder muscles ?	0.58
Have you heard about advance thrower's ten training for shoulder muscles ?	0.56
Are you interested in undergoing a specialized physiotherapy training protocol based on evidence to improve strength, power, and reaction time?	0.53
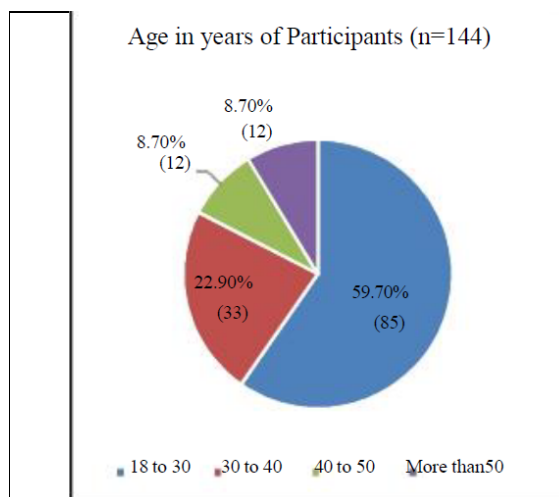
Figure 1: Pie Chart of Participants Age in Years
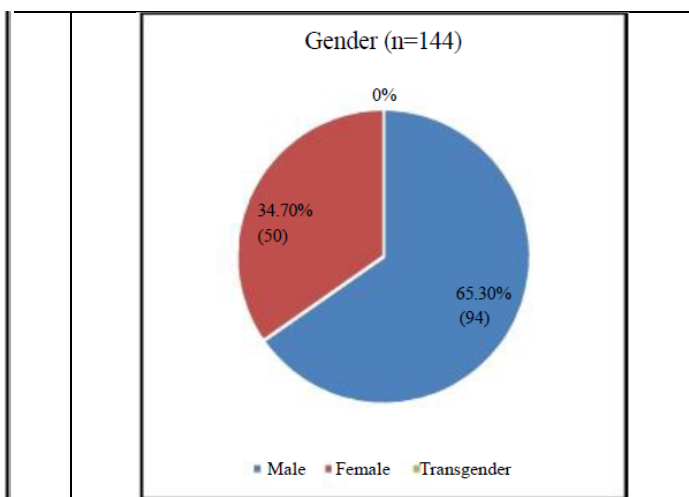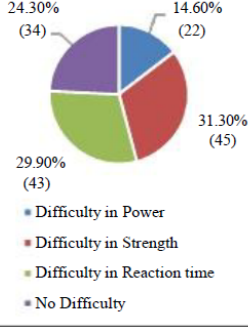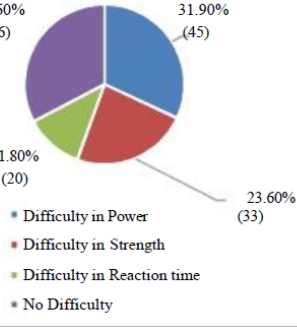

Figure 2: Pie Chart of Participants Gender Distribution

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Figure 3: Pie Chart of Participants Responses of Question 1

Figure 4: Pie Chart of Participants Responses of Question 2

Figure 5: Pie Chart of Participants Responses of Question 3

Figure 6: Pie Chart of Participants Responses of Question 4

Figure 7: Pie Chart of Participants Responses of Question 5

Figure 8: Pie Chart of Participants Responses of Question 6

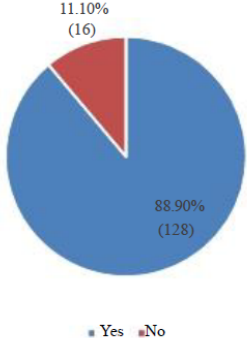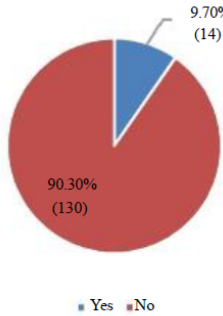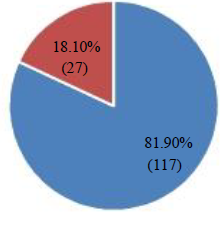**Parth Trivedi** *et al.*

Figure 9: Pie Chart of Participants Responses of Question 7

Figure 10: Pie Chart of Participants Responses of Question 8
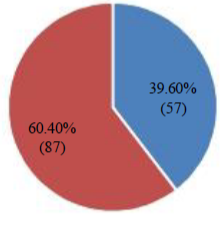

Figure 11: Pie Chart of Participants Responses of Question 9

Figure12: Pie Chart of Participants Responses of Question 10

Figure13: Pie Chart of Participants Responses of Question 11

Figure14: Pie Chart of Participants Responses of Question 12

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Figure15: Pie Chart of Participants Responses of Question 13

Figure16: Pie Chart of Participants Responses of Question 14

Figure 17:Pie Chart of Participants Responses of Question 15

Figure18: Pie Chart of Participants Responses of Question 16

Figure19: Pie Chart of Participants Responses of Question 17

Figure20: Pie Chart of Participants Responses of Question 18

RESEARCH ARTICLE

A Comparative Study on Cloud Computing and Edge Computing with its Applications

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ABSTRACT

In today's world Computer networks have become increasingly abundant. Day-day a huge volume of data is generated by many IoT devices. There is a need to maintain a separate server to process the massive volume of information. Therefore, came cloud for handling a large volume of data quickly. But still, cloud computing faces some issues in terms of latency and bandwidth for storing and processing the information. As a solution to this, an edge computing occurs. It is a distributed computing model that computes the data to the nearer node to improve the response time and thus saves the bandwidth. Initially, this article encapsulates the concept of cloud environment and edge followed by the various application of edge technology.

Keywords: Edge computing, Cloud , Advantages, comparison, use cases.

INTRODUCTION

A Networks plays an important role in our daily life. A computer network is a collection of computers, that are connected with each system to exchange data between themselves and to other systems on the network. The protocol act as an intermediate between the computers to share the information. It exchanges the resources such as data files, printers, software, or any other items used by clients on the network[14]. However there are many benefits brought by the networks, still there arise network traffic for suspicious activity. Initially, data were stored on a server for computation, when the size of data varies and increases in size the traditional server fails to store such a huge volume of data for processing traditional Business organizations are always costly and difficult to manage. This

type of industry requires different types of software and hardware to run the organization is challenging. It requires a lot of experts to install, check and update the software. Therefore, occurs a "cloud computing" in the replacement of the traditional server to rid the problems.

Cloud Technology

Cloud is a process of delivering the services and resources to the user on demand basis. Instead of maintaining all the files on a storage media , the cloud technology saves all the files on a remote database that is owned by the organisation. The files that are stored on cloud are accessible to us via the internet. The main benefit of cloud storage is that the users,or the customers can access their data from different locations at any time. Cloud storage has a few more characteristics, such as, Availability- data can be accessed from different devices(PCs and mobile phones), Durability-data are protected from crashes.

Deployment Models

Public cloud provide services to all users on demand basis.
Private clouds provide services only for authorized users over the internet or an internal network.
Hybrid cloud is a aggregation of above two models.

Architecture

- There are two layers :
- Front End
- Back End

Figure 1 shows the architecture of edge computing that divides into two layers such as a front end and a back end.

Front End

The front end includes client-side interfaces to access the cloud platforms that is used by the client. It includes Chrome, Firefox, or internet explorer.

Back End

The back end manages all the required resources to provide cloud services used by the service provider. All Physical peripherals are referred to as back end. It consists of a huge amount of data storage, security mechanism, traffic control mechanisms, etc.

Advantages of Cloud Computing:
Efficiency / Cost Reduction

No need to spend huge amount of money on purchasing and maintaining equipment.

Unlimited storage capacity

Cloud supports a huge storage capacity to store any kind of files.

Mobility

Cloud allows sharing of data via smart phones and devices.

Disaster Recovery

It provides data recovery from natural disasters to power outages.

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Issues in Cloud Storage
Although there are many advantages, still cloud computing faces some issues like,

Data Loss
Intruders may hack the client's applications on the cloud, and thus access sensitive data [5][4]. Cloud computing faces a high risk on security due to computer virus or powerlessness. Servers can as well suffer from data loss. [11][15] [16].

Connection Problem
Sometimes the cloud service may not able to connect due to errors and system crashes [5].

Latency Issue
Since, accessing the cloud frequently, the processing time also increases, thus arises a latency problem.

Security: When transmitting the data in the smart phone, it may also contain private data. When such data are transferred to the cloud storage will leads to security problem.

Energy Consumption: As increase in the number of smart appliances the power consumption of data centers has increased drastically[1]. As a solution, a new computing technology called edge computing booms.

Need for Edge Computing
- Due to less connectivity.
- To avoid uninterrupted connection.
- Due to the delay in transmitting and delivering the data
- To store and process only the relevant data, instead of storing entire data on the cloud. So that it reduces the workload.
- Reduces the network cost of data transmission [5].

Edge Technology
Edge computing computes only the relevant data on nearer nodes instead of transmitting to the cloud storage. The user moves from cloud to edge mainly for speed processing, reducing latency, data security, uninterrupted connection, reduce traffic, lower connectivity cost and less maintenance [6]. The bandwidth and latency issues can be solved by edge computing [2]. It provides a computing model for edge intelligence services. The place of computation is called the edge node, For example, routers, switches, a mobile phone etc., are examples of edge nodes [8]. Thus the data are processed in their edge where the data is generated. So each node act as a server in edge computing. Edge computing is between cloud and IOTdevices. Edge Technology is not a replacement to the cloud, it is the extended version of the cloud. Instead of running processes in the cloud, edge computing runs processes on a local place like a computer or IOT devices/edge server. For long-term storage, the cloud is used and for fast processing, the edge computing is used.

Advantages
- Reduce traffic loads
- Overcome the issues of privacy regulations
- Reduce redundant cost
- Improves scalability

When capturing the footage from surveillance camera, all the footage will be uploaded to the cloud data centre, it will take more time to process ,but in the case of Edge technology , only the relevant footage will be taken for

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process, also edge is used for traffic analysis, health monitoring system, analyzing live video streams etc.,[12]. By using edge computing in these fields helps to reduce the network latency issue [3][13].

Architecture
There are 3 layers in Edge technology. Terminal layer, Edge layer, and cloud computing layer [1].

Terminal Layer
All types of smart devices such as intelligent cameras, cell phones, vehicles etc., are connected to the edge network. This layer is responsible to sense the data and is used for processing and storage.

Boundary-Layer
This layer is responsible to separate the necessary information from large pool of data to upload on edge nodes for fast process. Thus provides security to the sensitive information.

Cloud Layer
The cloud computing layer included servers and storage devices, for fast computation. It is used to make a better decision in business [1].

Cloud Vs Edge Computing
Figure 3 shows the way how the data is processed in cloud and edge. Cloud can access data from anywhere at any time. It works on the Pay-as-you-go method that is, it charges for the resources based on the usage. This is similar to the electricity bills that generate only on the usage. The cloud corresponds to its services directly without involving any other layers. Whereas in Edge Computing, only .the relevant data are processed to the closer nodes, instead of loading all data to the data center. Thus it reduces the latency and increases the Quality of Service [9]. Table 1 summarizes the variation between cloud and edge technology [14].Cloud and edge computing vary with various factors such as time taken to transfer data, variation in latency, hardware capability, user, number of hops etc., and the same have been summarized in the table.

Application of EdgeComputing
The following are the applications where edge computing is used.

Health Care
The major components of smart cities are health care. Healthcare deals with a massive volume of information about the patient time to time. It is a difficult task to collect, store and analyse all the information by using cloud technology. Therefore, the best method to this issue is edge computing. This brings a cost-effective and reliable [10].

Video Analysis
In the current scenario, the cameras for surveillance are ample. By transmitting all the information to the cloud data store, it is restricted with relevant information by using Edge technology [7]. In video conferencing it will buffer due to time delay, but the same is used on edge will solve the problem and improves the quality in terms of video and voice.

Vehicle Interconnection
When two or more vehicles are interconnected with one another a large amount of data gets transmitted. Cloud can handle with such data but doesn't assured for speed processing. This is where the Edge technology plays a role today. The information is processed to the closer nodes and sends the notifications to the vehicles during complex situations.

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Mobile Big Data Analysis

The usages of mobile phones are increasing day by day. A huge data is generated and is difficult to filter the necessary information for an insight. By using an edge server it is easy to extract the relevant information to make better decisions on business [6].

Smart Building Control.

The sensors are fixed to the building for analyzing the activities. It may generate more data, these data can be collected and processed by using Edge server for better performance

Naval Monitoring and Control.

Edge server is used in Marine environment to protect from disasters problem quickly [4].

Smart home.

For home security, many smart devices are connected to analyse if any suspicious activities occurs. This can be achieved by using Edge technology .

Smart city.

Smart cities improve the quality of life for resident. The sensors, traffic lights, etc, are highly dependent on the cloud, but having every traffic light go out downtown because of an internet failure. By using some edge computing, traffic signals can continue to operate and streetlights can communicate with each other without going to the central cloud.

Manufacturing.

Edge technology enables the machinery to make better decisions without man power. It helps to analyse if any failure component has to be replaced. Thus it reduces the time and cost [6].

Smart Speakers.

Smart speakers plays an important role in today's era. The user accepts the smart speakers and voice-activated remotes to respond quickly and accurately. But, most of us worried about privacy issues. That is, whether only necessary commands such as online shopping go to the cloud or storing the financial information, and we are not sure if non-commands are deleted at the source.

CONCLUSION

As an increase in data day to day, there occurs the problem in a delay to transfer data and need a separate server to store it. When there is a problem in connectivity, there may be a chance to lose the data. These are the difficulties that occur while using cloud computing. As a solution to it, Edge Computing arises with many features. Edge computing is not a replacement to the cloud, it is an extension to the cloud. Instead of a running process in the cloud, Edge Computing process it on a local place like IOT devices or edge server. Thus it improves the bandwidth and decreases the latency problem when transferring data.

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Table:1 Cloud Vs Edge Computing

Parameters	Cloud Computing	Edge Computing
Service Location	Within the Internet	In edge network
Distance (Number of Hops)	Multiple hops	Single hop
Latency	High	Low
Jitter	High	Very low
Location awareness	No	Yes
Geo-distribution	Centralized	Distributed
Mobility Support	Limited	Supported
Data enroute attacks	High probability	Very low probability
Target user	General Internet users	Mobile users
Service Scope	Global	Limited
Hardware	Scalable capabilities	Limited capabilities
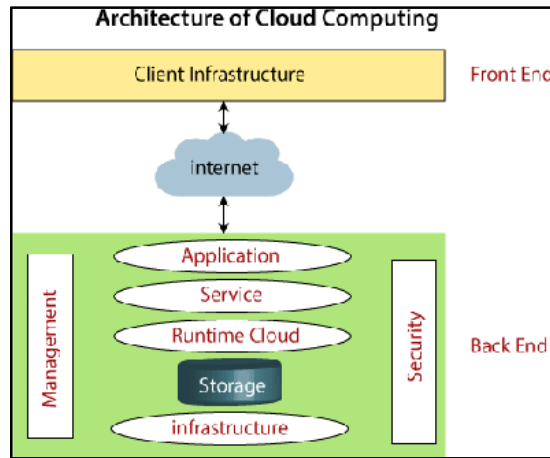
Figure 1 : Architecture of cloud computing
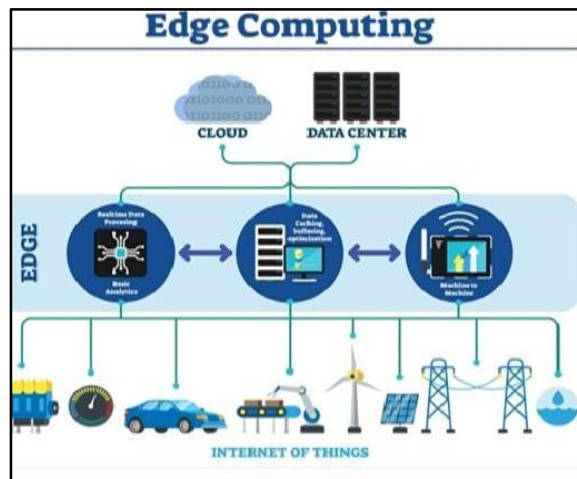
Figure 2 : Edge Computing
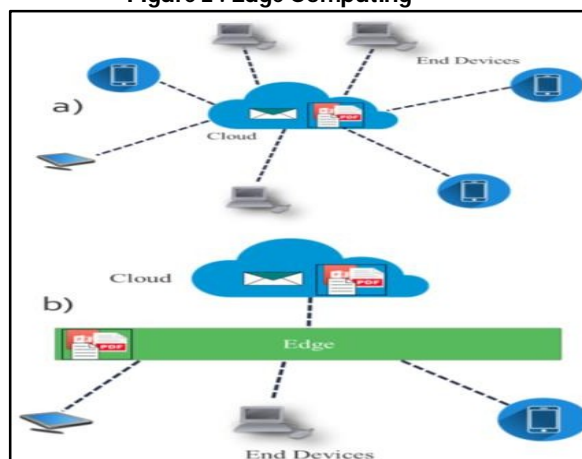
Figure 3 : Cloud Vs Edge Computing

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RESEARCH ARTICLE

Gut Microbiota-Brain Interaction with Special Reference to Alzheimer's Disease

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ABSTRACT

Gut microbiota is showing and raising evidence that the dynamic changes in the gut microorganism can influence physiology and behavior of brain. Dysbiosis or dysbacteriosis is a condition of microbial imbalance inside the intestinal microbiome. It has been associated with disorders of intestinal and extra-intestinal such as inflammatory bowel disease and other multiple diseases like asthma, diabetes mellitus, rheumatoid arthritis and autism. Microbial dysbiosis is also linked to neurodegenerative disease like Alzheimer and Parkinson. Gut microflora and brain have dynamic bidirectional relationship. Butyrate synthesized by the gut bacteria through the fermentation of nondigestible fibers or polysaccharides. Butyrate obtained from gutmicrobiota has a noteworthy impact on the health of the gut, but the effects of butyrate go away from the colon to the brain. Butyrate has a most important effect on gene expression especially in the brain. It functions like a histone deacetylase inhibitor (HDAC) affective to the gene activation in brain. Butyrate can protect cell death of brain neurons from conditions like Alzheimer disease (AD). It has a weighty impact on memory and help in improving capacity of learning especially in condition like dementia. In some studies it has found that butyrate played an important role in cell repairing mechanism and provides protection against cell damage from toxic metals. In humans, it is reported that metals like mercury, lead and copper are concerned in dementia in Alzheimer disease susceptible patients.

Key words: Gut microbiota, Dysbiosis, Alzheimer disease, Histone deacetylase inhibitor (HDAC), Brain.

INTRODUCTION

Several microbes grow and continue to exist inside and on humans. There are various environmental factors that is responsible for affecting gut microbial inequality, which is closely related to human health [1]. This review thus highlights the role of essential gut microbial flora in basic biological processes for providing general information on

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the development of therapeutic strategies with special reference to Alzheimer's disease. Various advances in technologies i.e. computational bioinformatics have been made related to microbial research. Current research on gut microflora is more complex and comprehensive [2]. Nowadays, it is advisable to focus on the effects of germs and related mechanisms in research. This will help understanding the function of the gut microbiota associated with disease and health. It provides new therapeutic goals and approaches for the treatment. The microbial composition is specific to host, occurs throughout the life of the individual, and is sensitive to external and endogenous changes [3] The microbiota is deeply involved in many areas, from the nutritional state of normal physiology to behavior and stress. The ratio of gut microbial community is important, as they are involved in providing specific responses, ensuring homeostasis [4]. Although the mechanism that microbiota exerts beneficial or harmful effects is often unknown, it involves the processing of signaling molecules and bacterial epitopes recognition by intestinal epithelial cells and immune cells within the mucosa (Figure 1). The intestinal substrates i.e. dietary fiber produced by gut microbiota, promotes the development of short-chain fatty acids like acetate, propionate and butyrate [5]. Butyric acid is major source of energy for human intestinal cells, causing apoptosis in colon cancer cells, activating gluconeogenesis and other homeostasis [6].

The biologically active short-chain fatty acids produced by intestinal microbiota can ferment fibrous foods and pass through the blood-brain barrier [8]. Enterobacteria secrete several metabolites, but their effects on AD etiology have not been revealed. Isobutyric acid, butyric acid, formic acid etc. are reported to affect AD pathogenesis by altering various activities like microglia as well as astrocytes activation, that help reduce inflammation and accumulation of $A\beta$ and tau [9].

Gut Metabolites and Alzheimer's disease

The intestinal microbiome in the ileum and colon are involved in synthesis of biologically active components i.e. short-chain fatty acids (SCFAs) that have capability to ferment fibrous food and breaching the blood-brain barrier (BBB) [10]. Experimental studies have shown that in during the pathogenesis of AD, in central nervous system (CNS) there are significant rise in inflammation level, tau and $A\beta$ aggregations, confirmed by meta-analysis [11]. Approximately 100 metabolites have been produced by intestinal bacteria, but there is still no clear evidence of their mode of action with respect to AD pathogenesis. Butyric acid along with other metabolites has been reported to exert significant affect against the pathogenesis of AD by altering major mechanisms like activations of microglia and astrocytes as seen in Figure 2 [12]. When a comparative analysis was made between two strains of gut microbial flora i.e. *Anaeroplasmatales*, and *Anaerostipes* it was reported that *Anaerostipes* is reported to have an important role in production of butyric acid and maintenance of brain health [13].

Butyric acid and Aβ clearance

Major neuropathological way involved in AD pathogenesis is formation $A\beta$ aggregates through self-assembling of $A\beta$ peptides. Researchers have monitored individual SCFAs effect through PICUP assay that is involved in estimating the effect of SCFAs in attenuating formation of neurotoxic aggregates by inhibiting assembly of $A\beta$1-40 or $A\beta$1-42 peptides [15]. Major SCFAs identified through this assay are butyric acid, valeric acid isobutyric acid etc. Multimeric $A\beta$ forms and other associated monomeric peptides of $A\beta$1-40 or $A\beta$1-42 were analyzed by SDS-PAGE and visualized by staining [16]. Studies have shown that without consideration of SCFAs in the experimentation crosslinking of $A\beta$1-40 occurs and leads to the formation of the dimer and trimer form. Specifically, butyric acid interferes with $A\beta$1-40 protein-protein interactions, when SCFA and $A\beta$ were taken in molar ratio of 1:1, as observed in PICUP assay [17].

Butyric acid and gene expression

The proliferation of microglia and the cell cycle progression is dependent on level of genes expression pattern involved. Researchers have shown that when SCFAs, specifically butyric acid is used for energy metabolism in AD, there is significant decrease in the expression pattern of genes specific to tau and $A\beta$ [18]. It is known that gut

microbiota have role in maturation and activation of microglia, and therefore, in cases where the gut microbiota changes, there is decrease in microglia's ability of phagocytosis to reduce tau and Aβ. Maturation and APP proteases are regulated through trafficking by means of secretory pathway [19]. In AD, combination of stress signal and pathological brain disorder supports interaction between neurodegeneration and endoplasmic reticulum stress. As a result, small molecular chaperones that support protein folding and minimize ER stress can be effective in interfering with the harmful progression of AD [20].

Modified Butyric acid and AD
APPswePS1delta 9 AD transgenic mice was used as an experimental model for treatment with molecular chaperone i.e. phenylbutyric acid (PBA) PBA therapy is involved in enhancing increased APP cleavage based on secretase [21]. AD transgenic mice treated with PBA significantly reduced the amyloid plaques size throughout the hippocampus as well as cortex region. The results thus obtained justifies that PBA alters its amyloid pathogenesis independent of biogenesis. One of the essential neurotransmitters like gamma-aminobutyric acid (GABA) have been secreted by *Lactobacillus* and *Bifidobacterium* strains mediate the negative effect on neurological dysfunctions [22]. Cognitive performance is facilitated by PBA therapy, as confirmed by amyloid plaques reduction as treated by the same, along with increased levels of ADAM10 and TACE in the cortex and hippocampus. Pathological features of AD are reported to get improved by PBA therapy [23].

Broad-based medical benefits of butyrate
Butyric acid or butyrate is the member of short chain fatty acids (SCFA) family. This is also included members like acetic acid, propionic acid and valeric acid. These SCFA or metabolites are physiological compounds which are found in especially every mammalian organism. It is principally synthesized by fermentation of undigestablesugar and protein obtained from soluble fibres. It produced by probiotics (gut bacteria) in the colon through anaerobic process. The concentration of SCFA is balanced by production and absorption rates as well as removal rate through gut microbiota. They are metabolized inside the colon by epithelial cells, where SCFA work as prime source of energy and play an important role in balance the physiologic functions [24-26].

Butyrate is the most useful resource along with the SCFA which be consider like successful the rapeutical metabolite in a number of intestinal dysfunctions due to its role in inflammation and cancer. It has many positive effects on human health. It synthesized from different type of non-absorbed carbohydrate by gut microbiota. At the intestinal point, butyrate are playing an important role in regulation of intestinal motility, transepithelial fluid transportation, ameliorates mucosal inflammation, an epithelial defense barrier and oxidative status.[27] It is also metabolized by gut microbiota and work as the chief energy resource for gut microorganism and makes it a essential and mutually beneficial relationship as seen in figure 3 [28].

Along with the SCFAs, butyrate has established beneficial consideration due to positive effects on balancing human health. *Butyricicoccus sp.* and *Clostridium* sp. is the principal microorganism of gut microorganism which produced butyrate in intestine [29]. It has been also reported that person suffering from Alzheimer disease have minimum number of butyrate producing bacterial species like *Butyrivibrio hungatei* , *Butyrivibrio proteoclasticus*, *Eubacterium eligens*, *Eubacterium hallii* and *Eubacterium rectal*. It enhances the respiration rate of mitochondria and production of ATP. Butyrate work as a inhibitor of histone deacetylation enzyme that induces the development of dendrites, enhance the number of neuron synapses, reinstates knowledge behavior and longterm memories access [30-32]. Butyrate can encourage expanded gut digestive tract motility by stimulating cholinergic neurons while propionate diminishes motility and builds discharge.

Short acyl chain of fatty acid (SCFA) like butyrate is a possible remedial and an attractive therapeutic agent for neurological disease which is regularly incorporated by microscopic organisms in the colon. It has ability to work as an inhibitor for histone deacetylation, energy metabolite for production of ATP, energy supplier for the epithelial cells of colon, participates to the maintenance of gut barrier, immunomodulatory, anti-inflammatory properties and

as GPCR (G protein-coupled receptor) activator. Pharmacologically, it has been found that butyrate had extremely favorable results on different disorders of brain including from neurodegenerative disorder to psychological disorder [33]. Some probiotics could facilitate the successful therapeutic management of neurodegenerative disorders to decrease the manufacturing of pro-inflammatory cytokines and to increase the activity of the special type of macrophages like M2 phenotype. It has been recently reported in vitro that a probiotic mixture of *Bifidobacterium lactis, Lactobacillus rhamnosus*, and *Bifidobacterium longum* showed an anti-inflammatory and immunomodulatory action on cells [35]. It is reported that 70–80% reduction in the synthesis of interleukin 1 and 6 (pro-inflammatory cytokines) and a significant increase in the synthesis of interleukin 10 (anti-inflammatory cytokine) due to above probiotic mixtures. In animal models, some probiotics emerge to affect the central nervous system (CNS) via the gut–brain axis [36].

Effects of butyrate on the brain

The description of microbiome associated with health of human is well explained in Human Microbiome Project Consortium (2012). It explained that the gut is involved in regulation of brain function and involve in defensive immune responses [37]. Evidences representative tight connections between gut-associated microbes with immune system, enteric system, endocrine system, nervous systems, psychiatric problem and neurological system. These connections showed gut–brain interactions and possible target to treat brain diseases [38]. Butyrate is metabolites with multifunctional nature that have noteworthy beneficial effect on brain. Butyrate can protect brain from harmful effects and enhance the plasticity of cells during neurological disease. With the function in detecting extracellular indicators, GPCRs are important for some of physiological functions which includes regulation of immune machine, autonomic nervous system regulation, sensory (flavor and smell) feature, and retaining power homeostasis.Dysfunction of GPCRs is related to some of diseases, which has made them the target for extra than 40% of authorized drugs [39]. In 2003, two orphan GPCRs has reported with unknown ligands that is GPR-41 and GPR-43. It was recognized as target receptor for butyrate (SCFA).They are renamed as free fatty acid receptors (FFAR) 3 and 2, respectively. Even though GPR41 and GPR43 are related and screening 52% identical sequences and present on chromosome 19. But they differ on their ligand choice which is based on fatty acid chain length. FFAR2 is more unique to the shorter aliphatic chains of acetate and propionate, even as FFAR3 preferentially binds to ligand as propionate, butyrate and valerate [40].

Brain neurological disease like Alzheimer's has reduced absorption capacity of glucose at the early stage of disease or just before the loss of memory. This is due to disconnection of metabolic events in the colon from the brain. Metabolic link is considered an important because immense energy demands of the brain and the energy dyshomeostasis that occurs in the brain. Alzheimer's brain is a good example of reduced glucose utilization which happens at the earliest stages of the disease and simply before memory loss [41]. The decrease utilization of glucose has encouraged a number of researches to discover therapeutic agents or targets to work as substitute sources of energy to complete the energy demand of brain. For example, triglyceride is used as a medicinal food which enhances the ketogenesis process via increasing production of β-hydroxybutyrate. After 45 days, it has been shown to improve brain health in Alzheimer's disease patients [42].

Reduced concentration of glucose in brain is due to dysfunction of mitochondria in neurological diseases at acute and chronic phase but in theory, it is fullfilled by the presence of butyrate in metabolism. Butyrate has many direct and indirect consequences on energy metabolism such as :

1) It has an effect on energy metabolism by using as a substrate for beta-oxidation.
2) It could upregulate genes concerned in biogenesis of mitochondria.
3) It affects the acetylation of histone protein as a selective HDAC inhibitor.
This last effect of butyrate affect the enzymes concerned in glucose metabolism, fatty acid metabolism and glycogen metabolism [43]. The powerful HDAC inhibitors are capable to extensively increase histone proteins acetylation. Some studies also demonstrated that butyrate is able to enhancing activity of mitochondria, which could help to

solve the disease related with non functional mitochondrial in the brain [44-46]. At present, no research have tested the metabolic impact of gut-derived butyrate at the brain. However, it hypothesize that if sufficient butyrate concentration could be reached inside the cells of brain, it may work as an alternative strength source in the colon and restore energy homeostasis. but the specific concentration of butyrate to have an effect on brain body structure via adjustments within the weight loss plan, gut microbiome or through pharmacological supplementation which include probiotics are nevertheless remain undefined.

Nanotechnology based therapeutic approaches

Several approaches have been opted to enhance the therapeutic effect of butyric acid. Hydrophobic NPs i.e. Liposomes could be used for greater bio absorption and crossing across BBB [47]. NPs based on hydrophilic polymers are used as a parenterally supported drug delivery system by providing privacy and extending drug retention time. Therefore, they facilitate passive diffusion of the drug through BBB by providing a higher gradient of concentration between the blood and brain [48]. For enhanced nasal drug delivery, muco-adhesive polymeric NPs could be used that allow direct drug absorption by endocytosis through BBB.NP targeted by surface ligands for receptor-mediated transcytosis [49].

Chitosan coated liposomes and uncoated liposomes with thin-film hydration mediated modified surface consisting of BA were synthesized for providing better therapeutic efficacy. BA loaded on Liposomes capped with chitosan showed greater therapeutic efficacy, due to unceasing of liposomes and releasing BA [50]. The released butyric acid has showed inhibitory activity with respect to pro-inflammatory cytokine production. Butyric acid pro-drug i.e. Cholesterol-butyrate (col-but) have shown anti-inflammatory as well as inhibitory activity against histone deacetylases (Liu et al., 2018). In order to evaluate efficacy of pro-drug i.e. Chol-but, solid lipid nanoparticles (SLNs), having Chol-but as lipid matrix have been used as a delivery system. This pro-drug delivery system has been tested for it antineoplastic effects to evaluated its activity against chronic inflammatory and associated diseases [51]

CONCLUSIONS

Alzheimer's disorder (AD) is the maximum commonplace persistent neurodegenerative sickness. because of Alzheimer's disease, patients suffer from quick-time period memory loss, vocal memory loss, temper swings, loss of enthusiasm and intellectual coordination abilities. The intestine microbiomes also are essential for the regulation of myelin-associated genes inside the improvement of a wholesome brain. Butyrate also works as key neurotrophic factors (chemicals that increase brain cell growth) which improves brain cells plasticity, increase new neuronal connection, growth and also increased cell survival. The human gut microbiota plays an important role in the structural integrity as well as metabolic functions of the colonic mucosa via the production of short chain fatty acids (SCFAs) such as acetate, propionate, and butyrate. These are the most abundant SCFAs present in the intestinal gut lumen at millimolar concentration levels. In the brain of Alzheimer's patients there is reduced utilization of glucose for energy, which can lead to dementia with the time. Many Alzheimer's patients suffering from depression well before symptoms of memory loss which appear after early biochemical changes. Butyrate is one possible way that can affect brain cells health and provide an alternative energy source.

CONFLICT OF INTERESTS
We have no interests to declare.

CONTRIBUTORSHIP
Dr. Neha Sharma did original draft preparation, validation, reviewing and editing, Dr. Pallavi Singh Chauhan conceived conceptualization, original draft preparation, validation, reviewing and editing, Dr. Vikas Shrivastava did validation and Dr. Rajesh Singh Tomar reviewed drafts of the paper.

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Fig. 1 Process of butyrate production in human intestine by carbohydrate fermentation pathways [7].
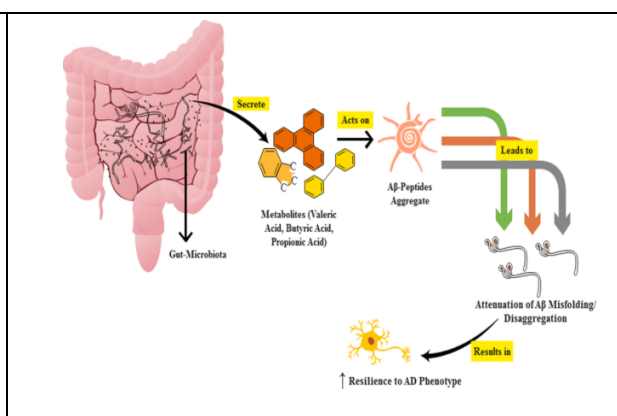
Fig. 2 Role of Microbial Metabolites in Attenuating AD Pathogenesis [14].

At intestinal level
- Absorption of ions, Proliferation and differentiation of cell, Intestinal barrier function, Immune-regulation, Intestinal motility, Visceral perception and rectal compliance, Acute gastroenteritis,

At extra-intestinal level
- Insulin sensitivity, Cholesterol synthesis, Energy expenditure, Ammonia scavenger, Stimulation of β-oxidation of very long chain fatty acids and peroxisome proliferation, CFTR function, Neurogenesis, HbF production

Fig. 3: Therapeutic effects of butyrate [34].

RESEARCH ARTICLE

In vitro Evaluation of Anti-Alzheimer's Efficacy and Safety Assessment (In Zebra Fish) of Marine Brown Alga, *Sargassum wightii* Greville Ex J.Agardh

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ABSTRACT

Neurodegeneration is the progressive loss of function and structure of neurons, including neuronal death. Alzheimer's disease is a neurodegenerative disease whose most common symptom is a progressive loss of mental functions and intellectual abilities, resulting in serious loss of daily life activities. In recent years, the use of natural products has been progressing in the treatment of various incurable diseases and disorders. Therefore the present study aims at evaluation and characterization of antioxidant potential and safety aspects in zebra fish of *Sargassum wightii* Greville ex J.Agardh. The aqueous extract of *S. wightii* was assessed for its antioxidant potential by DPPH radical scavenging assay, Hydrogen peroxide radical scavenging assay and reducing power assay. The extract was subjected to bioactive guided fractionation and all the fractions were assessed for antioxidant activity and acetylcholine esterase inhibitor assay. Fractions that exhibit higher antioxidant activity was segregated and pooled and characterized by GC-MS analysis. Acute toxicity study was performed in Zebra fish model. The result suggests that among all the fractions evaluated, ethyl acetate and acetone fractions exhibited excellent activity and the GC-MS analysis revealed the presence of bioactive phenolic compounds in it. The results of acute toxicity suggest that the aqueous extract of *S. wightii* did not exhibit any mortality in the adult fish. The results were further validated by liver function test and histopathological analysis. The seaweed upon further characterization might be exploited as an excellent lead compound for drug discovery.
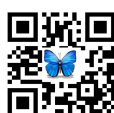
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INTRODUCTION

Neurodegeneration is the reformist loss of function and structure of neurons, including neuronal death. Those sorts of diseases are hopeless, bringing about progressive neurode generation. As the examination advances, there are numerous similarities that identified with these diseases at the sub-cell level. There are numerous equals between various neurodegenerative disorders including atypical protein gatherings just as actuated cell death. (1).The greater part of neurodegenerative diseases incorporates the Parkinson's illness, Huntington's sickness, Alzheimer's disease, and amyotrophic lateral sclerosis is associated with the neurodegenerative process. Alzheimer's Disease (AD) is a neurodegenerative disorder whose most basic manifestation is a progressive loss of mental capacities and scholarly capacities, bringing about genuine loss of everyday life exercises (**2**).Alzheimer's disease is a kind of brain disease. It turns out to be more regrettable with time. Alzheimer's disease is thought to start 20 years or more before symptoms emerge (**3**). Alzheimer's disease includes beta-amyloid peptide creation and aggregation. It isn't known precisely what prompts the condition. The amyloid theory has generally centered around the gathering of beta-amyloid peptides that induced neuronal degeneration. Accumulation of amyloid fibrils is accepted to be the harmful type of the protein is responsible for disturbing the cell's calcium particle homeostasis. Alzheimer's influences the brain, and it restrains some protein function and glucose take-up by neurons (**4**).Alzheimer's disease is unpredictable, and it is impossible that any one medication or other intercession will effectively treat it. Donepezil, Rivastigmine, Memantine and Galantamine are most prescript by physicians yet it gives more hurtful impacts so we need the natural medication and lesser side effects since focused the marine characteristic items over 70% of the world's surface is covered by seas, the tremendous variety of marine organisms gives a rich wellspring of natural materials that make up almost a fourth of the absolute worldwide biodiversity and are rich repositories of basically different bio-useful segments. In marine organisms, marine algae are rich wellsprings of basically assorted bioactive mixes with different natural compounds (5).The *Sargassum wightii* Greville ex J.Agardh populace growth, quick utilization of fuels products, and the related extreme environmental change issues have incited the search for a proficient, economical and harmless to the ecosystem sustainable power source. Change of solar energy into power with the assistance of minimal effort photovoltaic technology is functioning and contemporary examination area dedicated to handling worldwide energy interest and environmental issues. The significance of wipes for human utilization has been notable since 300 BC in China and Japan. These two nations are the world's significant ocean growth cultivators, makers and customers. In Indian Ocean Territories Malaysia, Indonesia, Singapore, Thailand, Korea, wipes are utilized in a plate of mixed greens, jam, soup and so forth Be that as it may, in India, kelp utilization is exceptionally low aside from *gracilia* species and porridge. *Acanthophora* species in coastal conditions of Kerala and Tamil Nadu(**6**).The zebra fish (*Danio rerio*) is a freshwater fish origin of the minnow family (Cyprinidae) of the order Cypriniforme. Local of the zebra fish Himalayan region, it is generally well known in the aquarium fish, as often as possible sold under the business trademark is the zebra fish. The zebra fish is most importent and broadly utilized spinal model life form in clinical exploration. It is especially distinguished for its regenerative abilities (**7**).

MATERIALS AND METHODS

Chemicals

Ellman's reagent (5,5'-dithiobis-(2-nitrobenzoic acid) and Acetylthiocholine iodide (ATCI) was purchased from Hi Media Laboratories Pvt. Ltd., Mumbai. Acetone, methanol, ethyl acetate, chloroform and DPPH were purchased from Sisco Research Laboratories Pvt Ltd Chennai, Tamil Nadu. Other chemicals and reagents used were of analytical grade with the highest purity.

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Seaweed Collection

The brown seaweed *Sargassum wightii* was collected from coastal region, Gulf of Mannar of Mandapam, Rameshwaram on the South East coast of India. The seaweed samples were washed thoroughly with fresh water to removal of the surface salts and other unwanted materials. Then seaweeds were shade-dried, powdered and stored in airtight containers for further study (**8**).

Extract Preparation of *Sargassum wightii*

The shade-dried *Sargassum wightii* powder (50 g) was extracted with 500 mL 0f distilled water by decoction method. The Sample Water complex is heated to a temperature of 60-70ºC when the volume of water is reduced by half and drained with Muslin cloth. The concentrate was then exposed to finish dissipation and put away in a hermetically sealed compartment (**9**).

In vitro Antioxidant Assay
DPPH (2, 2-diphenyl-1-picrylhydrazyl) Assay

DPPH radical scavenging activity was described by the method (**8**). In brief, DPPH 1.97 g was dissolved in 50 mL of methanol to prepare the stock solution. Various concentration of aqueous extract of *sargassum wightii* was evaluated 100 mg-500 mg extracts are used in 10 mg in 1mL water and their various concentrations were prepared by dilution method. The mixture was shaken and allowed to stand at room temp for 30 min. Then absorbance was measured at 517 nm. Ascorbic acid was used as standard all the experiments were done by triplicates.

Total Reducing Power

The reducing power of *Sargassum wightii* aqueous extracts was determined by the method of (**10**). Different concentrations of *Sargassum wightii* seaweed aqueous extract (10 mg/1 mL) in 1 mL of distilled water were mixed with phosphate buffer (0.5 mL, 0.2M, pH 6) and potassium ferricyanide [K_3Fe (CN) 6] (0.5mL, 1%). The mixture was incubated at 50ºC for 20 min. Aliquots (0.5 mL) of trichloroacetic acid (10%) were added to the mixture, which was then centrifuged for 10 min at 2500 rpm. The upper layer of solution (0.5 mL) was mixed with distilled water (0.5 mL) and ferric chloride $FeCl_3$ (0.5 mL, 0.1%), and the absorbance was measured at 700 nm in a spectrophotometer. Increased absorbance of the reaction mixture indicates increased reducing power.

Hydrogen Peroxide (H_2O_2) Scavenging Activity

The ability of H_2O_2 scavenging activity of *Sargassum wightii* aqueous extract was determined according to the method of (**11**). A solution of H_2O_2 was prepared in phosphate buffer (40 mM, pH 7.4). The hydrogen peroxide in various concentrations was determined spectrophotometrically at 230 nm. Different concentrations of *Sargassum wightii* (100-500µg/mL) were added to H_2O_2 solution (0.6 mL, 40 mM). Ascorbic acid (100-500µg/mL) was used as a positive control. Absorbance of H_2O_2 at 230 nm was determined after 10 min used blank solution containing phosphate buffer without H_2O_2.

Acetyl Choline Esterase Activity Assay

The AChE was prepared from 30 fishes was collect the brain homogenate and centrifuge collect the supernatant was collected and used as enzyme source for AChE assay. Differential concentrations (100-500 mg / mL) of aqueous extracts of *sargassum wightii* were incubated with 50µl of AChE make up 200µl of Tris- Hcl for 45 min at room temperature. To the reagent mixtures, 125 µL of 3 mM DTNB were added and total volume was added to 650 µL with Tris-HCl buffer (pH 8.0). Subsequently, 1 mM ATCI was added to 25 µL the reaction mixture to initiate enzyme activity. The formation of 5- di-thiobis-2-nitrobenzoic acid anion was detected and the absorbance was detected at a wavelength of 405 nm using UV-visible spectrophotometer .The assays were performed in triplicate. Donepezil was used as a standard drug (12).

Qualitative Analysis of Phytochemical Substance

The aqueous extract was assessed for the existence of the phytochemical analysis by using the following standard method (13).

Test for quinones: 2 mL of sample was taken and 1mL of sulfuric acid was added. The formation of red color indicates the presence of quinones

Test for phenols: 2 mL of sample and few drops of 10% ferric chloride were added. The appearance of blue or green color indicates presence of phenols.

Test for phlobotannins: 2 mL of samples was taken 2% of hydrochloric acid was added. Formation of red color is indicates presence of phlobotannins.

Test for Anthraquinones: 2 mL of sample was taken and 1 mL of 10% ammonia solution was added to the filtrate and shaken vigorously for 30 seconds and pink color indicated the presence of anthraquinones.

Test for Tannins: 2 mL of aqueous extract was taken few drops of 0.1% ferric chloride was added the formation of brownish green or blue black is showed the presence of tannins.

Test for Saponins: 2 mL of distilled water was mixed with aqueous crude extract in a test tube and it was mixed vigorously. Formation of foam is showed the presence of saponins.

Tests for Flavonoids: 2 mL of ammonia solution was mixed with 2 mL of aqueous crude extract concentrated yellow color was produced, which became colorless when we added 2 drops of diluted acid to mixture. This result showed the presence of flavonoids.

Test for cardiac glycosides: A solution of glacial acetic acid 2 mL with 1 drop of 2.0% Ferric chloride solution was mixed with the 2mL aqueous extract and 1 mL H_2SO_4 concentrated. A brown ring formed between the layers which showed the entity of cardiac glycosides.

Test for glycoside: 2 mL of sample was taken 3 mL of chloroform and add 10% ammonia solution was added. Pink color precipitation formed which indicated the presence of the glycoside.

Test for Terpenoids: 2 mL of chloroform was added with the 2 mL aqueous extract and 3 mL of H_2SO_4 concentrated. A reddish brown color formed which showed the entity of terpenoids.

Test for Steroids: 2 mL of chloroform and concentrated H_2SO_4 were added with the 2 mL aqueous crude extract. In the lower chloroform layer red color appeared that indicated the presence of steroids.

Test for carbohydrates: 2 mL of sample was taken 1mL of molish reagent and add few drops of sulfuric acid were added. The formation of red color is indicates presence of carbohydrates.

Test for alkaloids: 2 mL of sample was taken 1.5 mL of 10% hydrochloric acid were added then heated 20 mints after cooled and filtered then add 1mL of dragendorff's reagent. Formation of reddish or orange precipitate is indicating the presence of alkaloids.

Test for coumarins: 2 mL of sample was taken 1mL of 10% sodium hydroxide were added, after addition of NaOH its turn to yellow color it's indicates the presence of coumarins.

Bioactive Guided Fractionation by Column Chromatography

Silica gel column (60–120 mesh) was used for separation. The column bed (evenly set) was prepared using methanol. Aqueous extract (5 g) was impregnated with silica gel and loaded onto the silica gel column (60–120mesh). The solvents of varying ratio were introduced to the column and the fractions of double the bed volume were collected sequentially (**8**).

Column Fractions

The column fraction work to be done (Fig 1)

GC-MS (Gas Chromatography Mass Spectrometry)

1 mL of pooled active fractions was subjected to the supernatant and Identification was based on the molecular structure, molecular mass and calculated fragments Interpretation on mass spectrum GC-MS. The name, molecular weight and structure of the components of the test materials were ascertained. The relative percentage amount of

each component was calculated by comparing its average peak area to the total areas. GC-MS analysis was carried out on a GC clarus 500 Perkin Elmer system comprising AOC-20iautosampler and gas chromatograph interfaced to a mass spectrometer instrument employing the optimum conditions. Total GC running time is 36 min. The relative percentage amount of each component was calculated by comparing its average peak area to the total areas. Software adopted to handle mass spectra and chromatograms was a Turbo Mass Ver 5.2.0 (14).

Procedure for Acute Toxicity test for aqueous extract of *S. wightii* in Adult Zebra-fish

Wild-type adult zebrafish weighing 0.5-1.5 g was purchased from a local supplier. They were placed in the water tank and provided proper ventilation. The fish were fed daily with micro-particles to maintain. They were kept for 15 days with a total of 40 fish divided into four different groups and 10 fish per group. The three different concentrations of each compound were prepared in a geometric series with the incremental factor group serving as a control group (normal feed). Group 2 to group 4 received a combination of 50 mg, 100 mg and 200 mg. The drug was crushed before being added to the respective fish tank (**15**). After 14 days of the acute toxicity test, the total number of zebrafish in the group of 4 was 4 fishes were randomly selected and the major organs were removed (liver, brain, and gill) and placed in formalin and the histopathology test was performed.

Evaluation of the Histopathological Parameters

Histopathology is the microscopic study of the tissues affected by disease or infection. The technique deals with the preparation of tissues for microscopic examination. Tissues were cleared twice in xylene and embedded in paraffin. Six micrometer thick sections were made and stained with organs Hematoxylin and Eosin. The slides were blinded to the observer and histopathologic scoring was performed on all serial sections. Previously, untreated zebrafish, whole fish sections were used to determine zebrafish histology. The slides were observed under the microscope in 40X (16).

Liver Function Test

After 14 days experimental period of the acute toxicity test, the total number of zebrafish in the group of 4 was randomized to take 1 fish per group, the liver was dissected. The liver function test was performed by taking the supernatant after centrifugation. AST, ALT and ALP activity in the liver tissue was determined followed by the reference (17).

RESULTS AND DISCUSSION

Measurement of antioxidant potential of crude aqueous extracts of *S. wightii* by DPPH (2, 2-diphenyl-1-picrylhydrazyl) radical scavenging assay.

DPPH free radicals are very stable and it is a widely used method for determining the antioxidant potential in less time period. The scavenging ability was evaluated with various concentrations of aqueous extracts of *S. wightii*, ascorbic acid was used as a standard antioxidant (positive control) the results of the assay suggest that at the concentration of 100 µg/ mL the aqueous extract of *S. wightii* exhibited noticeable DPPH radical scavenging activity (74.32±6.51%). Upon increasing the concentration, the percentage of inhibition was also increased respectively (95.94±3.51%) in 500 µg/ mL is showed in fig 2.

Measurement of antioxidant potential of crude aqueous extracts of *S. wightii* by total reducing power

Measurement of the antioxidant potential of *S. wightii* aqueous extract was also assessed by the total reducing power assay. The scavenging ability was evaluated with various concentrations of aqueous extracts of *S. wightii*, ascorbic acid was used as a standard antioxidant (positive control).The results of the assay suggest that at the concentration of 100 µg/ mL the aqueous extract of *S. wightii* exhibited noticeable total reducing power activity (0.21±0.005). Upon increasing the concentration, the percentage of inhibition was also increased respectively (0.3±0.01) in 500 µg/ mL is showed in fig3.

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Hydrogen peroxide (H_2O_2) scavenging activity

H_2O_2 scavenging activity is very stable and it is a widely used method for determining the antioxidant potential of natural compounds in less time period. The scavenging ability was evaluated with various concentrations of aqueous extracts of *S. wightii*, ascorbic acid was used as a standard antioxidant (positive control).The results of the assay suggest that at the concentration of 100 µg/ mL the aqueous extract of *S. wightii* exhibited noticeable hydrogen peroxide scavenging activity (76.49±1.31%). Upon increasing the concentration of the extract, the percentage of inhibition was also increased respectively (97.72±2.27%) at 500 µg/ mL is showed in fig: 4.

Phytochemical characterization of aqueous extract of *S. wightii*

The preliminary phytochemical studies on aqueous extracts of *S. wightii* revealed the presence of tannins, steroids, flavonoids, saponins, quionones, terpenoids, phenols and phytosteroids. The obtained results can be used as an initial step for further identification of bioactive compounds from the aqueous extract of brown seaweed *Sargassum wightii.* Similar to our findings, the preliminary phytochemical screening of aqueous extract of*S. wightii* was found to possess the phytochemicals such as steroids, tannins, flavonoids, Polyphenols and glycosides (**18**) (Table: 1).

Bioactive guided Fractionation and identification of active constituents of *Sargassum wightii* aqueous extract

The fractionation and separation of the extract was performed using a wide range of solvent ratios in the order of increasing polarity by using column chromatography. The column was prepared using silica gel (60 -120) mesh. In order to ensure proper packaging, the silica gel was packed with 100% of methanol and the top of the gel was covered with a layer of filter paper, over that the aqueous extract of *Sargassum wightii,* (which was previously mixed with methanol) was introduced over the bed. The fractions were collected double the bed volume.

Identification of antioxidants of DPPH (2, 2-diphenyl-1-picrylhydrazyl) radical scavenging activity for column fractions

The fractions eluted were evaluated for antioxidant activities. The results of DPPH radical scavenging assay suggests that among all the fractions, F4 and F5 exhibited excellent antioxidant activity, whereas chloroform and ethyl acetate extracts showed moderate activity. At the concentration of 500 µg/mL (56.25±8.83%) the F4 exhibited a percentage of inhibition of ethyl acetate and acetone extracts showed higher scavenging ability with respectively. The antioxidant activity fraction F4 (19:1) is show the higher activity when the compare the standard drug (Fig.5), then fraction F5 (3:1) is to determine the antioxidant activity shown the result is higher than activity 500 µg/mL (75 ± 0%) in compared normal drug (fig:6) Methanol and water extracts did not exhibit DPPH radical scavenging activity. The ascorbic acid is a standard antioxidant, was used as a positive control.

Acetyl Cholinesterase Assay

The use of AChE inhibitors which increases the amount of acetylcholine present in the synapses between cholinergic neurons has become one among the various therapeutic strategies to enhance the cholinergic functions in the brain demonstrates the AChE inhibitory activity of various concentrations (20–100 µg/mL) of aqueous extracts of *S. wightii.* Results showed that aqueous extracts showed inhibitory activity in a concentration dependent manner. AChE inhibitory activity in the fraction 19:1 was determine the similar inhibitor activity 100 µg/ mL is presence (80.03±3.46%) (Fig: 7), The results of the assay suggest that at the concentration of100 µg/ mL (fraction 3:1) the aqueous extract of *S. wightii* exhibited noticeable DPPH radical scavenging activity (90.19±3.77%) to compared the standard drug (Fig: 8). In contrast to the present findings, **(19)** reported that the fractions of crude extract of *S. wightii* was found to exhibit lesser radical scavenging activity, which might be due to the source of collection of seaweed.

GC-MS Analysis

The column fractions, which exhibit excellent antioxidant and anti-cholinesterase activity (F4 & F5) was pooled and subjected to GC-MS analysis. The GC-MS result showed in the name of the presence compounds then formula of

compounds and peak area (fig: 9).The results showed the presence of 21 chemical constituents with the molecular weight ranging from 100 to 300. The components identified were given in Table 2.Among all the compounds, 6-octadecenoic acid ($C_{19}H_{36}O_2$), methyl ester (stearic acid derivative) was found to be present in the pooled column fraction. Hence all the above mentioned antioxidant and anti-cholinesterase activity might be due to the presence of considerable amount of stearic acid in it. Previous findings also demonstrated that octadecanoic acid was found to possess excellent antioxidant activities in in vitro condition (**20)**.

Acute Toxicity Study

Acute toxicity study of a test substance is employed as an excellent tool for assessing its toxicity risk in human health and environment (**21).** The results of acute toxicity studies indicate that *S. wightii* did not cause any adverse behavioral changes or mortality upon treatment. At the end of the study, all fishes were sacrificed and the organs were collected and subjected to histopathological analysis.

Histopathological Examination Of Tissues

The histopathological analysis was done for the organs (gills, brain and liver) of the fishes subjected to acute toxicity studies. Fishes from four different groups (Control, 50 mg, 100 mg and 200 mg) were randomly selected. After the dissection of the fish the major organ brain was collected and subjected to the histophathological analysis the result was shown in (fig 10). G1- brain control, G2- brain treated with 50mg/kg of concentration of sample, G3- brain treated with 100mg/kg of concentration of sample and G4- brain treated with 200mg/kg of concentration of sample. The group 1, 2, 3 and 4 was suggesting that the sample doesn't affect the brain from the experimental period. The zebrafish brain was identified by the various significant studies (**22)**.

The group 1, 2, 3 and 4 result was shown in (fig 11). These all groups was shown the result was from the experimented period the treated sample of *S. wightii* does not cause any adverse effect in the gill in lower level of dosage in the higher concentration of the sample was give the mild changes in the gills. G1- gill control, G2- gill treated with 50mg/kg concentration of sample, G3- gill treated with 50mg/kg concentration of sample and G4- gill treated with 50mg/kg concentration of sample. The gill segments are identified to various studies to show similar values (**23)**.

The histophathological analysis of liver in the result was shown in (fig 12). The group 1, 2, 3 and 4 was suggesting that the sample doesn't affect the liver from the experimental period. The liver section was shown the normal liver tissues.G1- liver control, G2- liver treated with 50mg/kg concentration of sample, G3- liver treated with 50mg/kg concentration of sample and G4- liver treated with 50mg/kg concentration of sample. The stained organs were observed the various studies to show significant of value (**24)**.

Liver Function Test

Since Liver is the major organ for detoxification of the drugs and compounds, the effect of the aqueous extract of *S. wightii* was analyzed by the liver function test. Fishes from each group were randomly selected and the liver was dissected and subjected to Liver Function Test and the results were illustrated in (Table 3). The results suggested that among all the enzymes assessed, AST and ALT levels were slightly increased. All the other enzymes of liver remains unaltered, which suggest that the aqueous extract of *S. wightii* did not affect the liver function and it is safe for the application as drug in future studies.

CONCLUSION

The results obtained from this study clearly indicate that the brown seaweed *Sargassum wightii* crude aqueous extract was suggested that the excellent antioxidant activity. And the preliminary phytochemical analysis of aqueous extractof *S. wightii* revealed the presence of tannins, flavonoids, terpenoids and steroids. The Bioactive guided

fractions of *Sargassum wightii* was shown the excellent activity in scavenging assay and Acetylcholinesterase inhibition assay. The GC-MS analysis revealed the presence of 10 compounds with bioactive potentials. In order to assess the safety aspects of the seaweed acute toxicity studies at the end of study the result suggest they did not cause any behavioral and mortality changes on Zebrafish, which suggest that the seaweed is safe for consumption. The histopathological analysis and liver functions test results was revealed that the extract did not affect the functions of the organs. Since the *Sargassum wightii* showed higher antioxidant activity and the anti-cholinesterase activity, upon further characterization and assessement, this could be a safe and potential drug candidate for Alzheimer's Disease.

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Table: 1 Qualitative analysis of phytochemical constituents of aqueous extract of *Sargassum wightii*

S. No	TEST	PRESENCE	ABSENCE
1	Carbohydrates	-	Absence
2	Tannins	Presence	-
3	Saponins	Presence	-
4	Flavonoids	Presence	-
5	Quinones	Presence	-
6	Glycosides	Presence	-
7	Cardiac glycosides	-	Absence
8	Terpenoids	Presence	-
9	Phenols	Presence	-
10	Coumarins	-	Absence
11	Steroids & phytosteroids	Presence	-
12	Anthroquinones	-	Absence
13	Alkaloids	-	Absence
14	Phylobatannins	-	Absence

Table: 2 GC-MS Analysis of aqueous extract of *Sargassum wightii*

S.NO	Name of the compounds	Formula	Molecular weight	Peak area %	RT mints
1	2-tert-Butylcyclohexanone	$C_{10}H_{18}O$	154.25 g/mol	1.91%	4.898
2	D-Threitol	$C_4H_{10}O_4$	122.12 g/mol	5.07%	5.565
3	3-Ethylheptanoic	$C_5H_{10}O_2$	102.1317 g/mol	1.72%	7.431
4	Thiocyanic acid, 2-(2-butoxyethoxy) ethyl ester	$C_9H_{17}NO_2S$	203.3 g/mol	9.93%	12.286
5	Thiophene, 2-ethyltetrahydro	$C_6H_{12}S$	116.23 g/mol	71.52%	15.208
6	6-octadecenoic acid, methyl ester	$C_{19}H_{36}O_2$	296.48 g/mol	5.95%	19.529
7	7-Octadecenoic acid, methyl ester	$C_{19}H_{36}O_2$	296.5 g/mol	5.95%	19.529
8	4,6-Di-O-methyl-.alpha.-d-alactose	$C_8H_{16}O_6$	208.21 g/mol	71.52%	15.208
9	beta.-D-Glucopyranose,	$C_6H_{12}O_6$	180.16 g/mol	9.93%	12.286
10	1,6-Dideoxy-I-mannitol	$C_6H_{14}O_4$	150.17 g/mol	1.72%	7.431

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Table: 3 Screening of liver function test

Test	Group 1	Group 2	Group 3	Group 4	Normal range
Bilirubin total	0.3	0.2	0.1	0.3	0.3 U/L
AST (Aspartate Aminotransferase)	40	38	46	48	Up to 35 U/L
ALT (Alanine transaminase)	49	32	41	35	Up to 37 U/L
ALP (Alkaline phosphatase)	115	79	101	99	60-128 U/L
Total Protein	0.4	0.3	0.4	0.5	0.3-0.8 U/L
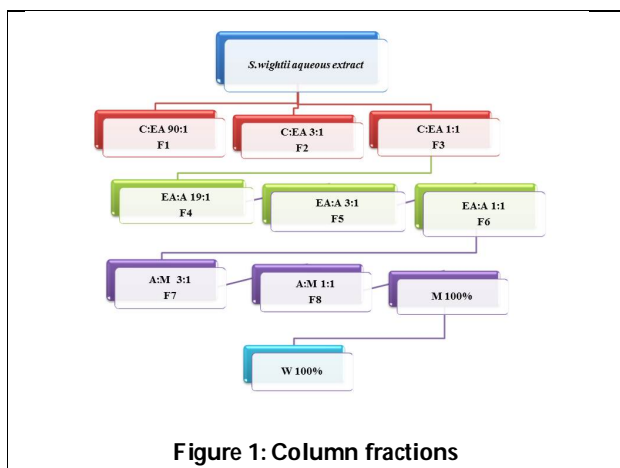
Figure 1: Column fractions
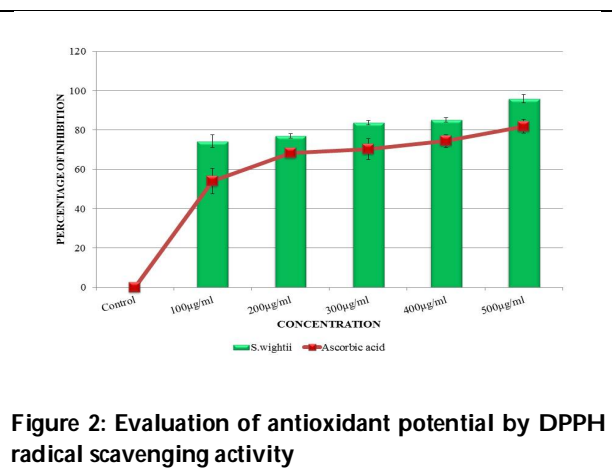
Figure 2: Evaluation of antioxidant potential by DPPH radical scavenging activity

Figure 3: Evaluation of total reducing power
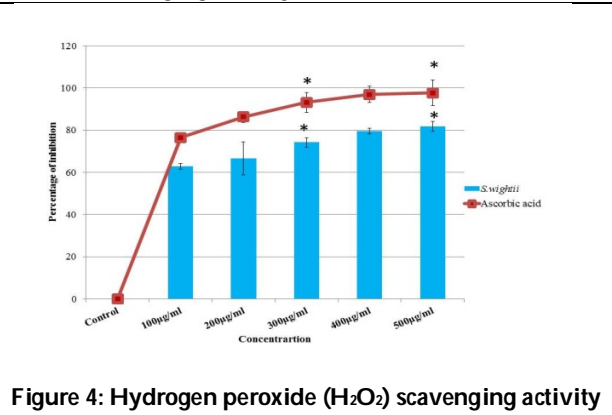
Figure 4: Hydrogen peroxide (H$_2$O$_2$) scavenging activity
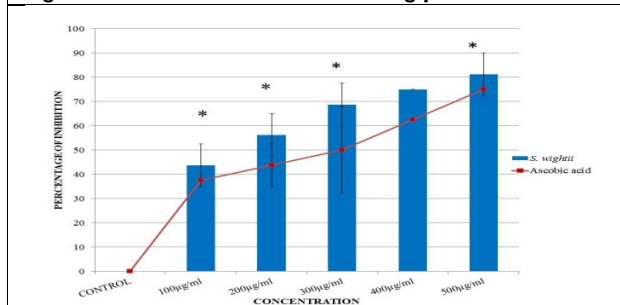
Figure 5: Evaluation of antioxidant potential by DPPH radical scavenging activity for ethyl acetate and acetone 19:1 fraction

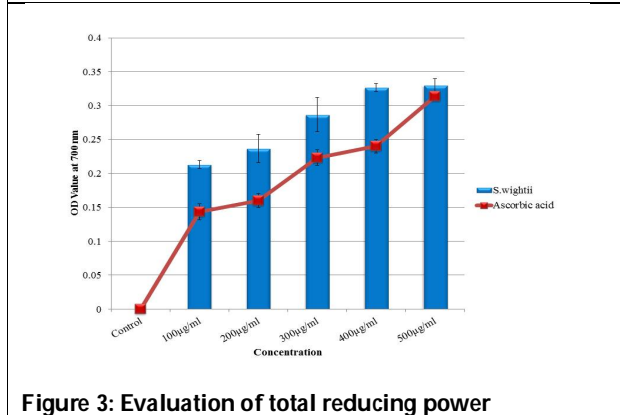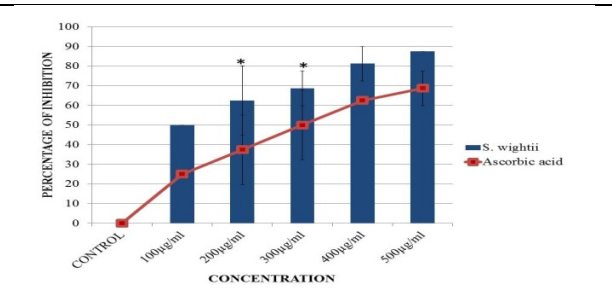**Figure 6: Evaluation of antioxidant potential by DPPH radical scavenging activity for Ethyl acetate and acetone 3:1 fraction**

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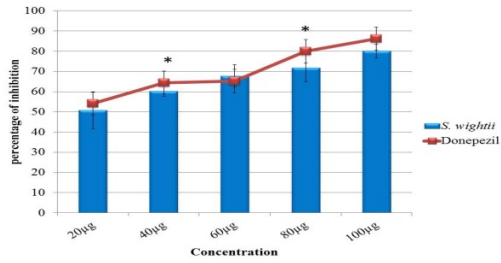
Figure 7: AChE inhibitory activities of ethyl acetate: acetone F4 (19:1) fraction of *S. wightii.*
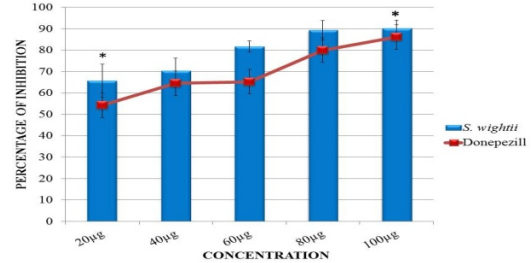
Figure 8: AChE inhibitory activities of ethyl acetate: acetone F5 (3:1) fraction of *S. wightii.*
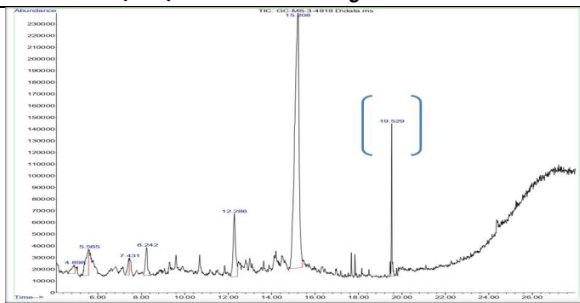
Figure 9: GC-MS Analysis Peak Value
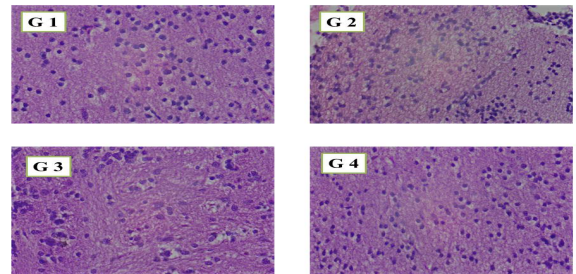
Figure 10: Histopathologiacal examinations in brain
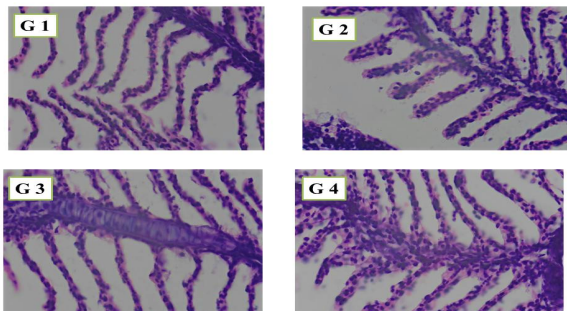
Figure 11: Histopathological examinations in gill
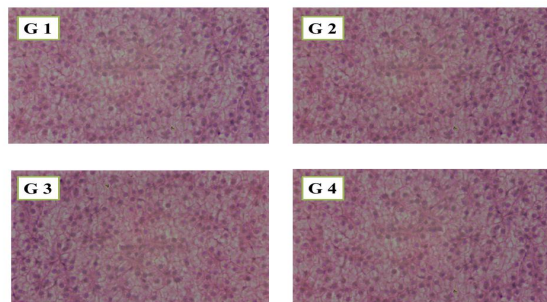
Figure 12: Histopathological examinations in liver

RESEARCH ARTICLE

Determination and Devaluation of Chloride Present in the Tannery Effluent using Silver Nanoparticles

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ABSTRACT

Water is precious and a most commonly used resource. It plays a significant role in our human body to supply the nutrients. Fresh and the potable water scarcity is predicted to become the greatest threat to the international stability. The biosynthesis of metal nanoparticles in an expanding research is a due to the potential application for the eco friendly development of novel technologies. Substantially, nanoparticles are prepared by a variety of chemical methods which are not environmentally friendly. It is a green, simple, practicable and cost-effective solution for waste water treatment. A green synthesis of silver nanoparticle was carried out using *Chrysopogan zizanoides* root extract. On treatment of aqueous solution of silver nitrate ($AgNO_3$) with root extracts, silver nanoparticles could be rapidly synthesized. These nanoparticles were characterized with UV-visible spectroscopy, SEM, XRD and DLS. The synthesized nanoparticles were treated with the effluent water. The synthesised silver nanoparticles reduce the chloride ion present in the water.

Keywords: *Chrysopogan zizanoides*, UV-visible, FTIR, SEM, XRD and DLS.

INTRODUCTION

The water is the main source to all the organisms present in the world. When effluent discharged into the water body like river, lake or ocean they undergo numerous number of process [1]. The physical, chemical and the biological changes will occur in the water body and causes the loss in organism [2-4]. The world of nanotechnology is implanting its footprint in the present decade very quickly. Nanoscience is also interesting in which the physics,

chemistry and biology meet together [4-8]. Here the understanding of interactions between the atoms and the knowledge about the basics of quantum mechanics is crucial and necessary [9-12]. The biological synthesis of nanoparticles is a great boon for the human society, as it has less hazardous effects. It has also got the ability for the production of size controlled nanoparticles. Microwave assisted bio synthesis is an easiest way and fast technique to synthesis nanoparticles [12-17]. This method is very approachable and an eco-friendly method by which they can be used as an alternative for the hazardous methods followed in the current scenario [17-22]. In the present study *Chrysopogan zizanoides* root is taken as reductant for the microwave assisted synthesis of silver nanoparticles [23-25]. The common name is Vetiver. *Chrysopogan zizanoides* root is utilised as the water purifier in ancient days. The main application of the Vetiver System is to improve the wastewater quality [26-27]. The green synthesised silver nanoparticles using *Chrysopogan zizanoides* root is used to analysis and estimate the amount of chloride ion present in the water sample which was collected from the tannery.

EXPERIMENTAL METHODS

Sample Preparation
Chrysopogan zizanoides root is collected from Manachanallur in Trichy-India. The roots are washed by using fresh water and then shade dried, then the sample is powder, required amount of sample is weighed and transfer into a beaker. Then we have to add measured volume of distilled water in it till the sample gets completely immersed in the solvent. The solution was boiled for 10-12 minutes by occasional stirring. The color of the solution changes from slight green to dark green color. Kept in digestion and let it cool, filtered and stored in cold condition.

Microwave assisted synthesis of silver nanoparticles
The stock solution was prepared by extracting the sample from *Chrysopogan zizanoides* root using water as the solvent. About 1mM solution of silver nitrate is weighed and made up in a 100mL standard flask using double distilled water. Different concentrations of the root extract like 10µL, 25µL, 50µL, 75 µL and 100µL were added to the silver nitrate solution in order to determine the correct ratio of root extract to the metal solution and kept in microwave for a minute. Upon addition of 50µL of the root extract to the silver nitrate solution, then it is kept under Microwave irradiation for the formation of silver nanoparticles the colorless silver nitrate solution changed to reddish brown after the addition of extract in drops. The color of the solution change to reddish brown color shows that the silver nanoparticles are thus formed without any agglomeration. This shows that the formed silver nanoparticles are highly stable. The synthesized silver nanoparticles collected by cooling centrifuge and washed with double distilled water thrice in small quantity and dried in hot air

Characterization Techniques
UV-Visible analysis: When light passes through a sample its extinction was measured by the UV-Visible spectroscopy. The size, shape, concentration, agglomeration state, and refractive index near the nanoparticle surface have unique optical properties for identifying, characterizing, studying nanomaterials made UV-visible as a valuable tool.

FTIR: A Fourier Transform Spectrometer record infrared spectra within the range 400-4500cm^{-1}.IR absorption of the functional group may vary over a wide range is due to the complex interaction of atoms within the molecule. Multiple functional groups may be absorbed at a particular frequency and it gives rise to several characteristic absorptions.

SEM: Scanning Electron Microscopy is a characterization technique where the morphology and surface topography of the can be studied. The SEM image obtained for the synthesized nanoparticle gives complete information about its morphology and predicts the shape of the nanoparticle synthesized.

XRD: The interplanar d-spacing and the relative intensities (I/Io) of the strongest peak of XRD pattern were characterized under the Hanawatt system. This technique is used to find the position of values of product crystallinity or amorphic nature. The fingerprint regions of relative intensity are found using the data with respect to d-spacing values.

DLS: Dynamic light scattering (DLS) is used to determine the particle size of the synthesized silver nanoparticles. Random changes in intensity of light scattered from the solution can be measured by using DLS.

Water Analysis
Determination of Chloride: In 250 ml Erlenmeyer flask take 50ml of plant sample and then added with 5 drops of potassium chromate indicator. This solution was titrated against the silver nitrate solution. The colour of the sample was turned to pinkish red colour. The estimated chloride was expressed in mg/l.

RESULTS AND DISCUSSION

Characterisation of silver nanoparticles
Visual observation: The formation of silver nanoparticles was confirmed by the visual observation. Initially there is no color appears when aqueous extract was added to silver nitrate solution, after kept in microwave for few minutes the color appears when time prolonged the color appeared was darkened. The change in color shows the formation of silver nanoparticles.

UV-visible spectroscopy: To determine the optical properties of a solution, absorbance spectroscopy is used. A light is passed through the sample solution and it measures the quantity of light absorbed. When the wavelegth was changed and the absorbance was measured at each wavelength.The absorption peak of synthesized silver nanoparicles for *Chrysopogan zizanoides* **root** extract wavelength were observed to be 447 nm was shown in figure 2.

SEM Analysis: The morphology of the silver nanoparticles prepared using *Chrysopogan zizanoides* **root**was studied by scanning electron microscopic (SEM) analysis, and the corresponding images are shown in Fig.3. The image shows the presence of spherical structures that correspond to nano dimensions. Various reports are available in the literature wherein the silver nanoparticles are reported to exist in spherical morphology. Fig.3 clearly shows that the synthesized silver nanoparticles are not aggregated, and that they exist in the mono-dispersed state.

Energy Dispersive X-Ray Analysis: Energy dispersive X-ray spectroscopy was used to find out the percentage composition of silver nanoparticles prepared using *aloin*. From the EDAX analysis data confirmed that the elemental silver nanoparticles were present in major composition ~100%. Using this technique the elemental composition of the materials was obtained with high resolution.

XRD Analysis: Powder XRD diffraction is a powerful technique to study powder or microcrystalline samples for structural characterization of nanomaterials. Diffraction patterns of the synthesized silver nanoparticles dried for 3h in vacuum and Ni reference are presented in Fig.5. The diffractogram exhibits peaks corresponding to (1 1 1), (2 0 0), (2 2 0) and (3 1 1) phases in the 2θ range of 30°–90°. In the XRD pattern, diffraction peaks at angles of 37.86°, 44.70°, 65.78° and 78.03° could be assigned to face centered cubic (fcc) metallic silver (1 1 1), (2 0 0), (2 2 0)and (3 1 1) facets of silver nanocrystals. It can be seen that the lines of nanocrystalline silver have a shape characteristic of the Lorentz function. According to these qualitative observations, it may preliminarily be concluded that, in this case, the main contribution to the physical broadening of the lines is made by the crystallite dispersity factor, which is confirmed by

the rigorous analysis presented below. It should also be noted that the lines of annealed crystalline nanoparticles are markedly narrower than the lines of amorphous nanopowder.

DLS analysis: DLS is explained as the technique of changing the intensity of the scattering light fluctuation to obtain the average hydrodynamic diameter of the sample. Monitoring the nanoparticle size in the real time can be analyzed by the DLS method. The DLS is used to evaluate the size distribution of the synthesized silver nanoparticles in the aqueous solution. The particle size analysis showed that the silver nanoparticles synthesized by using the aqueous ***Chrysopogan zizanoides* root** extract in figure 6. The peak distribution was shown in the table 2.

Chloride analysis: The green synthesized silver nanoparticles using aqueous ***Chrysopogan zizanoides* root** extract were added gradually with the collected tannery water sample.10mg of the synthesised silver nanoparticle is added with 50 ml of tannery water in the round bottom flask. Then it is kept in the thermostat water bath till 45 minutes at 40°C, continuously stirred with help of pellet. After completion, the sample was taken and checked for the PH and chloride analysis as per APHA standards were also performed. All the tests were done for triple times and the concordant values were taken for the comparison of results. Following, table 10 shows the value of PH and Chloride on before and after silver nanoparticles treatment Concentration of chloride can be determined using the following formula.

The pH of the tannery effluent before and after the addition of silver nanoparticle was 7.5 and 7.8 respectively. The permissible range of pH advised by the World Health Organization for portable water was 6.5 to 8.5. By monitoring the pH of the tannery water before and after the addition of silver nanoparticles shows better solution result for reducing the pH with its acceptable limit. The estimation of chloride present in the tannery waste water before and after the addition of synthesised silver nanoparticle was 346.43mg/l and 122.73mgl. The acceptable range of chloride which was recommended by the WHO for drinking water was 200mg/l. The estimation of chloride for the present study revealed, that after adding the silver nanoparticle it reduces the amount of chloride. Therefore it gives good result for reducing the chloride within the permissible limit.

CONCLUSION

The silver nanoparticles synthesis was successfully carried out by green method using silver nitrate as the precursor and aqueous ***Chrysopogan zizanoides* root** extract as the reducing agent. The method does not require any chemicals; it used as simple, safe, inexpensive, eco-friendly and non-toxic. The aqueous extract of ***Chrysopogan zizanoides* root** extract showed great capability to synthesize the silver nanoparticles. UV-Visible spectrum, SEM, EADX, XRD and DLS analysis are carried out. This study suggests that it was free from the requirements like high energy, extend preparation and special synthesis technique. The study revealed that the synthesized nanoparticles have capability to act against tannery effluent. The percentage composition chloride present in tannery effluent is determined by using standard procedure. The synthesised silver nanoparticles is used reduce the chloride in permissible limit 122.73mgl.

ACKNOWLEDGMENT

CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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Table 1: Elemental composition of synthesized silver nanoparticles

Quantitative Results for: Base(485)

Element Line	Weight %	Weight % Error	Atom %
Ag L	94.09	± 1.61	99.08
O K	5.91	± 0.77	0.92
Ag M	---	---	---
Total	100.00		100.00

Table 2: pH and Chloride before and after silver nanoparticles treatment

Parameters	Silver nanoparticle treatment		% of water treatment
	Before	After	
pH	7.5	7.3	2.66
Chloride(mg/L	346.43	122.73	64.57%

Figure 1:(a) *Chrysopogan zizanoides* root, **(b)** silver nitrate solution, **(c)**synthesized silver nanoparticle
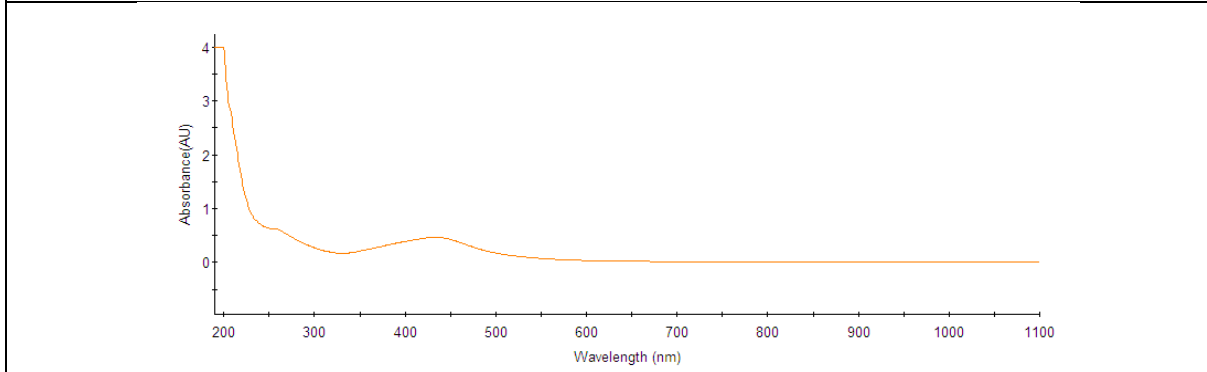
Figure 2 : UV-visible spectrum of synthesised silver nanoparticles
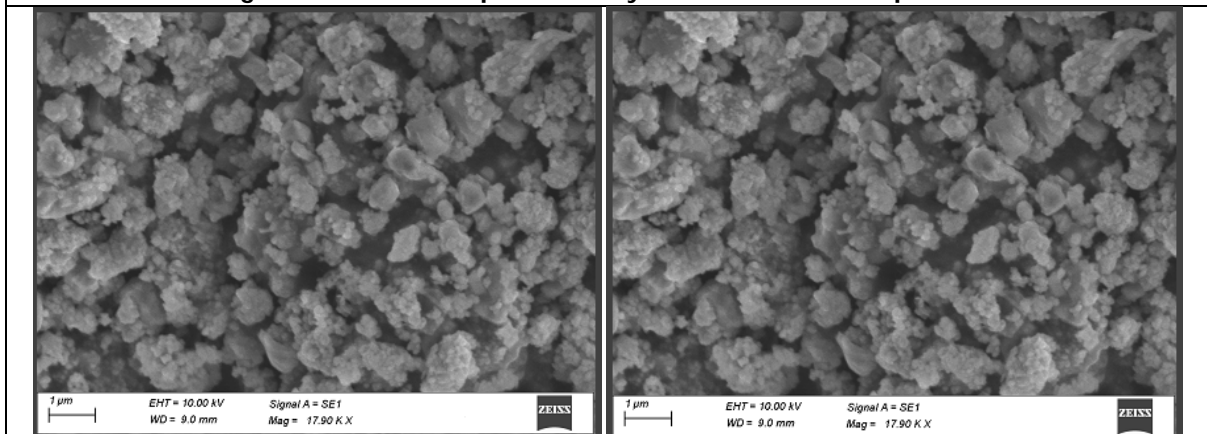
Figure 3 : SEM image of synthesised silver nanoparticles

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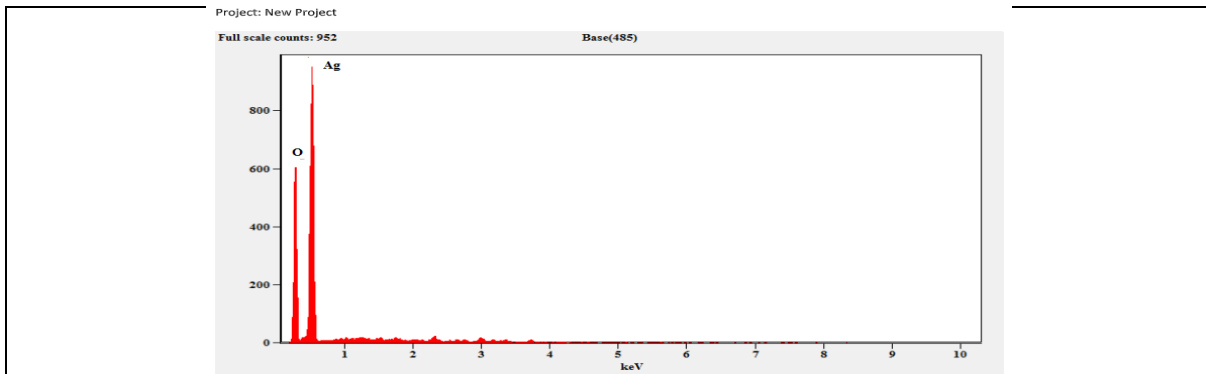
Figure 4 : EDAX analysis of synthesised silver nanoparticles
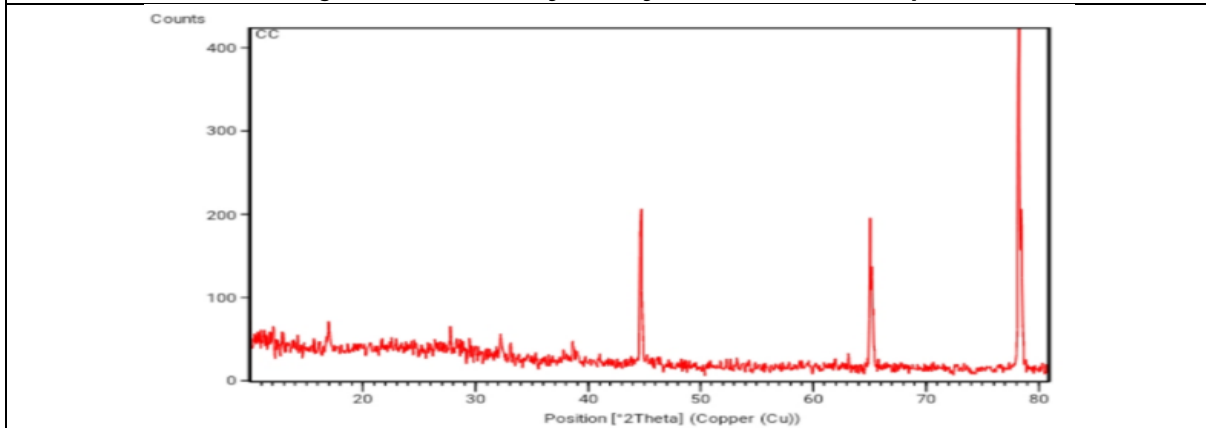
Figure: 5 Representative X-Ray diffraction of synthesized AgNPs
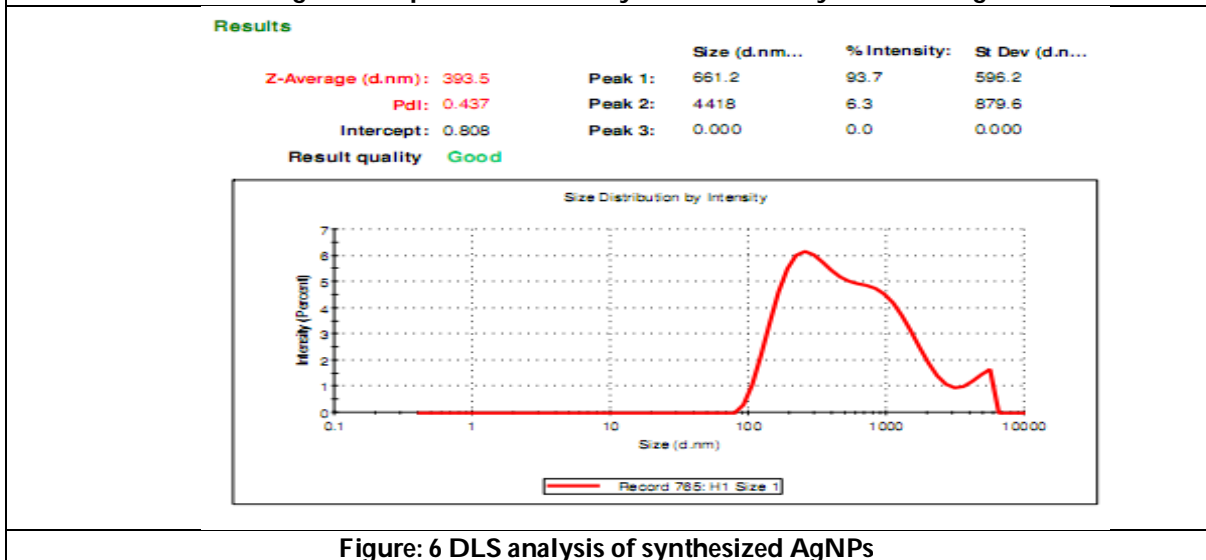
Figure: 6 DLS analysis of synthesized AgNPs

RESEARCH ARTICLE

A Comparative Seasonal Anatomical Analysis of Stem of *Cynodon dactylon* - A Herbal Plant

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ABSTRACT

Cynodon dactylon commonly known as Durva grass, Bermuda grass, Dog's tooth grass, Dhro, Lilidhro etc. Cynodon is one of the most common weeds in Bharat. Cynodon has many medicinal properties hence it is used as a medicinal plant in different medical systems. The medicine prepared from the medicinal plants is very useful to the health of human beings. The plant which is used to prepare medicines, it requires detailed identification study of the plant. Anatomical study provides correct identification of plants. In this paper, seasonal anatomical analysis of the stem of *Cynodon dactylon* has been studied in detail by Axio - scope. The plant parts were collected during winter, summer and monsoon season from the local area of Valsad city, Gujarat, Bharat. This analysis concluded that different seasons did not affect the anatomical characters of the stem of *Cynodon dactylon*

**Keywords:** *Cynodon dactylon,* stem, anatomical analysis, seasonal analysis, Axio - scope.

INTRODUCTION

Cynodon dactylon (L) is known as the second most significant weed in the world after *Cyperus rotundus*, a position over by its occurrence in every tropical and subtropical area. It has good drought endurance capacity because of a deep root system [1]. Roots may grow upto 15 to 20 cm deep in the soil. *Cynodon dactylon* is a stoloniferous, perennial grass with rhizomes. Rhizomes may grow 25 cm deep in the land. Leaves are open up at bottom, one to fifteen cm long depending on node, linear or lanceolate, glabrous. Flowers are formed through the year [2]. *Cynodon dactylon* a weedy grass belongs to a family Gramineae - Grass family [3]. Medicinal plants play a significant role in pharmaceutical companies in developing drugs from plants. *Cynodon dactylon* has great medicinal value and it is

used in some household treatment and also in traditional medicine and it may be applied externally as well as internally also [4]. Fresh juice of plants used in diarrhoea and dysentery. Internally the plant is used in various diseases like epilepsy, hysteria, bleeding in piles, haematuria, and menorrhagia [5]. Decoction of the plant can be used for the treatment of kidney stones [6]. Ethanol extract of the aerial part shows CNS depressive activity in rats. Hydroalcoholic extraction of rhizomes shows improvement in cardiac functions in rats. Aqueous extract preventive against aluminium induced neurotoxicity and carbofuran induced oxidative stress [5]. Lord Rahu is pleased by this sacred grass in navagraha Homa. A negativity of the planet Rahu can be vanished by taking an extract of sacred grass (3 – 5 spoons) on a daily basis for 48 days. *Cynodon dactylon* (L) will absorb various radiation in the atmosphere. Ultraviolet rays from the sun and negative radiations emit at the situation of eclipse will be absorbed by this grass. That's why many Hindu families keep this sacred grass in residences at the situation of eclipse [7]. In this paper either seasonal variation occurs in stem anatomy of *Cynodon dactylon* plant or not is discussed.

MATERIALS AND METHODS

In various seasons like Winter, Summer, and Monsoon, the stems of *Cynodon dactylon* were collected from the local area of Valsad District in Gujarat, Bharat during winter in November, summer in March and monsoon in July. The taxonomically, authenticated and identified plant material by Dr. Ferzin M. Parabia, Bioscience department, with reference number "VNSGU/BVBRC/2020/12/TC-04". The specimens of voucher have been submitted at the VNSGU, Surat, Gujarat for future reference in the herbarium section. Mature and healthy plants with normal plant parts were collected and the required stem sample was cut and removed from the plant. The plant was washed in pure water to remove all the impurities. For the stem, a cylindrical portion of almost straight and sufficient length to hold the sample was selected. Enough number of free hand sections were taken. These sections were carefully transferred to a Petri-dish containing water using a fine painting brush for selection of good sections. Selected good sections were transferred to a Petri-dish containing Safranin stain. Sections were stained by safranin to confirm its lignification. After 2-3 minutes of staining, sections were transferred onto a slide, mounted in glycerol and then examined under a microscope. Photomicrographs were taken with Axio-scope – A1, ZEISS company, (Ocular: P1 - 10X* 23; Objective: 10X, 20X, 40X, 100X). Photomicrographs were taken with the help of an Axio-camera.

RESULT

Transverse section of the stem of *Cynodon dactylon* is oval in shape and reveals the existence of epidermis. Cynodon stem has one to two layered, sclerenchymatous epidermis. Which contain a square shape cell and a whole layer covered by thick cuticles. In the inner side of the epidermis three to five layered areas occur, that is the cortex. Cortex cells are parenchymatous and oval to round in shape and they bear starch grains. Innermost single layer of the cortex is endodermis. Pericycle is present on the inner side of the endodermis. It is two to five layered and made up of sclerenchymatous cells. Two layers of vascular bundle are present on the inner side of the pericycle and consist Y-shaped xylem and phloem. Vascular bundles are surrounded by one to three layers of sclerenchymatous cells. Conjoint, collateral and closed types of vascular bundle occur in the stem. Pith is the middle region of the stem and made up of parenchymatous cells. Pith cells have starch grain.

DISCUSSION

Cynodon dactylon is an important drug and used in various medications of Ayurveda and it is a well-known plant since Vedic period to the present epoch. Detailed anatomical study would mainly help in proper identification of plant material and wood [8]. It would also be used in implantation of genetic relationship and for detection of adulterants in crude drugs. In the present study, internal structure of the stem of Cynodon was performed in winter, summer and monsoon. Stem anatomy of *Cynodon dactylon* has two different layers of vascular bundle, each and

every vascular bundle surrounded by 2 to 3 layers of sclerenchymatous cells. Parenchymatous cortex has starch grain. Pericycle was 2 to 5 layered and sclerenchymatous. The vascular bundles were conjoint, collateral and closed with 'Y' shape xylem.

CONCLUSION

This analysis concludes that different seasons did not affect the anatomy of the stem of *Cynodon dactylon.* Anatomical analysis could be used in identification of genuine pants and to know correct arrangements of cells in plants.

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Table 1: Details of studied plant sample

S.No.	Taxa	Source	Plant parts used for anatomy	Parts medicinally used
1	*Cynodon dactylon*	Valsad	Stem	Whole plant

Table 2: Summary of comparative seasonal microscopical characters of stem of *C. dactylon*

No.	Characters	*Cynodon dactylon*		
		Winter	**Summer**	**Monsoon**
1	**Cuticle**	Thick cuticle	Thick cuticle	Thick cuticle
2	**Trichome**	Absent	Absent	Absent

3	**Epidermis**	1 to 2 layered, made up of sclerenchymatous cells	2 layered made up of sclerenchymatous cells	1 to 2 layered, made up of sclerenchymatous cells
4	**Cortex**	3 to 5 layered, oval or round or hexagonal shaped cell with starch grain	3 to 5 layered, oval or round or hexagonal shaped cell with starch grain	3 to 5 layered, oval or round or hexagonal shaped cell with starch grain
5	**Endodermis**	Single layered	Single layered	Single layered
6	**Pericycle**	2 to 5 layered, made up of sclerenchymatous cell	2 to 5 layered, made up of sclerenchymatous cell	2 to 5 layered, made up of sclerenchymatous cell
7	**Vascular tissue**	2 layers of vascular bundle, each vascular bundle covered by sclerenchymatous cell Vascular bundle – conjoint, collateral, closed with 'Y' shape xylem	2 layers of vascular bundle, each vascular bundle covered by sclerenchymatous cell Vascular bundle – conjoint, collateral, closed with 'Y' shape xylem	2 layers of vascular bundle, each vascular bundle covered by sclerenchymatous cell Vascular bundle – conjoint, collateral, closed with 'Y' shape xylem
8	**Pith**	Middle parenchymatous region of the stem with starch grain	Middle parenchymatous region of the stem with starch grain	Middle parenchymatous region of the stem with starch grain
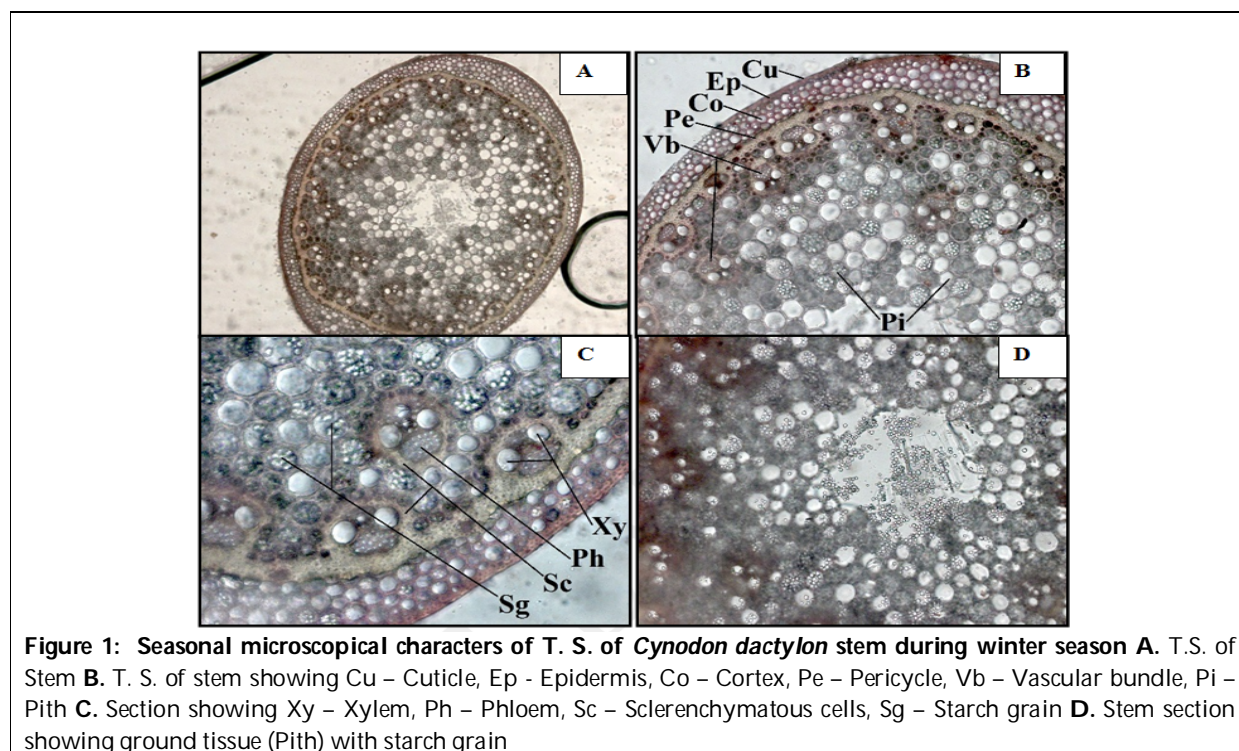
Figure 1: Seasonal microscopical characters of T. S. of *Cynodon dactylon* stem during winter season A. T.S. of Stem **B.** T. S. of stem showing Cu – Cuticle, Ep - Epidermis, Co – Cortex, Pe – Pericycle, Vb – Vascular bundle, Pi – Pith **C.** Section showing Xy – Xylem, Ph – Phloem, Sc – Sclerenchymatous cells, Sg – Starch grain **D.** Stem section showing ground tissue (Pith) with starch grain

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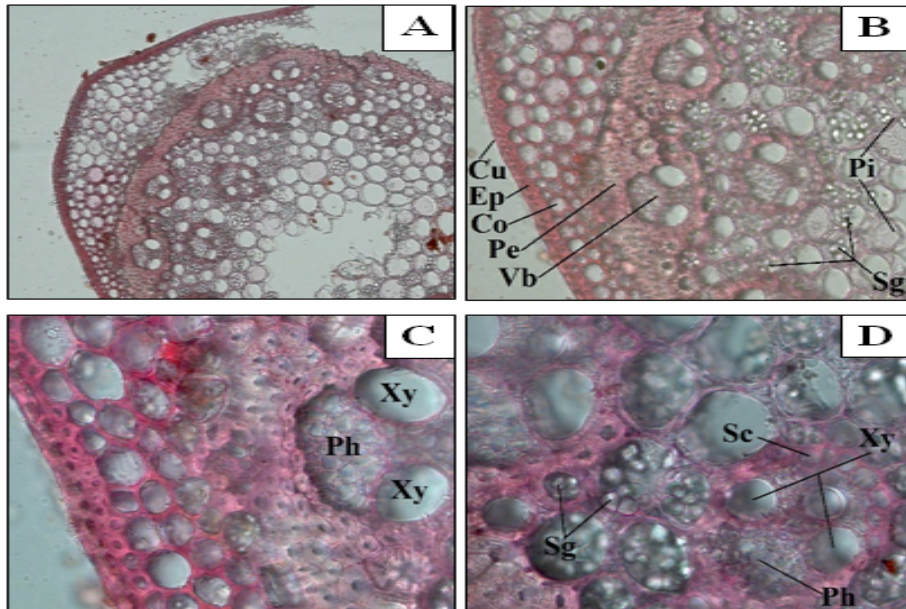
Figure 2: Seasonal microscopical characters of T. S. of *Cynodon dactylon* stem during summer season A. T.S. of Stem **B.** T. S. of stem showing Cu – Cuticle, Ep - Epidermis, Co – Cortex, Pe – Pericycle, Vb – Vascular bundle, Pi – Pith, Sg – Starch grain **C.** Section showing Xy – Xylem, Ph – Phloem **D.** Stem section showing vascular bundle with xylem and phloem, Sc – Sclerenchymatous cells, Sg – Starch grain
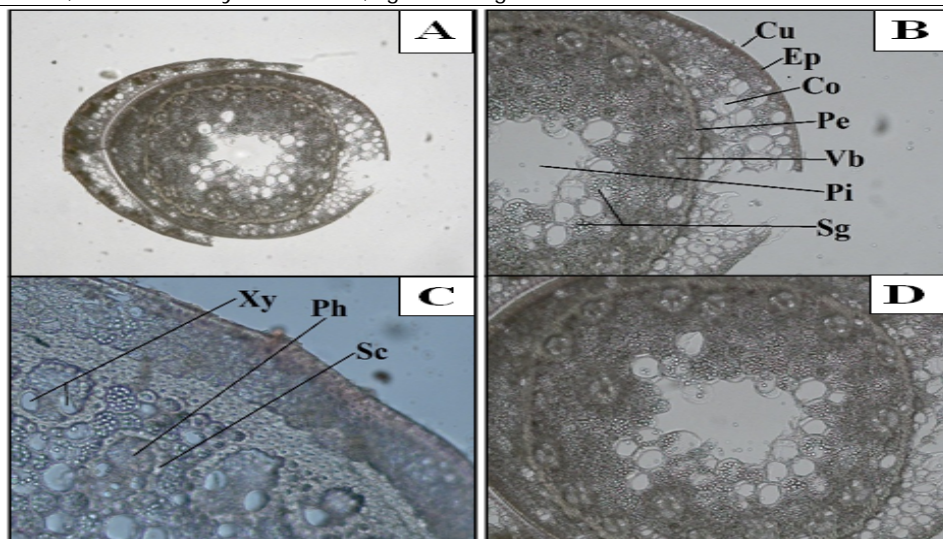
Figure 3: Seasonal microscopical characters of T. S. of *Cynodon dactylon* stem during monsoon season A. T.S. of Stem **B.** T. S. of stem showing Cu – Cuticle, Ep - Epidermis, Co – Cortex, Pe – Pericycle, Vb – Vascular bundle, Pi – Pith, Sg – Starch grain **C.** Section showing Xy – Xylem, Ph – Phloem and Sc – Sclerenchymatous cells **D.** Stem section showing arrangements of vascular bundle and ground tissue (Pith cell) with starch grains.

RESEARCH ARTICLE

Physical and Chemical Mutagenesis in *Hibiscus sabdariffa* L. to Induce Variability on Seed germination, Survival and Lethal Dose.

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ABSTRACT

The studies of induced mutation in *Hibiscus sabdariffa* L.(Roselle) were performed by exposing the healthy seeds to Gamma rays 05KR, 10KR, 15KR, 20KR, 25KR, 30KR,35KR, 40KR, 45KR and 50KR and EMS 05mM, 10mM, 15mM,20mM, 25mM, 30mM,35mM,40mM,45mM and 50mM. The *Hibiscus sabdariffa* seeds are having a low genetic diversity because of self –pollination. From this study seed germination, seedling survival was observed and determination of LD_{50}. The results concluded the increase in the dose / conc. of physical and chemical mutagens would show the variability of decreased in the seed germination, survival. Mutagens are most effective one. From this M1 generation, the M2 generation will be risen.

Keywords: Roselle, Gamma rays, EMS, LD_{50}.

INTRODUCTION

Roselle is a more widely knowing plant and traditionally used as a medicinal and food plant. Itcomes under the Hibiscus genus nearly more than 250 to 300 species are found in tropical and sub-tropical regions. *Hibiscus sabdariffa* comes under the Malvaceae family and its one of the largest family in the plant kingdom. Roselle is an annual or perennial plant and it is a tetraploid (2n=72). In recent times,roselle is gaining a importance in food crops. Roselle plant have a low genetic diversity because of the self-pollination type(Osman *et al.,* 2011). Roselle was native from India to Malaysia (Asia). Their leaves are three to five lobes and alternately arranged on the stem. The flavonoids compounds are rich in the roselle leaves (Mohd-Esa*et al.,* 2010).The leaves are traditionally used as a food in various

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dishes like a soup, salad, and curry. It is one of a best medicinal plant because of the pharmacological activities. The corolla were red pale yellow in colour and base of the corolla were spotted   red because of the high amount of anthocyanin and they arranged in the form of twisted aestivation. In contrast of its medicinal values, the dry flower and the fleshy red coloured calyces were used to make tea, jam, cosmetic items and some beverages (Faraji*et al.,* 1999). The calyces were having an economic importance in dye industries and the containing riboflavin, minerals, calcium, iron and ascorbic acids (Babalola*et al.,*　2001). Previous researchers reported that the roselle oil was expensive then coriander and niger seed oil (Ramadan *et al.,*　2004). The seed powder of roselle is rich in protein and it prevents a cancer. In roselle plant all the parts are edible like a leaves, flower, seed and calyces and root .

A sudden heritable change in an organism is called mutation. The mutation is a best technique to improve the plant in a genetic level. The aim of the mutation breeding is to develop new varieties of plant with disease resistance and characteristic features. Mutation can occur naturally or induced. The induced mutation agents are called mutagens. The induce mutations are done by the physical and chemical mutagens. In the beginning of 20th century the induced mutagens was developed for a crop improvement (Aamir Raina*et al.,* 2016). Physical mutagens are the most effective in the mutation breeding. In this study, gamma rays are used to used as a physical mutagen. Induced mutation using physical and chemical mutagens are create a genetic variation with a better characteristic features (Wongpiyasatid *et al.,*　2000).Gamma rays irradiation is one of the most important physical mutagen in a mutation breeding. The radical can change the important components of the plant cell. Gamma rays are the one of electromagnetic radiation their energy level are several hundred kilo electron volts (Kovacs and Keresztes , 2002).Gamma irradiation are used to alter the morphological and genetical characters of the plant. The low dose of gamma rays irradiation do not cause a mutation.

The chemical mutagen Ethyl methanesulfonate (EMS) is one of the powerful chemical mutagens and it mainly causes a point mutation. EMS is a carcinogenic organic compound and its cause random mutation in a genetic material because of the nucleotide substitution (Hajara ., 1979). The chemical mutagens are commonly produce an induce mutations and resulting the amino acid changes (GC – AT). EMS consist a group of bifunctional alkyl reactive group from the sulphonate components that reacts with DNA which cause mutations. These chemical mutagens also can induce a lot of variation and alternation in a level of genetical and morphological. The variations can be reflected in the yield parameters of crop plants. A range of novel traits and broadening of genetic diversity of plants produced by EMS alkylates guanine bases which leads to the misparing – alkylated G pairs with T instead of C and the end of the transitions is shown as G/C to A/T (Bhat*et al.,* 2007).

MATERIALS AND METHODS

Biological Material
The healthy and genetically pure seeds of Roselle (*Hibiscus sabdariffa* L) was obtained from the University of Agricultural Science, Hebbal ,Banglore.

Mutagens
In this investigation, two types of induced mutations were used. They are Physical and Chemical mutagens. Gamma rays as physical mutagen and Ethyl methanesulphonate as chemical mutagen.

Physical and Chemical Mutagen Treatment
The healthy and genetically pure seeds of*Hibiscus sabdariffa L* seeds were taken for treatments and the seeds were treated with gamma irradiation and ethyl methane sulphonate. Treatments (250 seeds for treatments) consist of ten different doses of gamma radiation 05KR, 10KR, 15KR, 20KR, 25KR,30KR, 35KR, 40KR, 45 KR and 50KR$_{60}$CO source at Indira Gandhi Centre for Atomic Research (IGCAR) Kalpakkam and EMS 05mM, 10 mM, 15 mM, 20mM, 25mM,

30mM, 35mM, 40mM, 45mM and 50mM. The EMS treated seeds was presoaked in a distilled water for six hours at room temperature and covered by a moist germination paper. After that, the treated seeds were washed in a running tapwater. The untreated seeds were respectively considered as a control. The seeds were sown in the field with following randomized block design method along with control to rise M1 generation. The germination percentage will be noted on 15th day, seedling survival on 30th day.

RESULTS AND DISCUSSION

Seed Germination

The plant growth from a seed was consider as a seed germination. Germinated seed was counted on 15th days from sowing. In control the germination percentage was 95. The germination was decreased with an increase in the dose/concentration of gamma rays and EMS (Khan *et al.,* 2005). The highest germination was obtained in 83% of 05KR and 86 % of 05mM. The LD_{50} of induced mutations was determined on 20KR of Gamma rays and 25mM of EMS. The LD_{50} was declared on the basis of 50 % of seed germination and seedling survivability. The similar results was reported in Little millet (Ramkumar and Dhanavel , 2020). *Andrographis paniculata* (Kasthuri S and D.Dhanavel, 2020) Maize (Rajapandian and Dhanam , 2018). After the LD_{50} value, the plant seed germination seems to be decreased with an increase in EMS concentration (Priyanka and Dhanavel , 2020).

Seedling Survival

The plant survival percentage was decreased with increase in the dose of physical and chemical mutagen. About 50 % of seedling survival in *Hibiscus sabdariffa* L. was shown when treated with 20KR of gamma rays and 25mM of EMS but survival percent of remained treated seeds was decreased due to the mutagenic treatment (Dalvi ,1990).The seedling survival was depended on mutagenic treatment .The lowest seedling survival in gamma rays was 10.95% and EMS 12.19%.

CONCLUSION

The M_1 generation results was observed and recorded. From this study I concluded that the seed germination and seedling survivability increase with the decrease in the concentration/dose of gamma rays and EMS. The LD_{50} value was observed in 20KR of gamma rays and 25mM of EMS.

ACKNOWLEDGEMENT

Conflict of the Statement
No

Appendices
IGCAR - Indira Gandhi Center for Atomic Research
EMS – Ethyl Methane sulphonate
KR- Kilo radiation
% - Per cent
LD_{50} –Lethal dose 50

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Table 1: Determination of Seed germination, seedling survival and LD$_{50}$ values for Gamma rays in *Hibiscus sabdariffa* L.

Treatment dose of Gamma rays	Seed germination Percentage %	Seedling Survival Percentage %	Percent over control	Percent of reduction over control
Control	95	93.68	100	00.00
05KR	83	89.15	95.03	4.97
10KR	74	77.02	82.21	17.79
15KR	62	69.35	74.02	25.98
20KR	51	50.98	54.41	45.59

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25KR	42	45.23	48.29	51.70
30KR	38	42.10	44.94	55.05
35KR	23	26.08	27.83	72.16
40KR	18	22.22	23.72	76.27
45KR	13	15.38	16.41	83.59
50KR	9	10.26	10.95	89.05

Table 2: Determination of Seed germination, seedling survival and LD$_{50}$ values for Ethyl Methane Sulphonate (EMS) in *Hibiscus sabdariffa* L.

Treatment cont. of EMS	Seed germination percentage %	Seedling Survival Percentage %	Percent over control	Percent reduction over control
Control	95	93.68	100	00.00
05mM	86	87.20	93.08	6.92
10mM	78	82.05	87.58	12.42
15mM	69	76.81	81.99	18.01
20mM	64	67.18	71.71	28.29
25mM	50	52.68	56.23	43.77
30mM	39	41.02	43.78	56.22
35mM	30	36.66	39.13	60.87
40mM	24	29.16	31.12	68.88
45mM	17	17.64	18.86	81.14
50mM	11	12.19	13.01	86.99
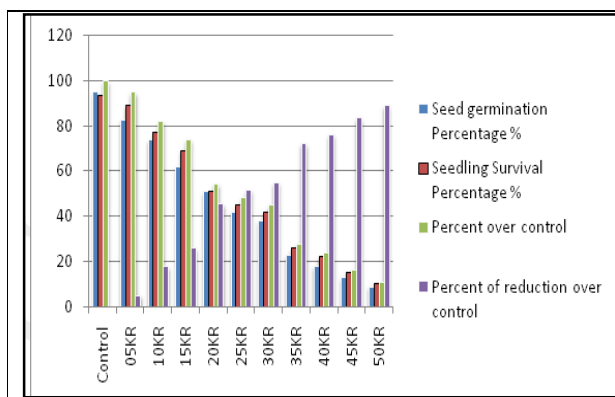
Graph 1: Determination of Seed germination, seedling survival and LD$_{50}$ values for Gamma rays in *Hibiscus sabdariffa* L.
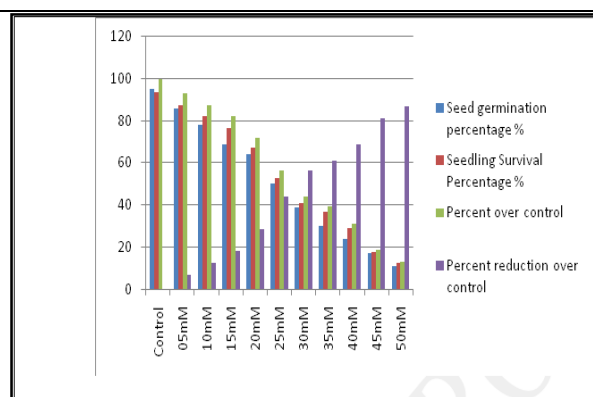
Graph 2: Determination of Seed germination, seedling survival and LD$_{50}$ values for Ethyl Methane Sulphonate (EMS) in *Hibiscus sabdariffa* L.

RESEARCH ARTICLE

Secondary Metabolites and *In vitro* Anti-Inflammatory Potential of *Priva cordifolia* (L.F) Druce

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ABSTRACT

Inflammation is a complex pathophysiological process mediated by various signaling molecules. Traditionally, people have been using many potential anti-inflammatory plants to cure this disease due to the presence of secondary metabolites. *Priva cordifolia* is an ethno medicinal plant used for the treatment of wounds, diarrhea, migraine, ulcer and anti-fertility. The aim of the present study is to evaluate secondary metabolites and *in vitro* anti-inflammatory potential of *P. cordifolia* using various plant extracts. Secondary metabolites such as total phenolics, flavonoids, tannins and terpenoids were determined using standard procedures. *In vitro* anti-inflammatory potential was determined by protein denaturation, proteinase inhibition, HRBC membrane stabilization, hyaluronidase and heat induced haemolysis activities. All the results were analyzed using ANOVA and the results of secondary metabolites and anti-inflammatory studies were subjected to Pearson's correlation analysis. Among various extracts, aqueous extract showed higher level of phenolics and terpenoids. Flavonoids and tannins were present more in petroleum ether and acetone extracts, respectively. The maximum percentage inhibition was observed for protein denaturation, proteinase and hyaluronidase in aqueous extract. Ethyl acetate exhibited higher inhibition level for membrane lysis (70.58±3.1) and heat induced hemolysis (76.07±0.2). Positive correlation was found between secondary metabolites and anti-inflammatory activities. Based on the investigation, it is concluded that aqueous and ethyl acetate extracts of *P. cordifolia* are good source of functional ingredients against inflammation.

Keywords: *Priva cordifolia,* Secondary metabolites, Anti-inflammatory, Pearson's correlation

INTRODUCTION

Priva cordifolia (L.f) Druce commonly known as Heart-Leaf Velvet Bur and belonging to the family Verbenaceae. For this, in Tamil the local name is Ottuurinji. The whole plant paste was applied externally for the treatment of wounds

by paliyar tribals in Theni district of Tamil Nadu, India [1]. In addition, the plant has been claimed to treat diarrhea, migraine [2], ulcer and anti-fertility [3] and eczema [4]. Stem water extract of *P.cordifolia* displayed good antimicrobial activity [5] and leaf ethanolic extract exhibited high free scavenging activity [6]. Leaf methanolic extract was used for phytochemical analysis and for biogenic synthesis of sliver nanoparticles [7, 8]. Inflammation is usually a body response to tissue damage and the response of cells toward inflammation will lead to certain pathological manifestations characterized by redness, heat, swelling and pain [9].Inflammation is the second stage of wound healing and begins right after the injury when the injured blood vessels leak extra vascular fluid causing localized swelling. Inflammation controls both bleeding and infection. The fluid blister allows healing and repair cells to move to the site of the wound. During the inflammatory phase, damaged cells, pathogens, and bacteria are detached from the wound area. Inflammation is a natural measure of the wound healing progression and only problematic if prolonged or extreme [10]. There are many anti-inflammatory drugs to treat the consequences of inflammation belonging to steroidal or non-steroidal anti-inflammatory drugs (NSAIDS). However, studies suggest that these drugs are not free from adverse effects, as they are responsible for gastrointestinal complications such as mucosal damage and bleeding [11]. Moreover, NSAIDS can also cause acute renal failure [12]. For these reasons, many researchers have shifted their focus on finding the medicinal plants, which have gotten the anti-inflammatory property and can serve as a potential ingredient for future drug development [13].

Plants are in one way or the other providing the basic need of mankind i.e food, shelter, clothing, protection from disease causing agents and treatment of various infections and illnesses since early days of human history [14]. A great variety of medicinal plants, their purified constituents and natural products from the medicinal plants offer unlimited opportunities for new drugs development because of the unparalleled accessibility of diverse chemical compounds [15]. The most crucial bioactive constituents of plants are alkaloids, terpenoids, flavonoids, phenolic compounds and tannins [16]. Many studies had been conducted on plants to investigate its anti-inflammatory potential, and also these plants have been screened for phytochemicals, which are actively associated with its anti-inflammatory property [17]. To the best of our knowledge, there are no reports on *in vitro* anti-inflammatory potential *P. cordifolia*. Therefore, the present study was aimed to determine *in vitro* anti-inflammatory potential with specific objectives of (i) quantification of some secondary metabolites (ii) determination of anti-inflammatory potential by various *in vitro* assays; and (iii) analysis of results using Pearson-correlation coefficient statistical method.

MATERIAL AND METHODS

Plant collection, preparation, extraction and yield determination

The whole plant material of *P. cordifolia* was collected from Bharathiar University campus, Coimbatore, Tamil Nadu, India during August-December and authenticated by Botanical Survey of India, Coimbatore (BSI/SRC/5/23/2019/Tech/455). The plant material was washed thoroughly in running tap water and cut into small pieces and then air-dried under shade condition for three days. After that the sample was powdered using Laboratory Willymill (0.4mm) and stored in air tight container for experimental use. The powdered plant samples were extracted successively with petroleum ether, benzene, acetone, ethyl acetate, methanol, ethanol and water in 1:10 ratio for 24 hr on an orbital shaker at 180 rpm at room temperature. The extracts recovered after seven successive extractions were weighed and the percentage yield was calculated. All the various solvent based plant extracts in two concentrations i.e. 50 μg/ml and 100μg/ml were used for all the experiments.

Estimation of secondary metabolites

All the various solvent based plant extracts were subjected to estimation of secondary metabolites such as total phenolics (TPC) flavonoids (TFC), tannins (TTC) and terpenoids (TTEC). The total phenolic content of various extracts was determined by Folin-Ciocalteu method [18]. The total flavonoid content was determined [19] and

expressed as gram of rutin equivalent (RE)/100 g of extract. Tannin content of plant extracts was determined [20] and total terpenoid content was measured.

In vitro anti-inflammatory activity

Protein denaturation ability: Protein denaturation activity of the plant extracts was determined [21] which is modified by Gunathilake [22]. The 5ml of reaction mixture was comprised of 0.2ml of eggs albumin, 2.8ml of phosphate buffered saline (PBS, pH 6.4) and 2ml of two different concentrations of extracts. The mixture was incubated at 37°C for about 15 mins and then heated at 70°C for 5 mins. After cooling, absorbance was measured at 660 nm. Diclofenac sodium was used as reference drug. The percentage inhibition of protein denaturation was calculated by the following formula,

$$\text{Inhibition \%} = \frac{\text{Absorbance of control - Absorbance of test sample}}{\text{Absorbance of control}} \times 100$$

Proteinase inhibitory activity: Proteinase inhibitory activity of the plant extracts was quantified according to the method of [23] with modification [22]. Briefly, the reaction solution (2 ml) consisted of 0.06 mg trypsin, 1 ml of 20 Mm Tris-HCl buffer (pH 7.4) and 1 ml test sample. The solution was incubated at 37°C for 5 min and then 1 ml of 0.8% (w/v) casein was added and the mixture was further incubated for an additional 20 min. After incubation, 2 ml of 70% perchloric acid was added to terminate the reaction. The mixture was centrifuged and the absorbance of the supernatant was taken at 210 nm. Aspirin was used as reference drug. The percentage inhibition of proteinase activity was calculated as mentioned in protein denaturation.

Membrane stabilization property

HRBC (Human Red Blood Cell) membrane stabilization method: Blood sample was collected from healthy volunteers. The collected blood was mixed with equal volume of Alsever's solution (dextrose 2%, sodiumcitrate 0.8%, citric acid 0.05%, sodium chloride 0.42% and distilled water 100 ml) and centrifuged with isosaline. To 1ml of HRBC suspension and 1ml of plant extract was added. All the assay mixtures were incubated at 37°C for 30 minutes and centrifuged after cooling. The haemoglobin content in the supernatant solution was estimated by using spectrophotometer at 560 nm. Using aspirin as a reference drug, the percentage of haemolysis was calculated [24]. The experiments containing human blood serum were conducted as per CPCEA norms (Ethical Committee Certificate No. BUHEC-043/2020).

Heat induced haemolysis

Preparation of Red Blood Cells (RBCs) suspension: Fresh whole human blood (10ml) was collected and centrifuged (3000rpm for 10min) and washed three times with equal volume of normal saline (0.9% NaCl). The volume of the blood was measured and reconstituted as 10% (v/v) suspension with normal saline [25]. For heat induced haemolysis, 2ml reaction mixture was prepared using 1ml of plant extract and 1ml of 10% RBCs suspension. Diclofenac sodium was taken as a standard drug. All the centrifuged (8000 rpm for 10 min at RT) tubes containing reaction mixture were incubated in a water bath at 56°C for 30min. After cooling, the reaction mixture was centrifuged at 2500rpm for 5min and the absorbance of the supernatants was taken at 560nm [26]. The experiment was performed in triplicate and the activity was calculated.

Hyaluronidase inhibition assay: Hyaluronidase inhibitory activity of plant extracts was evaluated by a spectrometric method with modifications. Extracts were assayed at the concentrations of 50 and 100μg/ml. Extract was incubated with 10 μL hyaluronidase enzyme solution at 37°C for 10 min followed by the addition of calcium chloride (12.5 mM, 20 μL) and re-incubation at 37°C for 10 min. Sodium hyaluronate (50 μL) was added to the reaction mixture and incubated at 37°C for 40 min followed by the addition of sodium hydroxide (0.9 M, 10 μL) and sodium borate (0.2 M, 20 μL) and incubation at 100°C for 3 min. 50 μL of 67 mM PDMAB was added to the reaction

mixture and incubated at 37 °C for 10 min. Absorbance was measured at 585 nm using ascorbic acid as the reference standard.

Statistical analysis: The data were subjected to ANOVA and the significance of the difference between means was determined by Duncan's multiple range test ($P < 0.05$) using SPSS 16.0. Values expressed are means of three replicates with ± standard deviation. The Pearson correlation test was employed to determine the correlation between secondary metabolites and anti-inflammatory activities.

RESULTS

Extraction and yield determination
In the present study, among various extracts, aqueous extract had the highest extractable phytocompounds solides i.e 31.7% followed by petroleum ether, ethanol, acetone, ethyl acetate, methanol and benzene with 21.8%, 20.6%, 19.8%, 14.85%, 11.7% and 5.35%, respectively (Fig. 1).

Secondary metabolites analyses
The results of the TPC, TFC, TTC and TTEC are presented in Table 1. Among various extracts, TPC was found more in aqueous extract i.e 642.91±7.3 mg GAE/g DW which was followed by methanolic extract (519.16±1.1 mg GAE/g DW). Petroleum ether extract had the highest TFC (177.77±3.2 mg Ru/g DW) while the minimum TFC was found in acetone extract (54.12±0.2 mg Ru/g DW). Among the examined plant samples, acetone had the highest TTC (986.66±2.1 TA mg/g DW) and aqueous extract had the lowest amount of TTC (253.06±0.2 TA mg/g DW). The highest terpenoids content was observed in aqueous extract (976.33±0.1 LN mg/g DW) and the lowest content was observed in methanol extract (126.66±0.9 LN mg/g DW). Of two different concentrations used, 100μg/ml concentration showed better results for all the secondary metabolites.

In vitro anti-inflammatory activities
Protein Denaturation: In the present investigation the *in vitro* anti-inflammatory effect of various solvent based extracts of *P. cordifolia* was evaluated against denaturation of egg albumin (Fig. 2a). The result exhibited a concentration depended inhibition of protein denaturation by solvent extracts. Among various extracts, aqueous extract showed maximum inhibition of protein denaturation (94.55%) followed by ethyl acetate (91.37%) at the concentration of 100 μg/ml. The effect of extracts was found to be higher when compared to reference drug (83.5%).

Proteinase inhibitory activity: Proteinase inhibitory activity of different solvent based extracts of *P. cordifolia* is shown in Fig. 2b. Among various extracts, aqueous extract showed maximum proteinase inhibitory activity (87.93%) on par with reference drug aspirin (88.56%) at the concentration of 100 μg/ml.

Membrane stabilization: Two different concentrations of different solvent based extracts of *P. cordifolia* were assessed for their membrane stabilization (Fig. 2c).The inhibition of hypotonicity induced HRBA haemolysis was found to be dose dependent and increasing with increased concentration of the extracts in the reaction mixture. Of various extracts, ethyl acetate extract showed a higher membrane stabilizing effect (70.58%) which was comparable for standard aspirin (68.47%) at 100 μg/ml.

Heat induced hemolysis: The percentage of heat induced hemolysis of red blood cells at two different concentrations of various solvent based extracts of *P. cordifolia* is presented in Fig. 2d. Inhibition percentages of hemolysis were ranged from 25.69 to 76.07% at 100μg/ml. Ethyl acetate extract showed significantly higher (76.07%) level of hemolysis on par with the standard drug diclofenac sodium (81.12%).

Hyaluronidase inhibition activity: The inhibition of hyaluronidase activity of different solvent extracts *P. cordifolia* is shown in Fig. 2e. The order of inhibition of hyaluronidase activity was ethyl acetate >aqueous> methanol> acetone>petroleum ether > benzene> and ethanol. Aqueous extract exhibited maximum percentage of inhibition (95.09%) which was almost on par with standard ascorbic acid (89.37%) at 100µg/ml.

Pearson's correlation coefficients between secondary metabolites and *in vitro* anti- inflammatory activities

The p values resulted from the correlation analysis among five assays are given in Table 2. Total phenolic content was correlated with protein denaturation (R_2=0.848) and proteinase (R_2=0.885) activities with high significant ($P<0.001$) whereas it was moderately ($P<0.01$) correlated with membrane stabilization (R_2=0.536) and heat induced lysis (R_2=0.577) activities. High significant correlation was found between flavonoids and protein denaturation (R_2=0.885) and membrane stabilization (R_2=0.949) activities. Tannin showed moderate correlation for protein denaturation (R_2=0.536), proteinase (R_2=0.662), hyaluronidase (R_2=0.774) and heat induced hemolysis (R_2=0.749) activities. High significant correlation was observed for membrane stabilization (R_2=0.929). Terpenoids had strong significant correlation with all the *in vitro* anti-inflammatory activities except hyaluronidase (R_2=0.437).

DISCUSSION

Present investigation evaluates for the first time anti-inflammatory potential of various solvents based whole plant extracts of *P. cordifolia* using different *in vitro* models. Before starting *in vitro* analyses, extractive yield was determined after plant extraction. Of various extracts, aqueous extract showed the highest yield (31.7%). Extraction is the chief process by which phytocompounds may be obtained from plant materials. The objective of extraction process is to exploit more amounts of target compounds. The extraction yield is not only affected by the extraction methods but also by the solvent used for extraction [27, 28]. The yield extract recovery variation is due to difference in the polarity of the extraction solvents used [29]. Our result is consistent with the results of [29-32] who observed high recovery percentage of phytocompounds using water. Generally plant secondary metabolites act as therapeutic and prophylactic agents for human health against numerous diseases including anti-inflammatory [33] and also aid in improving the immunity (Kang and Ginseng 2012). The results of quantitative phyto chemical analyses revealed various levels of secondary metabolites such as TPC, TFC, TTC and TTEC in all the plant extracts. This is due to higher solublility of phytocompounds in their respective solvents used [29].

In the present study, aqueous extract showed higher percentage of inhibition for protein denaturation, proteinase and hyaluronidase. Denaturation of tissue proteins is one of the well-manifested effects of inflammatory and arthritic diseases. Because of production of auto antigens in certain arthritic diseases will lead to denaturation of proteins under *in vivo* [25, 34]. Earlier studies showed the effect of different plant parts on protein denaturation. For example, bark extract of *Semecarpus anacardium* [35], an ethanolic extract of *Wedelia trilobata* [36], *Albucas etosa* [25], hydro methanolic extract of six leafy vegetables such as *Cassia auriculata, Passiflora edulis, Sesbania grandiflora, Olax zeylanica,Gymnema lactiferum,* and *Centella asiatica* [22] and terpenoid fraction of *Plectranthus hadiensis* [37] were used to study protein denaturation. Neutrophils are known to be a rich source of serine proteinase and are restrained at lysosomes. It was previously reported that leukocytes proteinase play an important role in the development of tissue impairment during inflammatory reactions and significant level of protection was provided by proteinase inhibitors [36, 38]. Hyaluronic acid (HA), an important glycosaminoglycan in the extracellular matrix and connective tissue is degraded by the enzyme hyaluronidase [39]. Finding out of inhibitors for this enzyme activity is very useful for therapeutic use of several diseases including cancer, rheumatoid and arthritis [40, 41]. Ethyl acetate extracts perhaps potent inhibitor for hyaluronidase enzyme.

In the current study, ethyl acetate extract had maximum percentage of inhibition for both membrane stabilization and heat induced hemolysis. Membrane stabilization leads to the inhibition of leakage of serum protein and fluids

into the tissues during a period of increased permeability caused by inflammatory mediators [42]. Ethyl acetate extract perhaps stabilized the red blood cell membrane by preventing the discharge of lytic enzymes and active mediators of inflammation. Exposure of red blood cells (RBCs) to injurious substances such as hypotonic medium, heat, methyl salicylate or phenylhydrazine results in the lysis of the membranes with oxidation of haemoglobin [43]. Since human red blood cell (HRBC) membranes are comparable to lysosomal membrane components [44], the inhibition of hypotonicity and heat induced red blood cell membrane lysis was taken as a measure of the mechanism of anti-inflammatory activity [45].

The correlation analysis is important to get an understanding of statistical relationships between secondary metabolites and *in vitro* anti-inflammatory activities. In the present study, all the secondary metabolites almost showed stronger correlation with anti-inflammatory activities except hyaluronidase activity where tannin showed moderate correlation with it. The stronger correlation may be due to synergetic interaction between secondary metabolites such as phenolics, flavonoids, tannins and terpenoids and *in vitro* anti-inflammatory activities. This is in accordance with the observation of [46] who showed correlation between the antioxidant activity and secondary metabolites of *Lepidium meyenii*. They noted the synergetic interactions between phenols, alkaloids, sterols and FRAP, hydroxyl radical scavenging and lipid peroxiodation activities.

CONCLUSION

In conclusion, the results obtained from this study indicate that the aqueous and ethyl acetate extracts of *P.cordifolia* possess anti-inflammatory properties which are due to the presence of phenolics, flavonoids, tannins and terpenoids. Future studies are required including *in vivo* experiments to findout lead compound/s from these two extracts for designing a potent anti-inflammatory drug.

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CONFLICT OF INTEREST

The authors have no conflicts of interest in financial or commercial issues of the present research work or its publication.

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Table 1: Quantitative analysis of different solvent based whole plant extract of *P. cordifolia*

Solvents	Total Phenolics (mg GAE/g extract)		Total Flavonoids (mg RU/g extract)		Total Tannins (mg TA /g extract)		Terpenoid (mgLN /g extract)	
	50 µl	100 µl	50 µl	100 µl	50 µl	100 µl	50 µl	100 µl
Petroleum ether	133.5± 0.1^c	134.2 ± 0.16^g	**127.4 ± 0.5^a**	**177.7 ± 3.2^a**	263.33 ± 1.8^d	708 ± 0.1^b	286.33 ± 1.7^e	680 ± 1.7^e
Benzene	154.3 ± 4.2^b	389.16 ± 3.7^c	84.1 ± 2.1^e	72.4 ± 0.3^e	513.33 ± 1.4^c	443.33 ± 0.9^e	284.66± 1.9^e	550 ± 2.3^f
Acetone	121.37 ± 2.7^d	214.58 ± 1.0^e	172.2 ± 1.5^b	54.12 ± 0.2^d	**840.33± 2.4^a**	**986.66 ± 2.1^a**	280.62 ± 1.2^e	880 ± 0.5^b
Ethyl acetate	135.77 ± 0.5^c	133.61 ± 6.7^g	149.3 ± 0.5^c	56.8 ± 0.9^d	370 ± 1.2^d	728.87 ± 0.4^b	446.66 ± 1.5^d	576.66 ± 1.1^f
Methanol	155.59 ± 2.1^b	519.16 ± 1.1^b	158.6 ± 3.7^c	72.4 ± 0.1^b	586.66± 3.7^c	413.33 ± 0.6^e	126.66 ± 0.9^f	823.33 ± 0.6^c
Ethanol	131.68 ± 3.2^c	194.58 ± 1.8^f	72.7 ±1.2^e	55.2 ± 0.4^d	570 ± 1.2^c	352 ± 0.3^e	776.66 ± 4.1^d	867.32 ± 0.4^b
Aqueous	**377.93± 1.5^a**	**642.91 ± 7.3^a**	128.4 ± 1.7^d	61.6 ± 0.4^c	636.66 ± 0.3^b	253 ± 0.2^f	**912.33± 1.2^a**	**976.33 ± 0.1^a**

Table 2: Pearson's correlation coefficients between secondary metabolites and *in vitro* anti-inflammatory activities

Correlation	R	P
Phenolic versus protein denaturation	0.848***	0.001
Phenolic versus proteinase inhibitory activity	0.885***	0.001
Phenolic versus membrane stabilization	0.538*	0.01
Phenolic versus hemolysis	0.577**	0.01
Phenolic versus hyaluronidase	0.473*	0.05
Flavonoids versus proteinase inhibitory activity	0.464*	0.05
Flavonoids versus protein denaturation	0.885***	0.001
Flavonoids versus proteinase inhibitory activity	0.464*	0.05
Flavonoids versus membrane stabilization	0.949***	0.001
Flavonoids versus hemolysis	0.196**	0.05
Flavonoids versus hyaluronidase	0.101*	0.05
Flavonoids versus proteinase inhibitory activity	0.464*	0.05`
	0.536*	0.01
Tannins versus proteinase inhibitory activity	0.662*	0.01
Tannins versus membrane stabilization	0.929***	0.001
Tannins versus hemolysis	0.749*	0.01
Tannins versus hyaluronidase	0.774*	0.01
Terpenoids versus protein denaturation	0.577**	0.01
Terpenoids versus proteinase inhibitory activity	0.874***	0.001
Terpenoids versus membrane stabilization	0.969***	0.001
Terpenoids versus hemolysis	0.861***	0.001
Terpenoids versus hyaluronidase	0.437*	0.05

Correlation coefficients (R) with the level of significance ***= $p<0.001$, ** = $p<0.01$, * = $p<0.05$

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Fig. 1: Plant extracts recovery percentage of *P.cordifolia*

Fig. 2a: Protein denaturation

Fig. 2b: Proteinase inhibitory activity

Fig. 2c: Membrane stabilization

Fig. 2d: Heat induced hemolysis

Fig. 2e: Hyaluronidase inhibition activity

Fig. 2a-e *In vitro* anti-inflammatory activity of various solvent based extracts of *P. cordifolia*

RESEARCH ARTICLE
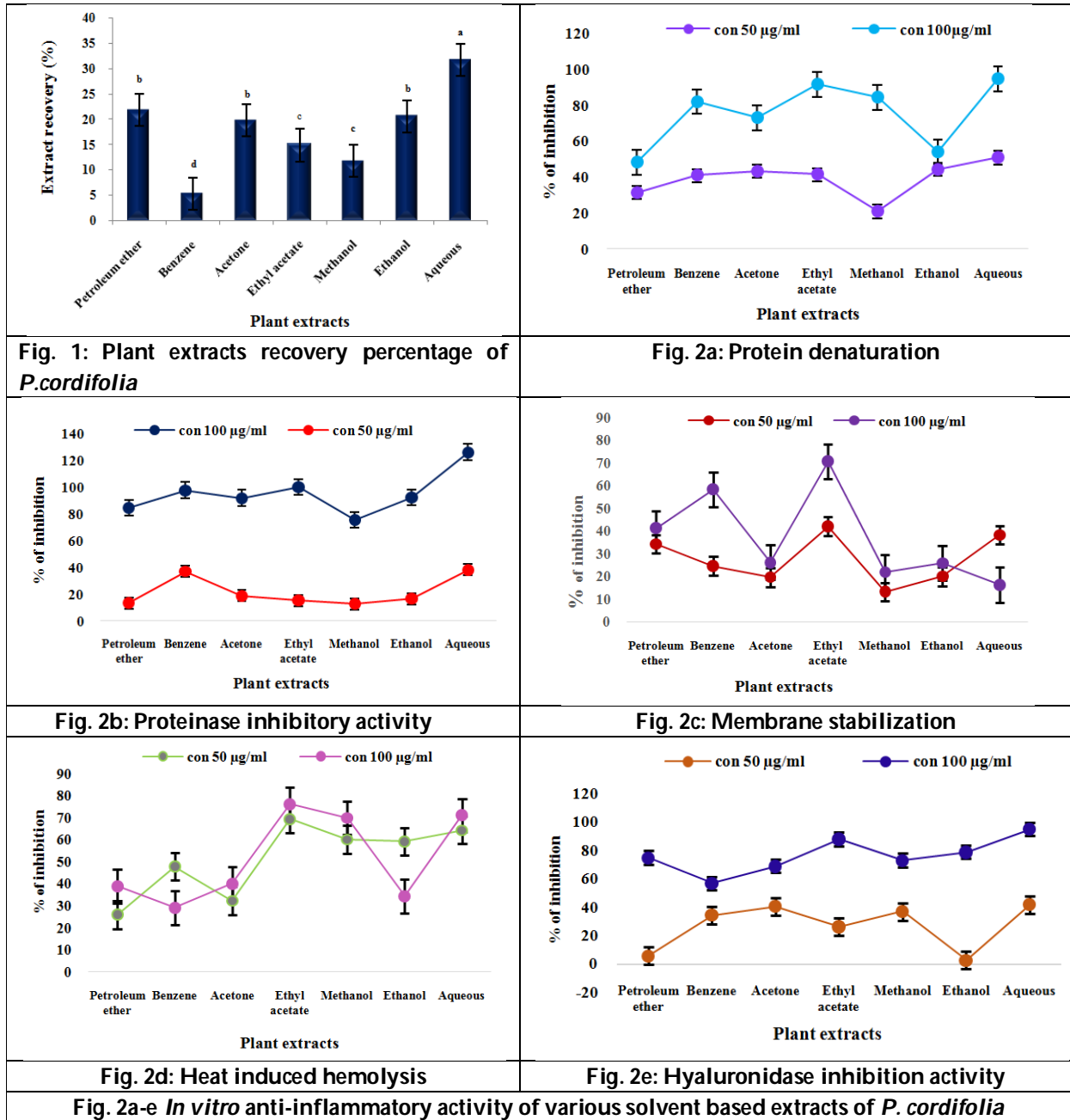
Solar and Wind Hybrid Power Generation System for Street Lighting

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ABSTRACT

The demand for electricity power is increasing day by day which can't be met with the satisfied level without non- renewable energy resource. Renewable energy source are wind and solar energy is universal and ecological. These renewable energy sources doesn't option of he world energy demand ,but renewable energy sources are dependent on whether condition, but option of utilization these available resources. The objective of this research paper is to study the various abstracts of hybrid solar and wind system, hybrid power using solar wind energy application in streetlight in highway. Solar and wind energy is a free of cost this reason is using solar and wind energy and it is pollution free environment. Hybrid energy system using solar & wind energy Control of street lighting Solar & wind street light is an intelligent, Small scale, off grid LED Lighting System. Components are solar panel ,wind generation system , Dynamo, LDR battery ,LED light, charge controller. We have used 12V DC system to supply energy to the lights.

Keywords: Charge Controller, Photo Transistor (LDR), Solar Panel, Vertical axis wind turbine.

INTRODUCTION

As convention fossil fuel energy sources diminish and the world's environmental concern about acid deposition and global warming increases, renewable energy sources are attracting more attention as alternative energy sources. These are all pollution free and one can say eco friendly. These are available at free of cost. In India, there is severe power shortage and associated power quality problems. The quality of the grid supply in some places is characterized by large voltage and frequency fluctuations, scheduled and un scheduled power cuts and load restrictions. Load shedding in many cities in India due to power shortage and faults is a major problem for which there is no immediate remedy in the near future since the gap between the power demand and supply is increasing every year. The term hybrid power system is used to describe any power system combine two or more energy

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conversion devices, or two or more fuels for the same device, that when integrated, overcome limitations inherent in either.

Solar energy system, Photovoltaic (PV) cells are electronic devices that are based on semiconductor technology and can produce an electric current directly from sunlight. The best silicon PV modules currently commercially available have an efficiency of over 18%, and it is expected that in about 10 years' time module efficiencies may raise to 25%. The photovoltaic system also depends on the weather conditions and only can operate during day-time. Wind power is basically electricity produced by a generator, which is driven by a turbine according to flowing air's aerodynamics, and is one of the fastest growing renewable energy technologies around the world.

The wind energy component will make a more significant contribution in the hybrid system than solar energy. While at the same time providing a reliable supply of electricity using a combination of energy sources. Numerous hybrid systems have been installed across the world, and expanding renewable energy industry has now developed reliable and cost competitive systems using a variety of technologies.   Research in the development of hybrid systems focused on the performance analysis of demonstration systems and development of efficient power converters.

METHODOLOGY

The methodology adopted for the design of a hybrid power generation system using soar and windpower is connected to the streetlight. For the use in the night or dark the hybrid system is combined use of solar and wind energy from available resources with efficient and maximum utilization along with power control. Based on the climate condition and availability of solar and wind power this system allow to supply power to the streetlight the energy from solar is availability voltage of the solar cells and the temperature the output solar energy produced. The energy from solar is boosted with the help of DC-DC boost converter to supply to a DC-AC inverter circuit to supply to the load for wind energy system the speed of rotor of wind turbines are captured by permanent magnet synchronous machines and the output wind energy is coupled with the turbine to convert to electrical energy. The output is fed to inverter for conversion of DC to AC supply to load. The system works at normal standard temperature and radiation from sun and the normal wind speed availability sun's radiation and temperature are the main factors' influencing the generation of solar energy .while for wind energy, the wind speed and the geographical changes effecting the wind speed needs to be known.

Operation
This hybrid generation power solar system of wind energy hybrid the power energy obtained from the source and convert it into dc and store in a battery. Both the output are odd in direction and the rotation of the wind turbine is vary. the speed is depend upon the vehicle passing distance at a particular instance. The blade shown in diagram & project of turbine are made up of polymer or fiber. The wind energy generating system is placed at the corners edges of the streets or near the traffic single were we can find a steady flow of vehicle .these use a of light weight blades can produce rotation motion at a low wind . the solar output also depend s on the intensity of the light. The lights shows are replaced by power led's for an effective output and flow power of consumption .the switching circuit is made for voltage generation from solar the street lights gets turned off. The power can also be synthesized by traffic signals ,director & distance indicator . Due to this power the above power can be reduced.

Solar Panel
A solar panel is an arrangement of solar cells sunlight knocks. Free the electrons & holes in the solar cells. Free electrons pass through conductive filament thereby generating electricity is stored in battery for use. The electron return to the free holes & the cells return to neutral state and be used again.When photon's hit a solar cell knock electrons loose from their atoms when electrons flow through such a circuit. They generate electricity multiple cells make up a solar panel and multiple panels can be wired together to from a solar array.

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Capacity of Unit: 50W/h Volts: 12V Period for which Solar Panel is exposed to Sun in Summer.
(Ts): 9 hrs Period for which Solar Panel is exposed to Sun in Winter.
(Tw): 7hrs Total Power per Day(Ps): 90W /d
If Losses are included,
(The rated power of Solar Panel* the no. of hrs of Sunshine* Dust, Weak Radiation * Efficiency of Charge controller)
 power(Ps)= 50*9*0.90*0.85=344. 25Watts/Day

Wind Energy

Wind is the stabilization movement of air between areas of high and low atmospheric pressure, creature by the uneven heating of the Earth's surface: land ,water, air. Wind energy is the inverting of wind power to electrical through the use of windmills or turbine. Wind turbine operates on a simple principle. The wind turns the blades(VAWT) which are connected to a rotor . it is divided into three parts.

Glant Blades + Rotor = Turbine

As wind passed by, it makes the blades spin around .The blades attached to the rotor, in turn spin the shaft.
Shaft:-A gearbox which increase the speed of the spinning blades enough to [power the electricity generator.
Generator:-Converts mechanical energy of the moving wind into electrical energy.
Calculation:-Let, m = Mass (in kg) of the air in the hypothetical cylinder which radius is equal to the vane length
v = the velocity of air in m/s.
So, kinetic energy $E = m u^2 / 2$
Power output $(P w) = (v^2 /2) \times dm/ dt$
$$= \varrho \times (v^2/2) \times dQ /dt$$
$$= \varrho \times (v 3/2) \times A$$
Where: $Q = Au$ = volume of air & $\varrho = 1.2$ (kg/m³)

Charge Controller: A charge controller and regulator is basically a voltage or current regulatorto keep batteries from overcharging. It's regulates the voltage and current coming from the solar panels going to the battery, Most batteries need around 14 to 14.5 volts to get fully charged.

Inverter: Inverter is a electronic system, converters direct current into alternating current, i.e. DC into AC. The stored electrical energy in the batteries is DC in nature. And it cannot utilize for various kinds of load. So, for delivering AC supply to the load inverter system is required. Inverter is either analog or digital kind. Digital inverter is microcontroller based which increase the buildup cost of the system also, is uses MOSFET technology providing more efficiency. But, considering the financial aspect and resolution the proposed project designs and builds the inverter analog in nature. The input energy is in DC (12V) form stored in the batteries. It will convert it into AC with ~230V, 500W (the maximum value of load to be attach), Frequency is~ 50Hz specification matching with the house hold mains supply. At output, AC loads can be attached.

Battery: The electrical energy produced by the system is need to be either utilized completely or stored. This circuit is used to charge Lead-Acid or Ni-Cd batteries using solar energy. Electrical batteries is the most relevant, low cost,, maximum efficient storage of electrical energy in the from of chemical reaction. Hence, batteries are preferred.
Output voltage
Set the output voltage to 14.5 volts(This voltage is specified on the battery as cycle use.)
Charging current
Charging current = Solar panel wattage
Solar Panel Voltage = 0.588A.

CONCLUSION

1)In the paper the wind and solar i.e., renewable energy have ability to complained each other.

2)the two streetlights in between that the solar panels are placed & it is interconnection for two leads.

3)the power convert which interact with the controller is used to control set of operation.

4)the interconnecting the sources to be made common and load sharing can be made. The power to the load can be equally shared .

5)the unequal and power can be regularized using the method , the initial investment is saved ^& the total energy loss I the conversion to be reduced.

Here LM317 can provide current upto 1.5A .So it is recommended to use high wattage panels if more current is required for your application.(But here my battery requires initial current less than 0.39Amps. This initial current is also mentioned on the battery).

If the battery requires initial current more than 1.5A,it is not recommended to use LM317.

Time taken for charging

Time taken for charging = 1.3Ah/0.588 A = 2.21 hours.

Power dissipation

 Here solar panel has 10Watts

Power going into battery = 14.5*0.588 =8.5 watts

Thus 1 watt of power going into regulator.

Working

Here we are going to increase electricity 230v as well as 12v DC .

SOLAR:-There is a battery of high current 12.5 ah. High current battery charged through solar panel and 12v battery provide power to solar inverter to generate electricity of 230v .

The transformer generate 230v ac. High current inverter convert 12v dc to 230v dc. 230v LED glowing by the help of inverter (on\off button). solar panel working when light is working incident on solsr panel. Solar panel is connected to solar charger circuit by wires . there is voltage regulator LM317 regulator which is allow input voltage to charge output voltage.

Potentiometer which is set by voltage. which we have to charge the battery we also set potential voltage there is on\off button for inverter . also there is 4047 Ic which generate fluctuation . those fluctuation which affect to high power transistor .

High current transformer which is step down transformer 2Amp (12012) which is connected to LED.

WIND:-There is a generator which generate electricity when the windmill is at high speed . we also need air thrower to rotate the windmill.

When the turbine is rotate by the help of air thrower which result in the power is transfer to turbine by soft rod . then power is supply to the street lights through the rectifier .We also can store energy in the from of battery (12v dc).

Hybrid Streetlight System

Hybrid energy system generally consist of two or more renewable energy sources which are used together. Due to renewable energy source it increase the efficiency of the system. An also increase is grater balance in energy supply, In the solar wind streetlight designed in the small scale and off grid led streetlight system

There are main advantage of streetlight

Since automatic streetlight system feature no moving part they required less maintenance than conventional streetlight.

The automatic solar streetlight system is stand –alone arrangement &therefore require no external wiring or having to connect with the grid.

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Cost of operating automatic solar streetlight is for less when compared to the conventional streetlight.
The automatic streetlight system is ecofriendly & hence helps in reducing the carbon footprint.
WORKING: In this project we are going to sow automatic ON/OFF of streetlight on bases of hybrid solar charging.
On basis of solar panels the streetlight starts working in night. When the sunrises.yhe sunlight rays falls on the solar plates and solar panel gets charged.
The battery is connected with solar panel its charge the battery. When sunlight goes OFF it's DARK in evening automatically the streetlight gets on due to battery is charge.

EXPERIMENTAL RESULT

1) The performance of solar & wind hybrid system is shown in diagram. The solar panel is 50W is used and approximately it will ginving us the 344 watts/Day output in whole day.
2) The wind speed of 11m/s is balance with linear polarity.
3) The rotor speed set point is at 99.6rad/s & it's fre4quency is 47.08Hz.
4) Since the power generated by the system is more than the required active power for the electrical loads.
5) To maintain the frequency of the load voltage constant the required active power for the electrical loads the battery absorbed the surplus power.
6) During the peak load time the required active power for the electrical loads and required battery capacity is determined by energy.
7) From small led the it is determine whether the circuit will operate from the mains or from the battery.
8) The reactive power required by the load is supplied by the load side converter to maintain the magnitude.

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Table.1. Solar panel

Parameter	Rating
Material	plastic
Design	vertical-axis wind turbine (VAWT)
Shape	Aradyamanic
Average (electricity start generating)	12.6 kph
Maximum speed	36 – 54 km/hr
Minimum speed	8km/ ph

Table.2.wind energy

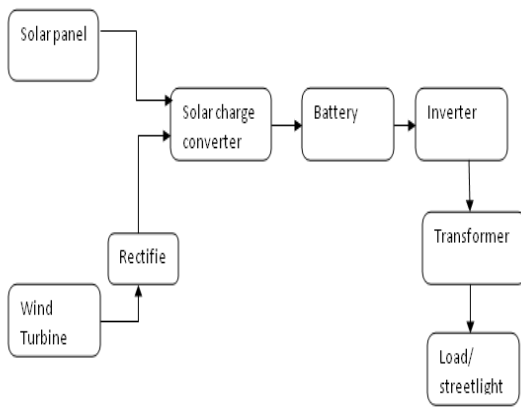| Parameter	Rating
Solar panel	50W
Dimension (L*B)	540*665*34
Maximum power Vmp (V)	18.00v
Maximum power Imp (i)	2.78A
No of cells	36
Open circuit voltage(Voc)	22.00 V
Short circuit current(Isc)	2.31 A
Maximum power	40.00 Wp

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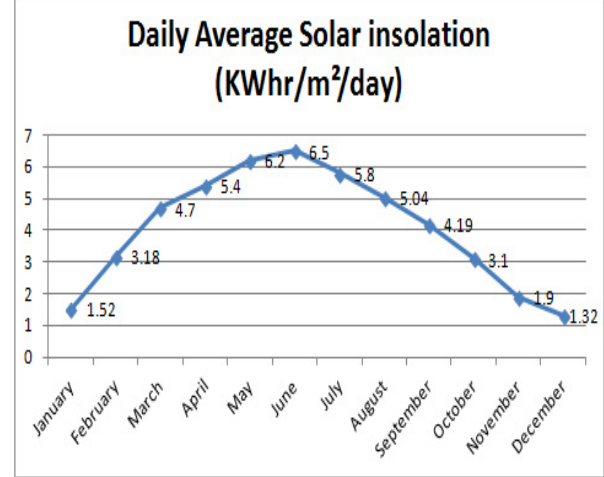**Fig. 1 : This is the flow chart of hybrid power system in street light.**
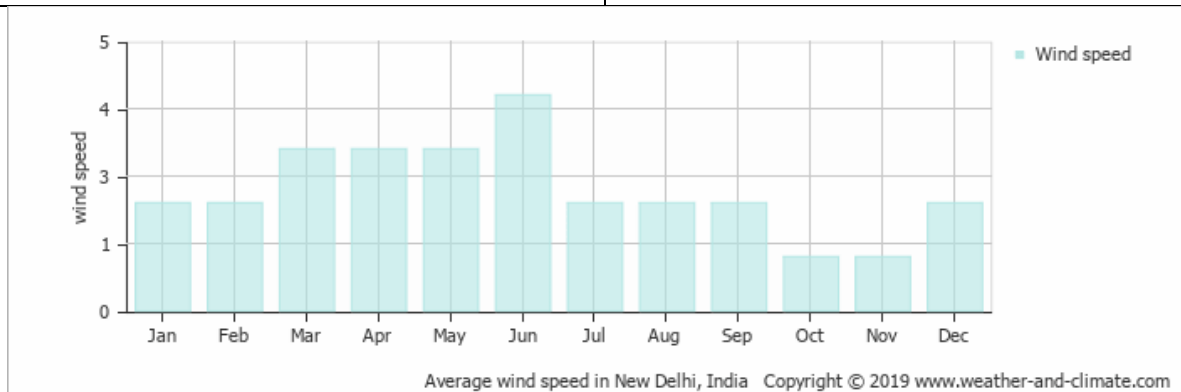

Fig .2 Daily Average Solar insolation

Fig.3 : Average wind speed in New Delhi, India.

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RESEARCH ARTICLE

A Computational Approach to Understand the Analysis of *Sansevieria trifasciata* Phytochemicals against Nicotine-Induced Lung Cancer

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ABSTRACT

Cytochrome P450(CYP) 2A13, is an enzyme that facilitates the metabolism of organic compounds and xenobiotics. It is integrated with haemmoity and functions as monooxygenase which involves in the oxidation of various biological compounds. Nicotine is a natural compound that has the ability to bind with CYP and transforms into a carcinogen 4-(methynitrosamino)-1-(3-pyridyl)-1-butanone (NNK), which leads to the lung cancer. This study explores the inhibitory potentials of selected ligands from *Sansevieria trifasciata* ((Ligand 1 - beta-sitosterol and Ligand 2- a component of saponin [1,2,3,4-Tetra-O-acetyl-beta-D-xylopyranose]).against the heme of CYP2A13 by *In silico* analysis . The work constitutes of examining their interaction by analysing its docking score and by calculating its physiochemical and molecular properties by Lipinski rule of 5 and ADMET property calculation for the selected phytocompounds .This study shows that the ligand which binds to the heme of CYP2A13 play a substantial role in establishing protein ligand interaction by inhibiting the nicotine-induced in lung cancer.
Keywords: Nicotine, lung cancer, Docking, Cytochrome P450, Heme, Phytocompounds.

INTRODUCTION

Lung cancer, is a serious type of cancer that is responsible for more deaths than any other cancer. In India disease burden initiative cancer collaborators validated that tobacco were the highest contributing risk factor for cancer in India. 70% of cancers in India were lung cancer attributed to tobacco use and air pollution [1]. Cigarette smoking is the principle risk factor for the development of lung cancer. Exposure to tobacco smoke also can cause passive lung

cancer in non-smokers. Much of the difficulty in smoking cessation is the addictive properties of the nicotine [2]. A cigarette is made up of number of compositions like nicotine, hydrogen cyanide, formaldehyde, lead, arsenic, ammonia, benzene, carbon mono oxide and other radioactive elements among that nicotine acts as an addictive agent as well activation of tobacco procarcinogen through 4-(methylnitrosamino)-1-(3-pyridyl)-1-butanone (NNK) [3]. Beyond inhalation of tobacco smoke, nicotine rapidly circulates systematically via blood stream and through the nicotine metabolism which occurs in the liver through cytochrome P450 (CYP). Nicotine-induced lung cancer was selected as a target disease. Lung cancer is the second most cancer responsible for more mortality and distant metastasis which was predominant among 44% of males and 47% of females [1]. Nicotine is an addictive agent in tobacco and activation of tobacco pro carcinogen NNK. Even after surgery smokers could not quit smoking due to the addictive agent nicotine and it again causes lung cancer and damage [9].

The CYP 450 from the 2A family plays a major role in the metabolism of nicotine. The nicotine has been metabolized through both the hepatic CYP2A6 and respiratory CYP2A13 enzymes. Activation of NNK in the lungs results in DNA adducts and lung tumors and so causes lung adenocarcinoma in smokers [4]. Medicinal plants are known to be natural resources and are being examined extensively for their medicinal properties [5]. *Sansevieria trifasciata* (Family-*Agavaceae* is an evergreen, succulent, perennial plant producing long, narrow, erect or slightly spreading sword-shaped leaves up to 75cm long from a rhizomatous rootstock were shown in Fig.1 [6] Screening of phytochemicals of *S.trifasciata* showed the presence of alkaloids, flavonoids, saponins, glycosides, terpenoids, tannins, proteins and carbohydrates [7]. *S.trifasciata* leaves naturally have the ability to control air pollution [8]. Ligands of *S.trifasciata* were obtained from Dr.Duke's Phytochemical and Ethnobotanical Database (https://phytochem.nal.usda.gov/) from which two compounds are selected for docking study against the targeted protein to predict their interaction with heme of CYP 2A13. The structures of the CYP 2A13 with complex of nicotine are derived from the Protein data bank which is already been deposited with the complex of nicotine. Consequently, to validate the proposed model, molecular docking was executed by calculating its molecular properties. In this context, we hypothesize the present study to suppress the nicotine-induced lung cancer by analysing its interaction with the selected phytochemicals of *S.trifasciata* with the heme of CYP 2A13.

MATERIALS AND METHODS

Selection of Plant Species and Selection of Phytochemicals Present

Ligands of *Sansevieria trifasciata* plants were derived from Dr.Duke's Phytochemical and Ethnobotanical Database (https://phytochem.nal.usda.gov/). The database reports that *S.trifasciata* has 11 phytochemicals and from those phytochemicals a steroid and saponin component was selected for the study, Ligand 1 – beta-sitosterol (Steroid) and Ligand 2- 1,2,3,4-Tetra-O-acetyl-beta-D-xylopyranose (Saponin) are the selected ligands for the *in silico* analysis and were reported as an effective bioactive compound[10] In addition, toxicity status and anti-ulcerative activity anti diabetic, analgesic and membrane stabilizing activities have also been investigated[11]. In some literature, analgesic and antipyretic [8], thrombolysis [12] activities of the plant extract have been evaluated.

Ligand Preparation

The ligands were drawn and prepared for docking studies using ChemSketch and are displayed in Fig.2. The ligands were converted tp PDB file by using open label 2.4. The structure was optimized by Argus Lab. Kollman united partial atomic charges were added for the docking study. The drug ability and pharmacokinetic assessment of the compound were done using molinspiration in which the drug likeness of the ligands was calculated (www.molinspiration.com) Osiris Property Explorer (https;//organic_chemistry.org/prog/peo/) is an online cheminformatics tool used to determine the toxicity potential of the selected two ligands. The chemical properties of the compounds were identified using Med Chem Designer which aids in the prediction of S+logP, S+logD, TPSA, Lipinski's Rule of Five, MlogP and Differentiate coefficient.

Physiochemical Properties of the Target Protein

Physiochemical properties of CYP450 2A13 (PDB ID: 4EJG) were predicted using ProtParam (https://web.expasy.org/protparam/) with UniProt ID: Q16696. ProtParam is a protein analysis tool, which computes various physiochemical parameters like molecular weight, composition of amino acids, atomic composition, theoretical isoelectric point (pI), extinction coefficient, expected half-life, aliphatic index, instability index and grand average of hydropathicity (GRAVY) of a protein [13].

Protein Preparation

The target proteins of CYP450 from 2A13 subfamily (PDB ID : 4EJG) with the complex of nicotine were derived from protein data bank (https;//www.rcsb.org). Heteroatoms (i.e. non receptor atoms such as water) and chains were removed except A chain atoms by using Auto Dock tool.

Molecular Docking Study

Docking was carried out by AutoDock4.0 AutoGrid was used for the preparation of the grid map using a grid box. Grid box is constructed by considering all the key amino acids between chain A and B. The grid size was set to 66×66×66 xyz points with 0.385 Å grid spacing and the grid center was designated at (x,y, and z): 1.095, 0.874 and 2.674 dimensions. The results less than 2.0 Å in root mean-square deviation (RMSD) was clustered together and represented by the result with the most favorable free energy of binding. The best model was picked by the best stabilization energy. PyMoL, a molecular visualization tool was used to view the interactions between the target & small molecules and to measure the distance (bond length) for docked complex. The best output poses were analyzed for interactions between the receptor and ligand. The 2D poses of the best hits of each of the compounds were generated using Accelrys Discovery Studio Visualizer 2.5(Visualiser).

RESULTS AND DISCUSSION

Ligand 1 – beta-sitosterol (Steroid) and Ligand 2- 1,2,3,4-Tetra-O-acetyl-beta-D-xylopyranose (Saponin) of *S.trifasciata* were selected from the duke's database. Initially, the molecular structure and nomenclature of the selected ligands were generated using ChemDraw Ultra V.12.0(x86) and the data were presented in Table 1. The molecular structure of computationally generated ligands 1 & 2 were shown in Fig 2a and Fig 2b, respectively. The molecular properties of the selected ligands of generated structures were calculated using Medchem designer and the data are presented in Table 2. The drug-likeness of the selected ligands was evaluated by Lipinski's rule of five which deals with four simple physiochemical parameters(log P ≤ 5, Mol.Wt ≤ 500, number of hydrogen bond acceptors ≤ 10, number of hydrogen bond donors ≤ 5) [14]. The oral ingestion, bioavailability and solubility behavior of the substance are measured using the logP values. The study revealed that the logP values of ligand 1 is 8.62 and ligand 2 is 0.38. Conversely, ligand 1 excluded the log P value above 5 and violates Lipinski's first rule. Ligand 2 log P value lies below 5 and shows that it has good lipophilicity or hydrophobicity. Both ligands 1 and 2 have a molecular weight within the acceptable range ≤ 500. Low molecular weight compounds are easy to be absorbed, diffused and transported than the compounds with high molecular weight which excludes than 500. Both the ligands possess an acceptable number of hydrogen bond acceptors and hydrogen bond donors, confirms the efficient interaction with hydrogen bonding groups of an intractable receptor. The number of rotatable bonds shows the flexibility and conformational changes of molecules for binding with receptors. The accepted range of rotatable bonds is ≤ 10 to pass the oral bioavailability. Both the ligands possess 6 to 8 rotatable bonds and confirms the optimum conformational flexibility. An important physiochemical parameter of molecules that gives information about the polarity of compounds is TPSA.[15] By using TPSA the transport properties of compounds are predicted, such as, intestinal absorption and blood-brain barrier penetration. The percentage of absorption (%ABS) is calculated by the equation %ABS = 109-(0.345×TPSA)[16]. The TPSA of ligand 1 is 20.23 and ligand 2 is 114.45. With these values, %ABS were calculated and presented in Table 2. The data indicated that both the ligands exhibited good percent absorption ranging 102.02 and 69.51 respectively. The calculated molecular properties of the ligands validate that

ligand 2 has a good molecular properties of drug likeness with zero violations of Lipinski's rule were ligand 1 violated the log P value of lipophilicity. It confirms that 1,2,3,4-Tetra-O-acetyl-beta-D-xylopyranose is a good drug material without any violations.

The bioactivity scores of both ligand 1 & ligand 2 were calculated by Molinspiration Cheminformatics software and the data are presented in Table 3. The bioactivity score gives information about the binding cascade of the molecules with different protein structures and new functional drugs with increased binding selectivity profile and less undesirable effects are identified. It is documented that, if the bioactivity score is more than 0, the molecules have better biological activity. If the bioactivity score is -0.5 to 0, the molecules have moderate activity, and less than -0.5, the molecules have no biological activity. The results from bioactivity data indicates that ligand 1 has high active Ion channel modulator, Nuclear receptor ligand, Enzyme inhibitor, Protease inhibitor and GPCR ligand and less active to Kinase inhibitor. Ligand 2 was a highly active Enzyme inhibitor, Protease inhibitor, GPCR ligand and moderately active Ion channel modulator, Nuclear receptor ligand, Kinase inhibitor. The bioactivity score of the ligands are calculated by Molinspiration a Cheminformatics software and the result validates that both the Ligand 1 and ligand 2 have good bioactivity as a GPCR ligand, nuclear receptor ligand, Ion channel modulator, Kinase and Protease inhibitor. As ligand 1 is an inactive Kinase inhibitor ligand 2 possess an effective bioactive score than the ligand 1.

The toxicity of ligand 1 and ligand 2 was assessed using Osiris Property Explorer and the data are presented in table 4. This computational tool also used to calculate ClogP, Solubility, Molecular weight, TPSA, Drug-likeness and Drug score. The study revealed that ligand 1 and ligand 2 were predicted as safe and non-toxic. The calculated ClogP values of both the ligands were similar to that of milogP values. TPSA calculation performed by Osiris Property Explorer was found same as that of Molinspiration a Cheminformatics software. The toxicity and risk assessment of the ligands which is calculated by Osiris property explorer verifies that both the ligand 1 and 2 are safe as a drug material without any risks. The molecular properties, bioactivity score calculation and toxicity assessment of ligands validate that ligand 2 is more effective than the ligand 1 and may possess high druglikeness and as a nictone suppressor. Cytochrome 2A13 (4EJG) exhibited hydrophilic nature with GRAVY value of -0.275, instability index of 38.14 which is below 40 (value greater than 40 predicts that protein may be unstable) shows that the target protein is a stable protein. Further properties also listed in Table 5. Physio-chemical properties of the target protein CYP2A13 (4EJG) are calculated using ProtParam with the Uniport ID of the target and it proves that the selected protein is a stable protein with an instability index of 38.14. It validates that the selected protein is a good target for the molecular docking study.

Results of the Molecular docking study showed that the compounds (ligand 1 & ligand 2) efficiently binds to the binding pocket of Active site Heme of the target (PDB ID : 4EJG) and it also gives good interactions with least binding energy. The high potential binding affinities of ligand 1 with the target protein (PDB ID: 4EJG) was displayed in Figure 3 and ligand 2 in Figure 4. Their corresponding energy values were shown in Table 6 respectively. The results of Molecular docking analysis indicate that the compound ligand 2 was more selective towards the target 4EJG Active site Heme. Its binding energy values indicate that ligand 2 has shown a fortunate selectivity towards Active site Heme of the target protein represented in Fig.3b, which might be a reason for good anti-cancer activity against Nicotine-induced Lung cancer than the ligand 1in Fig .3b.

Ligand 1 and ligand 2 were successfully co-crystallized with a soluble, truncated form of CYP2A13 (4EJG). Ligand 1 and ligand 2 was positioned over the heme in the F-F′ loop for H-bonding interactions. This co-crystal illustrates the flexibility of the CYP2A13 active site tertiary structure, peculiarly in the F-F′ loop. The adoption of ligands, especially in the confines of the active site heme iron, thereby enabling the functions of ligands. Nicotine is converted into carcinogen`4-(methynitrosamino)-1-(3-pyridyl)-1-butanone (NNK) [17]. With the help of the Cytochrome P450 enzymes produced by cytochrome proteins such as CYP 2A13. The overall NNK metabolism is oriented over the heme ligand of the cytochrome [4] .Targeting the heme of cytochromes inhibits the NNK metabolism over the heme and reduces the addiction of smoking by inhibiting the Nicotine metabolism over CYP 2A13 by altering the CYP

heme structure and concentrations the CYP are inhibited [18]. The biosynthesis process of cytochromes is also inhibited by targeting the Active-site heme of cytochromes [19,20]. Many studies possesses the idea that heme is an important target. The binding of 1,2,3,4-tetra-O-acetyl-D-xylopyranose with the Active-site heme of CYP 2A13, PDB ID:4EJG with the binding energy -8.13 possess the inhibition of the Nicotine over the heme of 4EJG than the beta-sito sterol with the binding energy -4.91.

CONCLUSION

Lung cancer is a severe respiratory ailment and is considered as a threat to existence. The active site heme of CYP is a good target to inhibit the biosynthesis process. The inhibition may relieve smokers from the addiction to smoking and also reduces the risk of nicotine-induced lung cancer by inhibiting the metabolism of nicotine into NNK over the heme. This computational based study can be augmented with *in vitro* and *in vivo* analysis which can heighten the therapeutic ability of the test ligands.

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Table 1: Nomenclature and molecular formula of the ligands

Ligand	Nomenclature	Molecular formula	Canonical SMILES
1	Beta-Sitosterol	$C_{29}H_{50}O$	CCC(CCC(C)C1CCC2C1(CCC3C2CC=C4C3(CCC(C4)O)C)C)C(C)C
2	1,2,3,4-Tetra-O-acetyl-beta-D-xylopyranose	$C_{13}H_{18}O_9$	CC(=O)OC1COC(C(C1OC(=O)C)OC(=O)C)OC(=O)C

Table 2: Molecular properties of the ligands from MedChem Designer.

Ligand	Milog P	M.wt	HBA	HBD	Volume	Nviolation	n rotb	TPSA	ABS%
1	8.62	414.72	1	1	456.52	1	6	20.23	102.02
2	0.38	318.28	9	0	273.01	0	8	114.45	69.51

Table 3: Bioactivity score of the ligands from molinspiration.

Ligand	Ion channel modulator	Nuclear receptor ligand	Enzyme inhibitor	Protease inhibitor	Kinase inhibitor	GPCR ligand
1	0.04	0.73	0.51	0.07	-0.51	0.14
2	-0.11	-0.31	0.31	0.04	-0.26	0.08

Table 4: Toxicity and risk assessment of the ligands

Ligand	Toxicity and risk	ClogP	Solubility	M.wt	TPSA	Drug score
1	Safe	7.86	-6.67	414	20.23	0.13
2	Safe	-0.08	-1.52	318	114.4	0.56

Table 5: Physio-chemical properties of the target protein (PDB ID: 4EJG)

S.No	Physio-chemical property	Value
1.	Number of amino acids	494
2.	Amino acid composition	Total number of negatively charged residues (Asp + Glu): 55Total number of positively charged residues (Arg + Lys): 65
3.	Molecular weight	56687.51
4.	Theoretical isoelectric point (pI)	9.31
5.	Total number of atoms	7987
6.	Chemical formula	$C_{2572}H_{3990}N_{692}O_{711}S_{22}$
7.	Instability Index	38.14
8.	Aliphatic index	77.73
9.	Estimated half-life	30 hrs (mammalian reticulocytes, in vitro). >20 hours (yeast, in vivo). >10 hours (Escherichia coli, in vivo).
10.	Grand average of hydropathicity (GRAVY)	-0.275

Table 6 : Docking analysis of ligands with the target protein(PDB ID:4EJG)

Ligands	Energy range	Binding energy	Ligand efficiency	Inhibit constant	Intermol energy	Desolving energy	Electrostatic energy	Total internal	Torsional energy
1	6.60	-4.91	-0.16	249.8	-7.0	-6.96	-0.04	8.25	2.09
2	1.75	-8.13	-0.37	1.09	-10.52	-9.17	-1.35	-1.66	2.39

Fig.1: Pictorial representation of *Sansevieria trifasciata.* (https://www.joyusgarden.com/wp-content/uploads/2017/05/snake-plant-care.jpg)
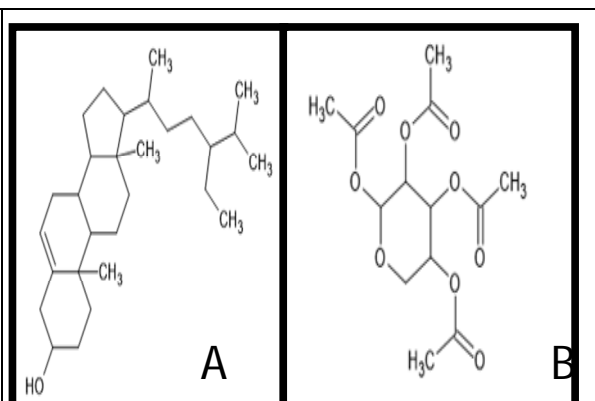

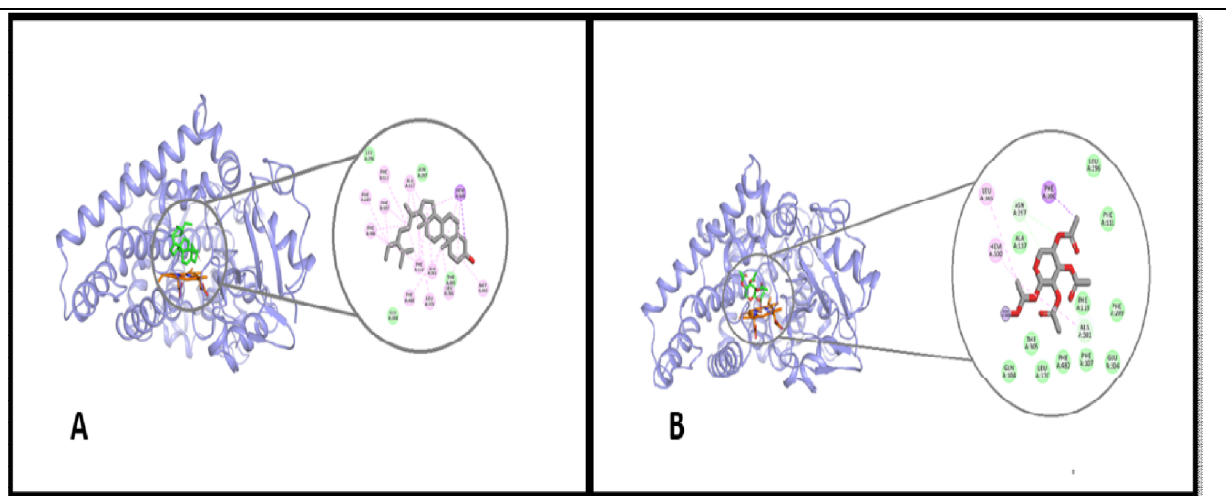**Fig.2A and B: The 2D representation of ligand 1 and ligand 2**

Fig.3. Molecular docking interaction of ligand 1 and ligand 2 with the target protein CYP2A13 (4EJG) a) Docked pose of ligand 1 in its active site of heme in CYP2A13 (4EJG) b) Docked pose of ligand 2 in its active site of heme in CYP2A13

RESEARCH ARTICLE

Electrochemical Studies and Surface Characterization of Dipropyl Sulphide on Zinc Metal in 0.5N Hydrochloric Acid

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ABSTRACT

Electrochemical studies and surface characterization of dipropyl sulphide (DPS) has been carried out in zinc metal immersed in 0.5N of hydrochloric acid. The corrosion parameters has been studied by weight loss method. The 100 mM formulation of dipropyl sulphide produces 72.6 percent of strong inhibition performance. Electrochemical trials have been reported, such as polarization and impedance. Polarization reveals, as a cathodic inhibitor, that this formulation regulates the cathodic reaction. AC impedance spectrums suggest that on the zinc metal surface, a protective film is formed. EIS data revealed that the charge transfer resistance (R_{ct}) increased, on the other hand the capacitance double layer (C_{dl}) decreased in the presence of inhibitor. The corrosion parameters obtained from mass loss method, polarization studies and impedance spectra shows this inhibitor offers good corrosion inhibition efficiency and control the corrosion. Electron Microscope (SEM), Energy Dispersive Analysis of X-rays (EDAX) and Atomic Force Microscopy (AFM) are used to characterize the protective film formed over the zinc metal surface.

Keywords: Corrosion, Dipropyl sulphide, Electrochemical studies, AFM, EDA X, FTIR and SEM.

INTRODUCTION

Corrosion shall be characterized by chemical or electro-chemical responses to the environment as impairment of the substance or its properties. Deterioration is a common practice that lowers substance binding energy. The last consequence of corrosion is the oxidation of a metal atom, which allows one or two electrons to be lost. Corrosion is a degradation of bulk metal into metal powder. The characteristics of materials are degraded by corrosion. Owing to incremental chemical contact on the material surface, the degradation of metals and non-metals occurs. This interaction influences the systems and infrastructure of multiple materials. This method, known as rusting, on steel surfaces, can also begin the ambient air filled with humidity and oxygen. The soil chemistry and humidity determine the damage levels for submerged structures and pipelines. For example oxide formation, metal cation diffusion through the coating matrix, changes in local pH and electrochemical potential. The study of corrosion of zinc metal and iron is an increasingly theoretical and realistic problem which has been highly interesting [1]. Corrosion is a large and varied effect and the effects of corrosion are much greater than the mere loss of the metal mass for the safe, stable and successful functioning of devices or structures. Different types of failures and costly replacement can emerge, even if the broken metal quantity is very small [2]. Corrosion is a phenomenon that induces metal loss as a result of a chemical environmental reaction. It is also difficult to eradicate entirely a recurring, constant and costly problem. The use of inhibitors prevents corrosion. Corrosion is a natural phenomenon that makes refined metals including oxides, hydroxides and sulphides more chemically stable. It is the incremental degradation by chemical and/or electrochemical reaction with the atmosphere of materials (usually metals) [3]. Industrial process inhibitors are used to regulate metal dissolution in acid, neutral and base conditions in particular. The organic compounds with a minimum one functional group are most effective inhibitors used in industry and are known to be an active core for the adsorption process. Several studies have sought to examine the inhibition of different bio compounds in acids, alkaline and neutral media degradation in titanium, alloys, mild steel, stainless steel and composites [4, 5].A mass loss method and electrochemical impedance spectroscopy were used to test the corrosion rate and inhibition efficiency. On the zinc metal surface, the protective film was developed using surface analysis tools, such as Fourier's Infra-red Transform Spectroscopy. The Scanning Electron Microscope studies which estimates the smoothness of the zinc metal surface from SEM research as opposed to the system without inhibitors and to the inhibitor system. Zinc metal surface elementary construction was distinguished by energy dispersive X-ray analysis. AFM has studied the rawness and smoothness of the specimens.

MATERIALS AND METHODS

Materials
The zinc metal specimens were chosen from the same sheet of the following composition: lead 0.03%, cadmium 0.04%, iron 0.001% and the quantity left over being zinc. Zinc metal specimen of the dimension 4 × 2 × 0.08 cm were polished to mirror finish, degreased with absolute ethanol and used for weight – loss and surface examination studies.

Chemicals used
The solution (0.5 N HCl) was prepared with double distilled water by diluting an analytical grade of hydrochloric acid. The remaining chemicals used in the research were AR.

Preparation of stock solutions
Double distilled water was used wherever necessary in the preparation of solutions. Analytical grade HCl is taken as such and they were diluted to the required concentration. The required concentration of the organic inhibitors (Dipropyl sulphide) stock solution was prepared by dissolving organic inhibitors in minimum amount of ethanol and making up to the desired volume with double distilled water. Then the required volume from the inhibitor stock solution was added hydrochloric acid solution to obtain the desired concentration.

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Methods

Weight loss measurements were done according to the described method [6]. Weight loss measurements were performed for 2 hrs by immersing the zinc metal specimens in 0.5 N Hydrochloric acid without and with different concentration (5 mM, 10 mM, 30 mM, 50 mM, 100 mM) of organic inhibitors. The specimen is removed, cleaned, dried and properly measured after elapsed time.

The following equation calculated the inhibition efficiency (IE percent).

$$IE\ (\%) = \frac{W_O - W_j}{W_O} * 100$$

Where W_j and W_O are the weight loss values in gram in the presence and absence of organic inhibitor namely dipropyl sulphide.

Potentiodynamic polarization study

Polarization experiments were performed in Princeton Applied Research versa STAT MC, an electro-chemical workstation impedance analyzer, using three cell assembly systems. The working electrode was a zinc alloy, with the remaining part shielded with red lacquer on one side of the electrode exposed to $1 cm^2$. The reference electrode was a saturated calomel electrode (SCE) and the counter electrode was used with a rectangular platinum foil. Compared to the operating electrode, the field of the counter electrode was considerably greater. The counter electrode should have a uniform potential field. In the absence and presence of an inhibitor, the working electrode and the electrode platinum is immersed in 0.5 N Hydrochloric acid[7]. A salt bridge was used to link saturated calomel electrode to the test solution. Plots (I) have been reported for possible (E) Vs log current plots. EVs Log Iplots have determined the outcomes, such as the propensity for corruption (E_{corr}) and I_{corr}, Tafel Paths b_a, b_c.

AC impedance measurements

Studies of AC impedance are performed at the Princeton Advanced Research versa STATMC electro-chemical workstation impedance analyser model. The set-up of the cell was similar to that used to calculate polarisation. For that device to reach a continuous open circuit capacity a time interval of 5 to 10 minutes was given. Then an A.C regarding the stable potential of the economy, superposed capacity of 10 mV. The actual part (z') and the picture part (z") of cell impedance were calculated in ohmics for different frequencies from a frequency of 100 KHz up to 100 MHz. Calculation has been made of the importance R_t(charge transfer resistance) and C_{dl} (double capacities). The following relationship was used to measure C_{dl} values [8].

$$C_{dl} = \frac{1}{2 \times 3.14 \times R_t \times f_{max}}$$

Surface characterization studies

For a total of 2 hours the zinc metal specimens were soaked with the solutions of blank and organic inhibitors. The specimens were removed and dried after 2 hours. Various research techniques investigated the presence of the film shaped on the surface of zinc metal specimens.

Surface analysis by FTIR spectra

The Perkin – Elmer 1600 spectrophotometer reported FTIR spectra. The pellicle was carefully cut, carefully combined and the FTIR spectrum recorded with the KBr made of pellets. The research solutions were separated from the specimens and dried after a 2-hour immersion time in different conditions. The film that was produced on the surface was carefully scratched and extensively mixed to ensure that it was stable all over the place [9]. FTIR powder spectrum (KBr pellet) was recorded using Perkin–Elmer 1600 FTIR spectrophotometer with a resolving power of 400 - $4000 cm^{-1}$.

Scanning Electron Microscopic studies (SEM)

The zinc metal specimen was extracted for 2 hour duration, dried with double distilled water in a blank solution and in the inhibitor solution for the analysis of surface morphology, and observed in a scanning electron microscope. CAREL ZEISS EVO 18, Hitachi computerized scanning electron microscope, analyzed the surface morphology measurements of the zinc metal [10].

Energy Dispersive Analysis of X-Rays (EDAX)

Doubly rinsed, dried and observed in the energy dissipation examination of X-rays (EDAX) to examine elements present on the zinc metal surface, the zinc metal specimen immersed in a blank and inhibitor solution for a time of 2hours was removed [11]. The computer-controlled energy-dispersive study of X-Ray was conducted using Bruker on the zinc-metal surface (Brucker Nano, GMBH, Germany).

Atomic Force Microscopy characterization (AFM)

The zinc metal specimen was stripped, rinsed with double distilling water, dried and subjected to a surface inspection over a time of 2 hours and immersed in the blank inhibitor solution [12]. Measurements of zinc surface morphology were performed using the Agilent technology 5500 series mode, using Atomic Force Microscopy (AFM).

RESULTS AND DISCUSSION

Analysis of the weight loss method

The corrosion rate (CR) of zinc metal immersed in 0.5 N HCl and the inhibition efficiencies (IE) in the absence and presence of dipropyl sulphide determined by weight loss method. The inhibition efficiency and the rate of corrosion values are given in **Table 1**. It shows that 100 mM dipropyl sulphide offers 72.6% of inhibition efficiency. The inhibition efficiency was observed to improve and the corrosion rate decreased with an increase in dipropyl sulphide concentration. This situation is due to fact that an increase in surface coverage of the inhibitor at higher concentration which retards dissolution of zinc metal. The electron donating properties of Sulphur atom can be attributed for higher inhibition efficiencies. This surveillance is in good agreement with the results reported by many researchers [1-7].

Analysis of results of potentiodynamic polarization study

During the corrosion inhibition process, the polarization analysis was used to validate safety film forming on the zinc metal surface. The linear polarity resistance (LP) values are increasing and the corrosion current (I_{corr}) value decrease when a protective layer is formed on the zinc metal surface [12-15]. The potendiodynamic polarization curves of zinc metal immersed in 0.5 N hydrochloric acid and also inhibition efficiencies (IE) in the absence and presence of inhibitor are shown in **Figure 1(a,b).** The corrosion parameters are given in **Table 2.** When zinc metal was immersed in 0.5N Hydrochloric acid the corrosion potential was - 517 mV vs SCE. When 100 mM dipropyl sulphide was added to the above system, the corrosion potential shifted to the cathodic side -530 mV vs SCE. This film controls the cathodic reaction of zinc metal dissolution by forming Zn^{2+} - DPS complex on the cathodic sites of the zinc metal surface. Further, the LPR value increases from 1054717 ohm cm^2 to 1640465 ohm cm^2, the corrosion current decreases from -151 µA to -185 µA. Thus polarization study confirms the formation of a protective film on the zinc metal surface.

Analysis of results of AC impedance spectra

AC impedance spectra (electrochemical impedance spectra) have been used to confirm the formation of protective film on the zinc metal surface [16-18]. The charge transfer résistance (R_t) increases as a protective film forms on the zinc metal surface; the value of double layer capacity (C_{dl}) decreases and impedance log(z/ohm^{-1}) increases. In **Figure 2(a,b),** and values are given as **Table -3**, the AI spectra of zinc metal immersed in 0.5 N HCl in the absence and presence of an inhibitor (DPS) are shown. It is observed that when the inhibitor (100 mM of DPS) is added to the

above system, the charge transfer resistance (R_t) increases from 12.03 Ω cm^2 to 16.38 Ω cm^2 and the CdI value decreases from 6.531×10^{-5}F cm^{-2} to 8.749×10^{-6}F cm^{-2}. The impedance value [log (z/ohm^{-1})] increases from 0.762 to 1.392. These results lead to the conclusion that a protective film is formed on the zinc metal surface.

Analysis of FTIR spectra

FTIR spectra have been used to analyze the protective film formed over on the zinc metal surface [19-22]. The structure of dipropyl sulphide is shown in Figure-3. The FTIR spectrum (KBr) of pure diprophyl sulphide is shown in Figure-4a. The CH stretching frequency appears. At 2856.11cm^{-1}. The CS stretching frequency appears at 712.76cm^1. The FTIR spectrum (KBr) of the film formed on the zinc metal surface after immersion in 0.5 N HCI and 100 mM of diprohyl sulphide is shown in Figure 4b. The CH stretching frequency has shifted from 2856.11 cm^{-1} to 2925.39 cm^{-1}. The CS stretching frequency has shifted from 712.76 cm^{-1} to 781.17 cm^{-1}. A new peak appears in the region of 490 cm^{-1} due to a zinc complex is formed on the zinc metal surface. The sulphur atom of DPS has coordinated with Zn^{2+} and form Zn^{2+} – DPS complex on the surface of zinc metal. Thus the FTIR spectral study leads to the conclusion that the protective film consists of Zn^{+2} – DPS complex.

SEM Analysis of zinc metal surface

SEM provides a pictorial representation of the surface of zinc metal. The SEM micrographs from the surface are studied [23- 24] in order to explain the nature and appearance of the surface-film in the absence and degree of the corrosion of the zinc metal. The smooth surface of the zinc metal (control) is shown by the SEM micrographs in **Figure 5(a,b)**. In Figure 5a indicates that the zinc metal surface does not contain any corrosion compounds or complexes. The zinc metal surface of SEM micrograph shows that zinc metal is immersed in 0.5 N HCI are shown in **Figure 6(c,d)** indicates the roughness of the zinc metal surface which represents the highly corroded area of zinc metal. However, in **Figure 6(e,f)** indicate that in the presence of inhibitor (100 mM DPS) the rate of corrosion is suppressed, as can be seen from the decrease of corroded areas. The zinc metal surface almost free from corrosion due to the formation of insoluble complex on the surface of the zinc metal. In the presence of DPS, the surface is covered by a thin layer of inhibitors which effectively controls the dissolution of zinc metal [25].

Energy dispersive analysis of X-rays (EDAX) of zinc metal surface

The objective of this section was to confirm the results obtained from chemical and electrochemical measurements. That a protective surface film of inhibitor is formed on the zinc metal surface. To achieve this, EDAX examinations of the zinc metal surface were performed in the absence and presence of inhibitor system [26-32]. The EDAX spectrum of zinc metal is shown in Figure 7(a). The EDAX spectrum of zinc metal immersed in 0.5 N HCI solution is shown Figure 7(b). They show the characteristic peaks of zn signal is reduced and intensity of O signal is increased, It indicates that the zinc metal undergoes corrosion attack by 0.5N HCI. They show the characteristic peaks of some of the elements constituting the zinc metal sample. The EDAX spectrum of zinc metal immersed 0.5 N HCI solution and 100 mM diethyl sulphide is shown in Figure 7(c). It shows the additional line characteristic for the existence of the intensity of O signals is reduced and the intensity of Zn signal is increased. These data indicate that the Zn, Pd, Cd and Fe atoms are shielded by the zinc metal surface. The inhibitor mechanism definitely is responsible for this layer. On the exposed zinc metal surface in 0.5 N HCI solution, the Zn signal and the strong contribution from O and C is not visible. The Zn peaks observed in inhibitor presence Figure 7(c) are considerably reduced compared to those found in 0.5 N HCI in Figure 7(b) (blank solution). The Zn peaks are suppressed by the unnecessary inhibitor film. This discovery reveals the presence of an adsorbed inhibitor coating that prevents zinc metal from corrosion. These results suggest that sulphur atom of DPS has coordinate with Zn^{2+}, resulting in the formation of Zn^{2+} -DPS complex on the zinc metal surface.

AFM Analysis of zinc metalsurface

Atomic force microscopy (AFM) is a very higher resolution type of scanning probe and it is considered to one of the most powerful techniques to investigate surface morphology from nano to microscale and has become a choice to

study the influence of inhibitors on the generation and the progress of the corrosion at the metal/solution interface [33-39]. The topography of the surfaces recorded in 2D, cross sectional profile diagram and 3D images was examined and average roughness (R_a), surface roughness (RMS), maximum peak - to - valley height were determined from the respective images. Table 4 shows the various AFM parameters obtained for the zinc metal surface immersed in different environments. Figure 8(a), 9 (d),10 (g) - 2D, 3D, broken line shows the AFM images and cross section analysis of the polished zinc metal surface, with a Ra value 421 nm, RMS value 365 nm and maximum peak to valley height value of2110nm.Figure 8(b), 9 (e), 10(h) 2D, 3D, broken line is observed after immersion in the 1.0N HCl in the absence of the inhibitor, with an increased Ravalue708nm, RMS value 605 nm and maximum peak to valley height value of 2603 nm, indicating the formation of zinc oxides. The root-mean-square (RMS) roughness is found to be 605 nm, which clearly indicates the high roughness of the corroded zinc metal surface. The microstructure of the surface shows many smaller and larger corrosion product deposits. However, Figure 8(c), 9(f), 10 (i) 2D, 3D, broken line shows that the zinc metal immersed in inhibitor formulation 0.5 N HCl + 100 mM DPS show a decreased Ra value 591 nm, RMS value of 460 nm and maximum peak to valley height is 2191 nm, which indicates the formation of a protective film on the zinc metal surface. The result of corrosion cannot be deposited on the surface of the zinc alloy. Furthermore, the strong variations between the optical cross-section analyses validate these findings. In order to avoid attacks by hostile ions from the corrosive conditions, a protective layer coated the metal surface with zinc. The added value of the inhibitor reduced the average roughness to 591 nm, which meant that the inhibitor was developed by zinc metal surface [40-45].

CONCLUSION

The following conclusions are drawn from the present study,

➢ The dipropyl sulphide inhibitor exhibit good corrosion inhibition efficiency in controlling the corrosion of zinc metal in 0.5N HCl.

➢ The corrosion of zinc metal in 0.5N HCl is significantly reduced upon the addition of dipropyl sulphide. The inhibition efficiency increased with the increasing concentration of inhibitor. The maximum inhibitor efficiency was observed at an optimum concentration of 100 mM.

➢ Data obtained from the conventional mass loss method and electrochemical measurements have shown that the compound has excellent inhibiting properties for zinc metal in0.5N HCl.

➢ The weight loss technique shows maximum the inhibition efficiency is 72.6%.

➢ Corrosion parameters like I_{corr}, E_{corr}, b_a, b_c, R_{ct} and C_{dl} values were evaluated using electrochemical measurements.

➢ The results of potentiodynamic polarization measurements revealed that the dipropyl sulphide act as adsorbed type of inhibitor in 0.5N HCl that could effectively suppress cathodic reaction and processes through the chemical adsorption on zinc metal surface.

➢ Decrease in I_{corr} and C_{dl} values and increase in R_t values confirmed the inhibition action of the inhibitor, owing to increased thickness of the adsorbed layer.

➢ Electrochemical impedance tests reveal that the charging transfer resistor (R_t) is raised, the capacitance in double layer (C_{dl}) and the corrosion current (I_{corr}) are lowered, as the adsorbed layer's thickness is increased.

➢ Thus the protective film consists of Zn^{2+}– DPS complex. This is confirmed by FTIR spectra.

➢ The EDAX analysis and SEM micrographs confirm the formation of protective layer on the zinc metal surface.

➢ The AFM confirm the roughness and smoothness of zinc metal surface.

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Table 1. Inhibition efficiency (IE %) and Corrosion rates (CR) as a function of concentration of Dipropyl sulphide on Zinc metal in 0.5 N HCl with immersion time 2 hours

Dipropyl Sulphide (mM)	CR (mmy)	IE (%)	Surface coverage (θ)
Blank	1.4478	-----	----
5	0.9612	33.8	0.338
10	0.8188	43.4	0.434
30	0.7120	51.6	0.516
50	0.5854	59.5	0.595
100	0.3955	72.6	0.726

Table 2. Corrosion parameters of zinc metal is immersed in 0.5 N hydrochloric acid and inhibition efficiencies (IE) in the absence and presence of inhibitor system obtained by potentiodynamic polarization method.

Systems	Ecorr vs SCE (mV)	I_{corr} (μA)	ba (mV/dec)	bc (mV/dec)	LPR (ohm cm^2)
0.5 N HCl	-517	-151	133	139	1054717
0.5 N HCl + 100 Mm DPS	-530	-185	174	125	1640465

Table 3: Corrosion parameters of zinc metal immersed in 0.5 N HCl solution in the absence and presence of inhibitor system obtained from AC impedance spectra

Systems	Impedance		
	$R_t \Omega cm^2$	$C_{dl} F cm^{-2}$	$Lg(Z \, ohm^{-1})$
0.5 N HCl	12.03	6.531×10^{-5}	0.762
0.5 N HCl + 100 mM DPS	16.38	68.749×10^{-6}	1.392

Table 4. AFM data for zinc metal immersed in the presence and absence of inhibitor systems

Environment	AFM parameters		
	Average Roughness Ra (nm)	RMS Value Rq (nm)	Maximum peak -to - valley Height (nm)
Polished metal	421	365	2110
Polished metal + 0.5 N HCl	708	605	2603
Polished metal + 0.5 N HCl + 100 mM diprophyl sulphide	591	460	2191

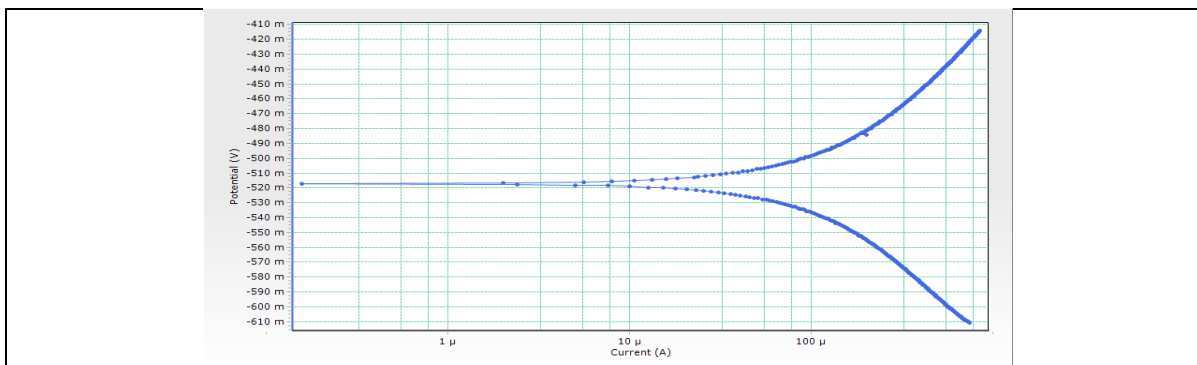**Samsath Begum** *et al.,*

Figure 1a. Polarization curves of zinc metal immersed in test solutions 0.5 N HCl (blank)
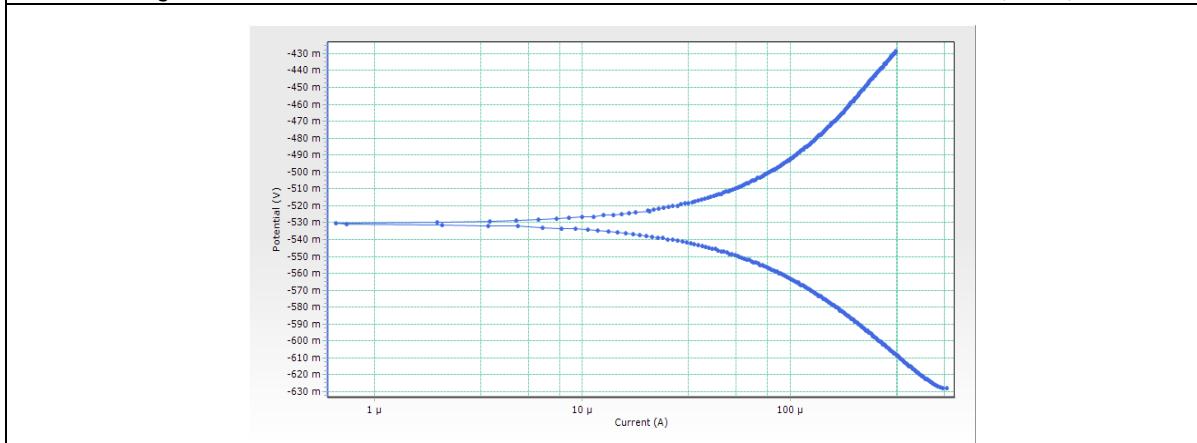

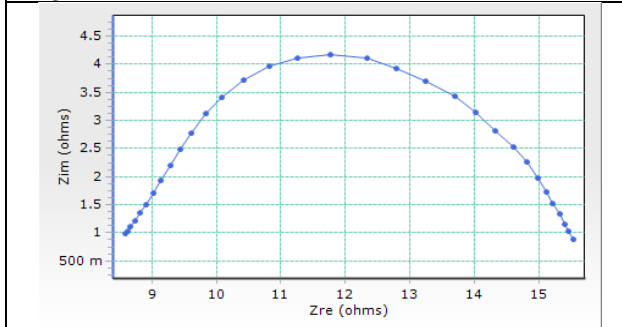**Figure 1b. Polarization curves of zinc metal immersed in test solutions0.5 N HCl + 100 mM dipropylsulphide**

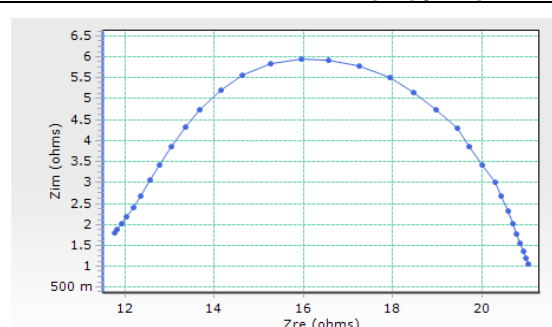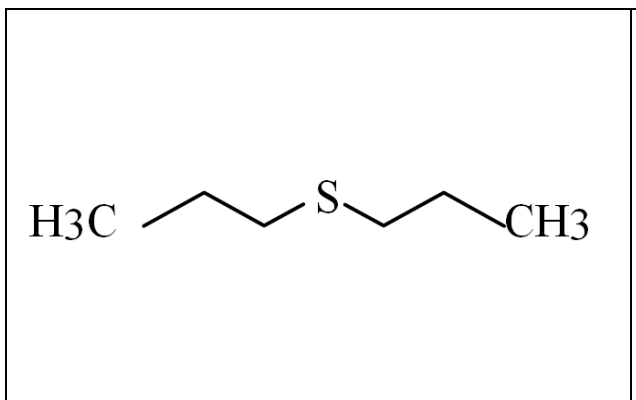| **Figure 2a.** **AC impedance spectra of zinc metal immersed in various test solutions 0.5 N HCl(blank)**	**Figure 2b. AC impedance spectra of zinc metal immersed in various test solutions 0.5 N HCl + 100 mM dipropylsulphide**

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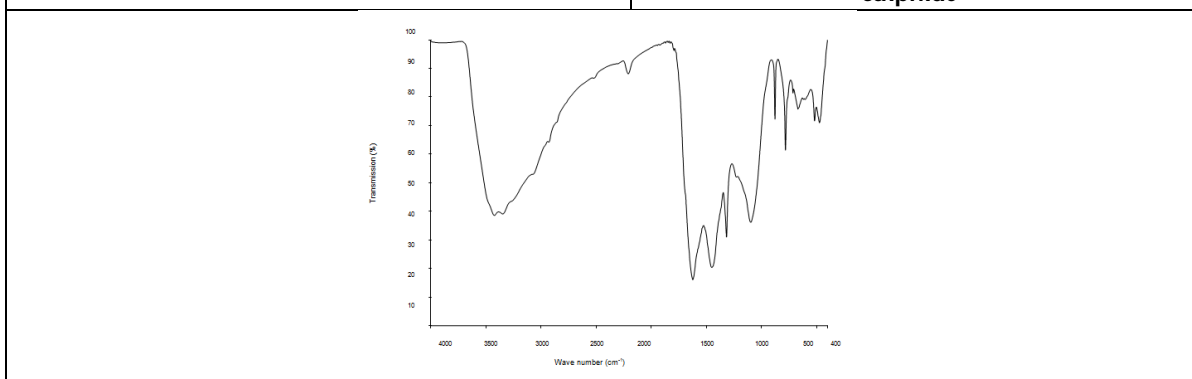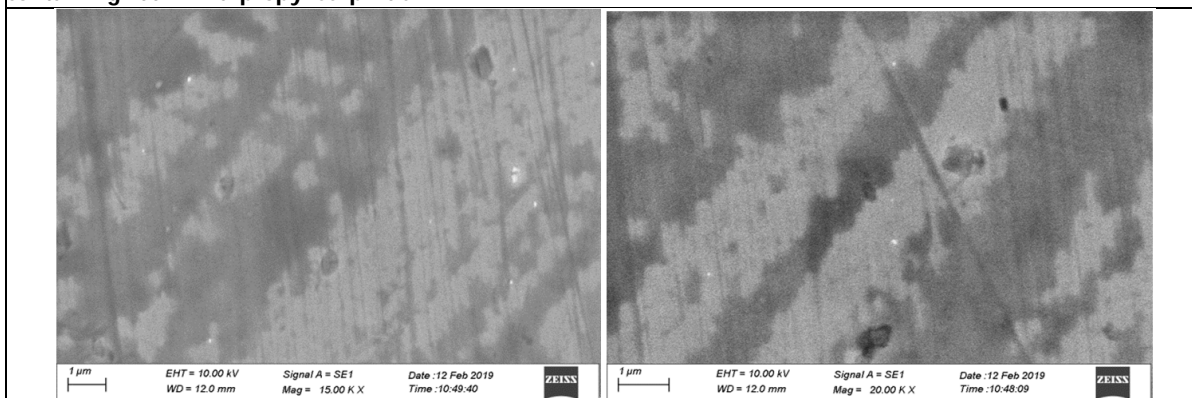|	
Figure 3. Structure of dipropyl sulphide	**Figure 4a. FTIR spectrum of pure dipropyl sulphide**
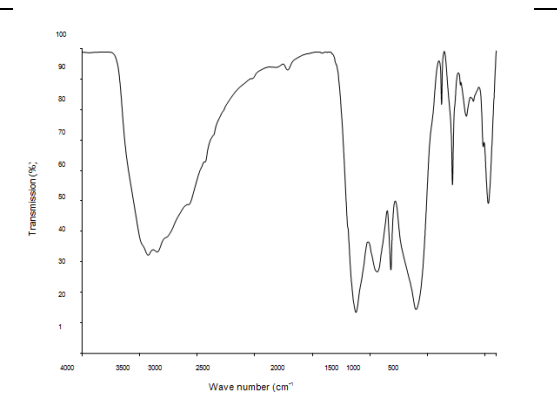
Figure 4b. FTIR spectrum of film formed on the zinc metal surface after immersion in 0.5 N HCl solution containing 100 mM dipropyl sulphide

(a)	**(b)**
(a) **Zinc Metal ; Magnification kx 15.00 (control)**	**(b)** **Zinc Metal ; Magnification kx 20.00 (control)**

(c)	(d)
(c) Zinc metal in 0.5 N HCl solution ; Magnification kx 15.00,blank	**(d)** Zinc metal in 0.5 N HCl solution ; Magnification kx 20.00,blank

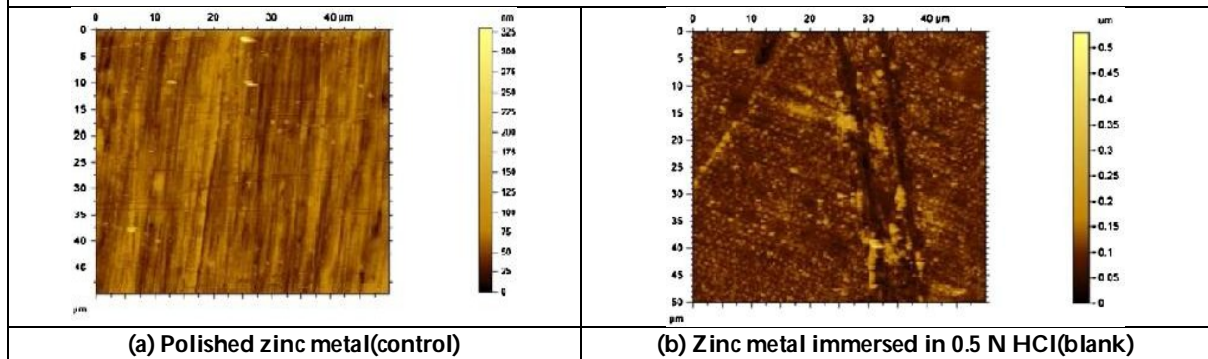| (e)	(f)
(e) Zinc metal in 0.5 N HCl solution + 100 mM DPS solution Magnification kx15.00	**(f)** Zinc metal in 0.5 N HCl solution + 100 mM DPS solution Magnification kx20.00
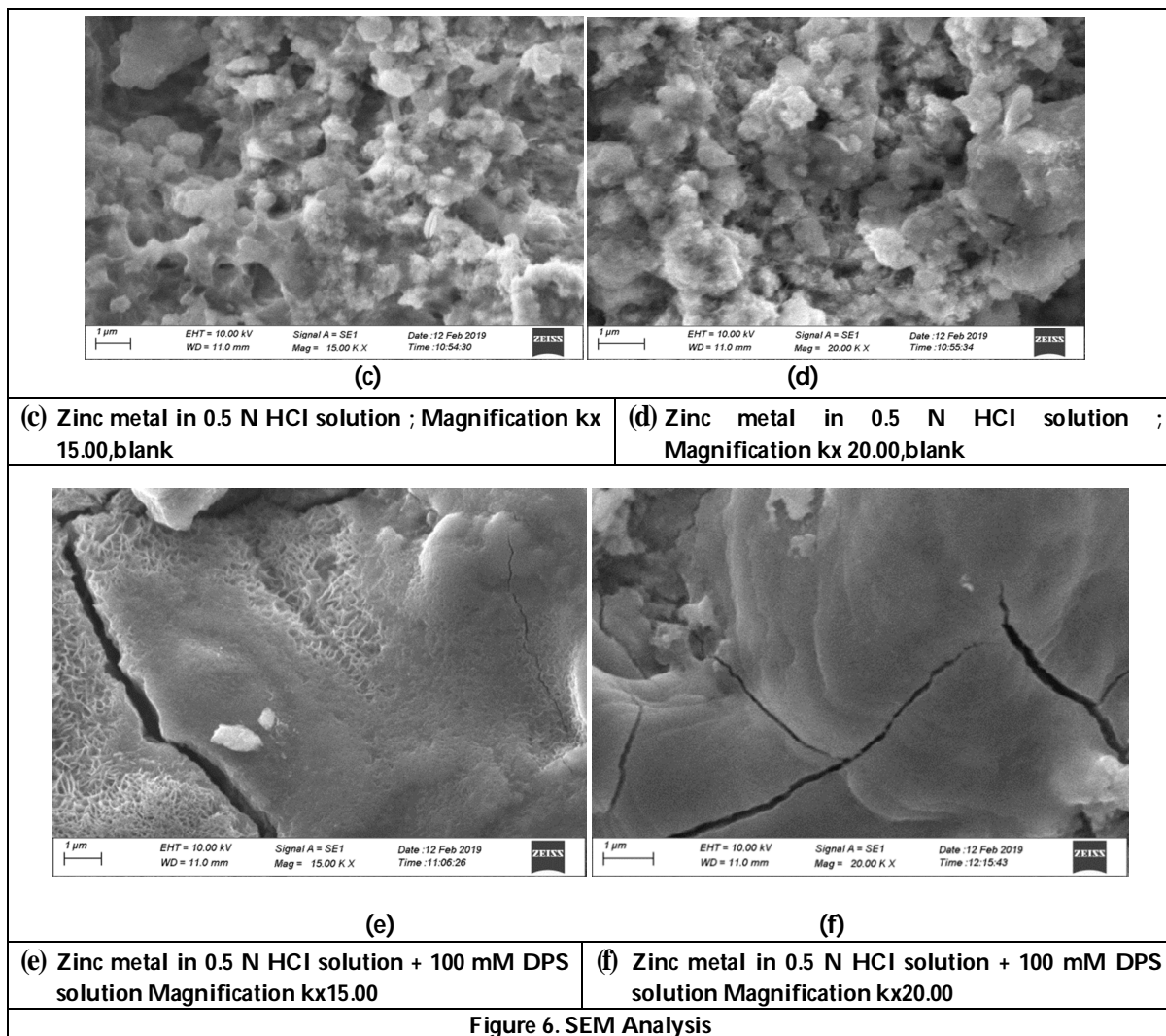
Figure 6. SEM Analysis

Figure 7. EDAX spectrum of (a) Zinc metal specimen(control), (b) Zinc metal specimen after immersion in 0.5 N HCl solution(blank) and (c) Zinc metal sample after immersion in 0.5 N HCl + 100 mMDPS
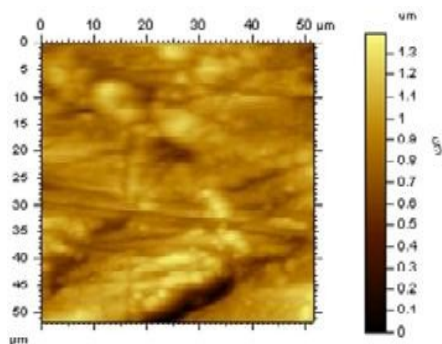

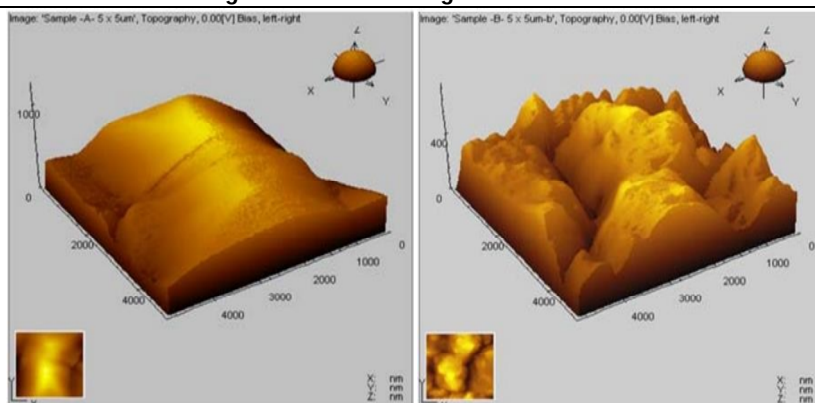| (a) Polished zinc metal(control)	(b) Zinc metal immersed in 0.5 N HCl(blank)

(c)

(c) Zinc metal immersed in 0.5 N HCl containing 100 mMDPS

Figure 8: 2D AFM images of the surface

(d)   (e)

(d) Polished zinc metal(control) | **(e)Zinc metal immersed in 0.5 N HCl(blank)**

(f)

Zinc metal immersed in 0.5 N HCl containing 100 mMDPS

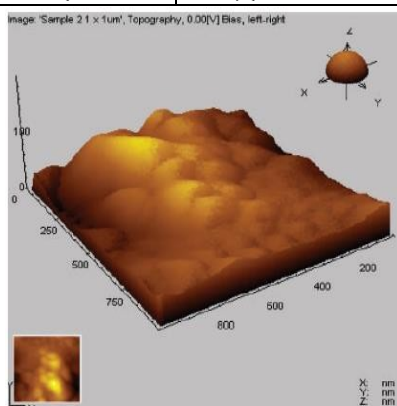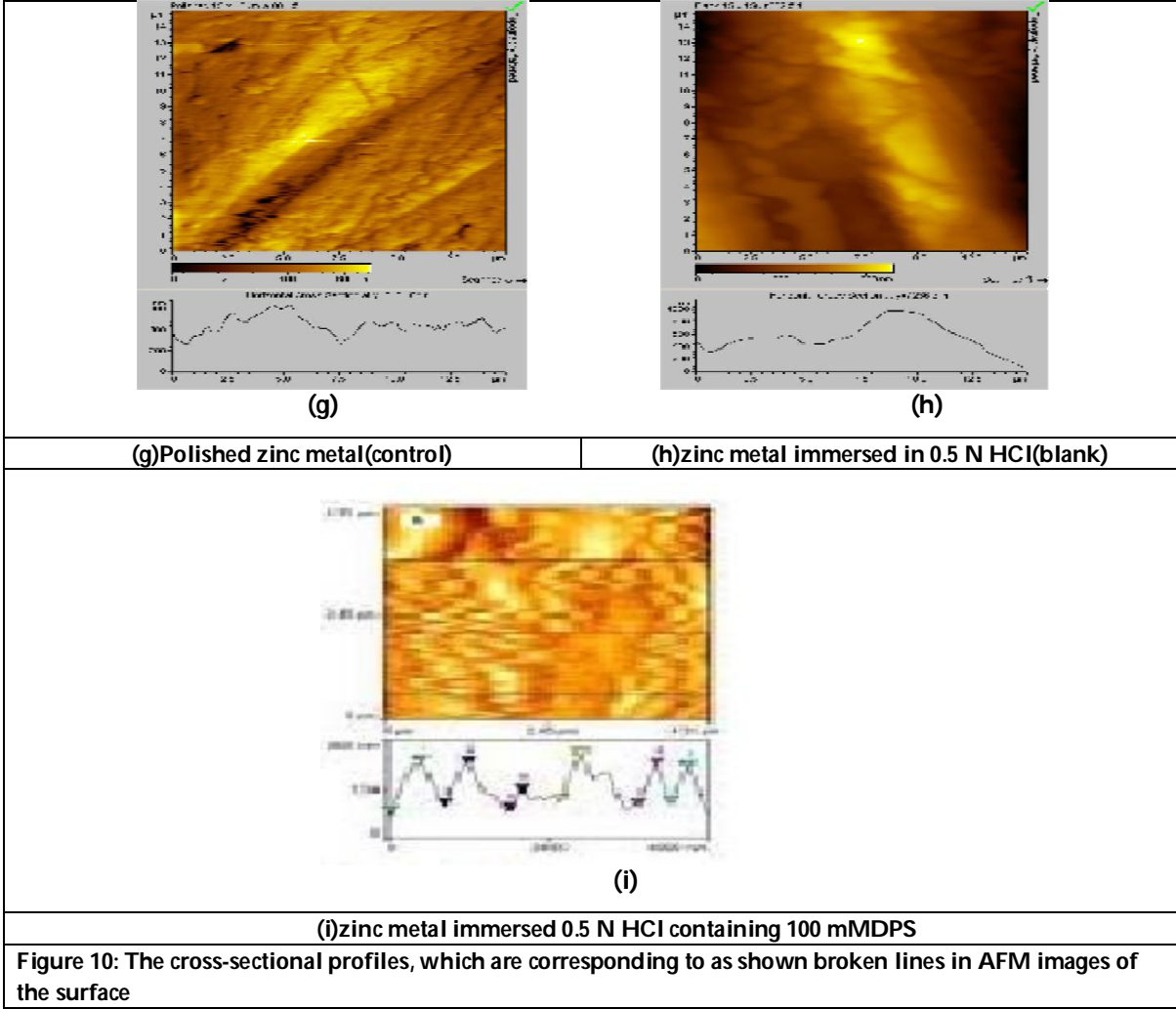**Figure 9: 3D AFM images of the surface**

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| (g)Polished zinc metal(control) | (h)zinc metal immersed in 0.5 N HCl(blank) |

(i)zinc metal immersed 0.5 N HCl containing 100 mMDPS

Figure 10: The cross-sectional profiles, which are corresponding to as shown broken lines in AFM images of the surface

Press and COVID-19 Pandemic: An Analysis of the News Coverage of Indian English Newspapers

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ABSTRACT

During challenging times, the role of news media becomes ever more important. During health emergency, people depend on news media for information. The coverage of pandemics is linked to how people perceive the seriousness of the crisis. Also, news media can influence the policy decisions by highlighting the key issues. Coronavirus presented a situation where confusion and uncertainty were available in abundance. This study was conducted with the objective of finding out how the major Indian English newspapers covered this health crisis and dealt with the confusion. To examine the newspaper coverage of the coronavirus-caused pandemic, this study uses content analysis and focuses on the themes predominantly mentioned by the selected newspapers – The Times of India and The Hindu. COVID-19 was covered from various angles by the newspapers. They highlighted issues related to health preparedness, migration, educational and economic issues. Selected English newspapers followed a careful and measured approach while covering the pandemic. People were conveyed important information, and issues they were facing were reported through a careful coverage of the pandemic through different angles and using relevant themes.

Keywords: COVID-19, newspaper coverage, pandemic, health emergency

INTRODUCTION

COVID-19 pandemic represents a global health emergency. After Spanish flu of 1918, this is the largest health crisis the world has faced [1]. In the last one-hundred years, the world had not witnessed anything like this. The outbreak of a global pandemic because of the SARS-Co-V2 virus affected and changed too many things around the world –

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became the reason of economy contraction, changed lifestyles, caused millions of deaths, almost stopped movement of people and so on. Because of the magnitude of the health emergency, COVID-19 pandemic received enormous amount of media coverage. In India, once a nationwide lockdown was ordered in March 2020 as a measure to keep the spread of coronavirus in check, newspaper pages were full of articles and stories about COVID-19. For the general public, this coverage functioned as the source of information. Considering the role of information in adequately preparing the public to cope up with this crisis, this was of utmost importance that news media conveys relevant information and people are kept informed about the changing landscape and the precautionary measures they need to take.

During times of COVID-caused lockdowns and thus the increasing concerns of people, it becomes natural for people to seek maximum information. At the same time, however, the importance of relevant and credible information also increases. While accessing information through media, it is most likely that people's behaviour and attitude is affected, depending on the kind of information media is reporting [2]. Previous research shows that media make people more aware during a pandemic and simultaneously also give air to fear among people [3, 4]. Fear among people also develops because of half-baked information, rumours and myths, which can easily be spread in this age of social media. This brings the focus on news media and highlights their importance, as they are still considered reliable sources of information [5].

The coronavirus pandemic threw several exceptional challenges to people – like lockdown, social distancing, and so on. Moreover, the authorities also faced a situation they had never dealt with. In such a situation, to understand the crisis and respond to the constantly emerging challenges, assistance for the general populace came through media. Newspapers would contain tips and information to deal with these challenges. These practices helped in the promotion of health-related information. However, the construction of news stories is generally done in such a way that certain issues receive importance [6]. The usual practice of constructing a story can influence the themes newspapers include or exclude, which in turn can have an impact not only on public discourse but also on policy-making decisions.

Through this research, the attempt is to evaluate the nature and extent of the newspaper coverage of COVID-19. Two popular and most widely circulated Indian English newspapers – The Times of India and The Hindu – were selected. The reason for the selection of these two English newspapers was influenced from them being popular among the readers. Additionally, these newspapers also to a broader reader demographics. Considering that media is known to play an important role in promoting public health [7], this research attempts to explore the important themes and media messages communicated by the mainstream English newspapers. A research of this kind can give insight into the range of issues and themes covered and also the discourse during the period when India was going through a severe lockdown as a result of COVID-19 pandemic.

MATERIALS AND METHODS

To collect the data, the time period selected was from April 1, 2020 to June 30, 2020. Articles published in the selected newspapers – The Times of India and The Hindu – were extracted from the archives of these newspapers that are available online. The sample newspapers selected for this study well represent Indian English newspaper scenario in India, as The Times of India is the largest selling newspaper of the country and The Hindu is considered one of the most influential newspapers of the country and one to find a place in the list of world's fifty great dailies [8].

To ensure that all the important articles containing information about COVID-19 becomes part of the research study, headlines of all the articles were read first. If the headline of an article contained any keyword related to "coronavirus", it was determined to be fit for inclusion in the final list of articles to be analysed. These keywords included "coronavirus", "COVID-19", "pandemic", "lockdown", "coronavirus disease", "COVID infection",

"positive cases", "COVID 2019", "virus", and "COVID cases". While collecting data for the study, the objective was to cover the widest possible coverage of the pandemic. At the same time, however, we also wanted to come up with an approach that can be effective in identifying the themes and the ongoing discourse. To do this, we only included the articles about the pandemic that was of more than 100 hundred words and had one of the decided keywords in its headline. From the beginning, it was expected that the volume of articles would be on a higher side, considering that the selected period fell during the time when the Indian government had ordered an extremely tough lockdown. In total, 4284 articles were found to be published during April to June in The Times of India and The Hindu., following the criteria set for data collection. During this period, newspapers extensively covered the pandemic and the related news in their effort to keep the public informed about the pandemic.

Coding

To deal with the huge volume of articles and make the analysis possible, it was decided that every fifth article should be selected and coded. Accordingly, the coding of 856 articles was carried out. We used the inductive coding method and approached articles with the ambition of finding out all the essential themes covered by the newspapers. It was also assumed that one article may carry more than one essential theme [9]. This method has previously been followed in several media framing studies [10, 11]. Additionally, we also coded the articles to find out the "overall tone" of the coverage. In this regard, we took a cue from a previous study carried out by [12]. In their study of the 2009-10 Swine-flu outbreak, UK newspaper articles were coded for their tone during a pandemic. The overall tone of an article was coded either as "alarmist, uplifting, and neutral." An alarmist article was the one that portrayed the pandemic in such a way that it caused some sort of apprehension for the reader [12]. "Uplifting" articles strived for bringing some balance in the coverage and dispelling the fears from people's mind [12]. These articles not only provided appropriate information, but also tried to reassure readers about how they can fight coronavirus with the help of precautions. Lastly, articles that were neither alarmist nor uplifting in nature were coded in the third category – neutral.

The coding work was done by the two authors. For measuring intercoder reliability, 100 articles were coded by both the coders. Cohen's kappa was used to know the inter-rater agreement. Substantial inter-coder reliability ($k = 0.68$) was found.

RESULTS AND DISCUSSION

As the coronavirus cases grew worldwide, India imposed a complete lockdown as a precautionary measure. This seemed to precipitate the news cov
erage extraordinarily. During the selected period, the number of articles carried by the newspapers only kept increasing on a day-to-day basis. Table 1 shows the number of articles carried by the two selected newspapers as per the above-mentioned data collection criteria. *The Times of India* had greater number of articles between the two selected newspapers. However, the difference between the two newspapers was not glaring, which indicates the kind of newsworthiness the issue had and the importance assigned to it by the newspapers.

Reporting of Issues

The newsworthiness of the pandemic shot up as Indians spent more time locked up in their homes. People started experiencing the effects of the lockdown. Consequently, the issues they faced because of the lockdown began to attract the attention of the newspapers. In the initial period, it was observed that the news coverage very much revolved around the rules of the lockdown and the coronavirus cases in India and outside India. However, as the coronavirus cases increased in the country, the newspapers focused on the gravity of the situation. COVID-19 tracker in the newspapers included information about reported number of cases, number of deaths and number of recoveries on a daily basis. Additionally, newspapers tried to improve people's understanding of the pandemic. They reported on the modes of transmission and the precautionary measures, which can protect people from

catching the virus. Additionally, an important aspect of the newspaper coverage in India was to beyond the reporting of coronavirus cases and deaths. Newspapers captured the severe effects of the pandemic and covered the difficulties general people were facing – the plight of migrants and the violence against healthcare workers, social and class divisions, as well as the human stories. **Table 2** further shows the range of themes and issues covered by the selected English newspapers.

Newspapers serve several functions. Apart from informing the public about the unfolding events, the analysis of events is also carried out by the newspapers from several angles, which helps in providing the general public with the perspective they can understand the events. During the coverage of the pandemic, newspapers attempted to cover the contexts and the consequences. Without fail, the reporting cantered around health and lockdown – emerging as the dominating issues. However, the coverage also included the response coming from the government and the preparedness. The research reveals the range of prominent issues covered as the pandemic evolved. For example, the human stories covered by newspapers captured the apprehension and helplessness of people. Similarly, within the migration of labourers and social issues covered, several articles highlighted the class dimension of COVID-19 in India. These articles captured the vulnerability of the weaker section and the impact of the crisis on different genders.

The Overall Tone

The selected Indian English newspapers mostly carried '*neutral*' headlines. The overall tone of majority of the article headlines in both *The Times of India* and *The Hindu* being found neutral indicates at the maturity with which headlines were written during their coverage of the pandemic. However, when compared, between the two newspapers, *The Hindu* carried 89% neutral headlines, 5% more than *The Times of India*. There was a modest difference between the two newspapers in their adoption of 'alarmist' tone. *The Times of India* carried more alarmist headline than *The Hindu* (see Table 3). Similarly, in comparison to *The Hindu*, *The Times of India* also had more number of uplifting articles.

DISCUSSION

A highly infectious novel coronavirus emerged initially in China. The virus rapidly reached other countries of the world, too. During the initial days, information about the virus was scarce. However, the sudden increase in the number of coronavirus cases turned this into an emerging health crisis and forced governments in almost every country of the world to focus on this. Transmission was rapid and there was no cure. People were urged to stay inside their homes and get out only for essential works. As a precautionary measure, lockdown was imposed in several countries of the world, in the attempt to slow down the transmission of the virus.

Back in India, the government decided to impose a strict lockdown very early, when coronavirus cases were still very less. Consequently, newspapers suddenly started covering various aspects of the pandemic as well as the lockdown. The lack of publicly available information turned out to be a key characteristic of the early newspaper coverage, which resulted in the dissemination of uncertainties about the virus threat. However, the effects of lockdown became more newsworthy as it started severely affecting the common people. Emerging issues dominated the newspaper coverage. Apart from the news about Corona cases and deaths on a daily basis, newspapers gave attention to the impact of the coronavirus on every aspect of public life. As time went by, news about vaccine development and lockdown relaxation made their way to the newspaper coverage as well. Continuous announcements of relaxation in the lockdown in July increased mobility and the perceived threat of coronavirus also diminished. This led newspapers to focus on other news stories, although a significant portion of newspaper reporting still revolved around the coverage of the pandemic.

Indian English newspapers resorted to providing factual information about coronavirus, which is clear from the majority of news articles carrying neutral headline. During health crisis, particularly during a crisis like coronavirus, factual articles go a long way in allaying public anxieties and building confidence among public. Also, journalistic coverage of the pandemic through dominating themes suggests overwhelming use of thematic frames. The prevalence of thematic frames helps in projecting the health crisis as a collective problem, which can alert people about their role and collective participation in the efforts of government to control the health crisis [13].

CONCLUSION

A pandemic throws several challenges at media. Despite those challenges, media cover the pandemics. Indeed, COVID-19 made it difficult for journalists to cover the unfolding events. The coverage of the pandemic, however, dominated the newspapers. This study shows the key issues found in the coverage of major Indian English newspapers – health, lockdown, government response and so on. These issues reveal the angles and the attention paid to the crisis by newspapers at a time when people expect newspapers to deliver them important and correct information. With newspapers mostly covering the pandemic in neutral tone, it was ensured that factual information is communicated to people.

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Table 1: **Number of articles published in *The Times of India* and *The Hindu***

Name of the newspaper	Number of articles (*n*)
The Times of India	2203
The Hindu	2081
Total	**4284**

Table 2: Essential themes in the newspaper reporting during the selected period

Essential Themes	*News articles coded* (*n* = 856)
Health 　　Transmission 　　Symptoms 　　Risk 　　Preventive measures 　　Death	384
Lockdown 　　Travel restrictions 　　Food shortage 　　Impact on Sports 　　Helplessness and death 　　Impact on workers	297
Economy	139
Migration of labourers	158
Misinformation	59
Situation of health workers	64
Education	37
Government response (preparedness)	103
Global response	67
Human stories	29
Societal issues	24
Discrimination and labelling	46
Vaccine and treatment	58

*One article, as mentioned above, was found to have more than one essential theme.

*The scope of study placed some restrictions on the inclusion of issues. Considering the large number of issues and themes covered by the newspapers, only major issues could be included in the study. Issues not reported here did not have any significant coverage in the selected newspapers.

Table 3: Overall tone of news articles

Article tone	*The Times of India* (*n* = 440)	*The Hindu* (*n* = 416)
Alarmist	9%	7%
Uplifting	7%	4%
Neutral	84%	89%

RESEARCH ARTICLE

Green Criminology Umbrella: A Concern on Green Crimes and Ecological Issues

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ABSTRACT

Green criminology is a multidisciplinary issue dealing with ecological violations and complications. Green criminology can be ascribed as umbrella research managing diverse natural enactments and biological atrocities. In green criminology, a cognizant exertion is arranged to strengthen an equity structure for denial of biological harms and offences. This examination highlights a gap between the fundamental criminal equity framework and that which oversees the guidelines of biological offences. The fundamental focus of green criminology is to shield the worldwide ecology from green offenders. In the recent decades, different human acts have seriously harmed the nature worldwide by exercises like illicit logging, contamination of the biological system, unlawful animal killing, poaching, unlawful fishing, biopiracy and illicit exchanging of natural creatures. It is opinioned in this investigation that green criminology has emerged because of the unsafe humanistic activities in the ecosystem and weak ecology shielding legislations. It is suggested through this research that legitimate advances ought to be actualized at the world level to limit green crimes, that will be valuable for social equity and future generations.

Keywords: Green criminology, Green crimes, Ecological diversity, Ecological injuries, Biopiracy, Social Injustice

INTRODUCTION

The locution 'Green Criminology' was firstly laid down by Lynch in the year 1990 [1]. He used this term for issues concerning ecological harms, ecological offences, losses incurred to human beings and other living organisms. Green

criminology deals with analyzing anti-ecological activities and injuries often being ignored by the basic criminology. It's a multidisciplinary study that incorporates criminology not limiting to crime or social injustice. The framers of green legislations are stagnated in a dilemma to define green crimes and the sorts of illegal offences that can be assorted under green crimes. Benton in the year 1998 depicted that within the framework of guarding ecosystem, it is necessary to distinguish harms committed on the ecosystem and its living organisms [2]. White in the year 2013 in his book "The Conceptual Contours of Green Criminology" elaborates the various perspectives of green crimes and its threats on the ecology [3]. However, there is a big argument on how to address the matters of green crimes, i.e. either under criminal acts or under civil acts. The core matter of arguments is how to correlate the present green criminological scenario with diverse ecological atrocities. Several global agreements failed against ecological safeguarding, like the Kyoto accord [4]. Various global agencies and not for profit organizations of the globe have taken several measures to protect the injuries occurring in the ecosystem. As a matter of concern, the United Nations Environment Programme in partnership with the United Nations Interregional Crime and Justice Research Institute organized an international conference concerning ecological crimes in the globe [5]. As per the World Economic Forum, 90% of the deforestation in the Amazon region is illegal, basically arising due to ecological crimes [6]. In response to safeguard the Amazon region, an Amazon Treaty Cooperation Organization was established [7]. To evaluate the global green crimes and various issues concerning it, this study was carried out under green criminology umbrella.

MATERIAL AND METHODS

Material: The data being employed for this study was gathered from secondary sources. The secondary sources included published research articles in journals, books, magazines and conferences. It also included news, reports and data from various internet sources.

Methods: The present investigation is an exploratory research in which secondary data was collected. The gathered secondary data was subjected to analysis of observations. The observations were further taken for evaluation and drawing a conclusion

RESULTS AND DISCUSSION

Types of Green Crime
Nigel South classified green crime into two types viz. primary green crimes and secondary green crimes [8]. The former type of green crimes are a result of harmful activities of human being on the ecosystem whereas the latter types attributable to the ignorance of the regulations that regulate ecological harms. The primary green crimes also include offences associating to, air pollution, illegal logging, species declining and rights of animals. The secondary green crimes include violence against groups working for ecology safeguarding and organized crimes to set aside regulations framed for the ecology.

Green Crime Is Causing Loss of Global Economy
Green crime is growing at an alarming rate on this globe. An estimate in 2016, by the United Nations Environment Programme, depicts that the criminals stole ecological resources worth 91 billion dollars to 259 billion dollars [11]. Moreover, green crime is exponentially rising at 5% to 7 % annually, that is two to three times the world's economy [11]. Green crimes are posing threat to the ecosystem that has caused a global ecological crisis due to illegal trade of ecological components worth 250 billion dollars annually [12]. The International Union of Forest Research Organizations depicted in its report that there has been illegal logging globally at an alarming rate particularly in Vietnam, China and India [9]. The United Nations in an international event organized by the Food and Agriculture Organization has urged the global states to actively regulate illegal and uncontrolled fishing [10]. Although the green

crimes are actively increasing worldwide the sanctions being granted for such immoral activities are very less as compare to those being implemented on other criminal offences.

Evaluating the Impact of Green Crimes

Different Scholars of human science recommend that the significant part of the development of green criminology is globalization. Environmental injuries happen in the global risk society and consequently can be alluded to as manufactured risks [13]. Green injuries can be comprehensively grouped into two sorts viz. anthropocentric injury and ecocentric injury [14]. The anthropocentric injury is considered because of the injuries that are being brought about by the human activities on the living systems while the ecocentric injuries are those that include injuries caused to the entire ecosystems and its living creatures. The major critical issue of green criminology is to systematise it. Conventional researchers portray offences as overstepping of laws. There is consistently disarray between criminologists over green offences like some consider animal cruelty while others may consider meat handling or meat utilization under an offence. Consequently, legitimate enactments in green criminology are difficult to develop. In the fiscal year 2019, the American sentencing commission reported that about 22.9 per cent organized offences were concerning to environmental crimes, as exhibited in Figure 1. [15].

Global Issues Concerning Green Criminology

Several issues can be listed under green criminological perspectives. The climate-related crimes are rising at world level at an exponential rate. The ecological studies and observations reveal that four main types of climate-related crimes are witnessed i.e. continuous isolation and emission, crimes that cannot be denied, crimes encouraged by politics, crimes due to wrongful acts and military adaptation. The case study of Exxon Mobil corporation reveals that it has harmed climate due to continuous emission of greenhouse gases and participated in global warming. In this year 2020 Attorney General William Tong has announced filing a lawsuit in the Superior court of Hartford against ExxonMobil stating that it has highly contributed to global warming and climatic change masking it from the populace [16]. Green crime can also be related to food crimes. Food acts as a good source of performing green crime through food adulteration [17]. Food adulteration is a common incident being experienced throughout the world but hardly any strict legal measure are even heard against this green crime. In a news report, the President of the European Patent Office or EPO, António Campinos has lifted a ban forced on patents embracing plants and animals through regular propagation methods [18]. The assessment of such patents was discontinued in mid-2019 because the EPO had taken opposing choices concerning licenses on seeds. The President's most recent choice was taken before all the applicable central points of contention had been settled. Specifically, there is scepticism on the characterization of ancestral breeding techniques. In patent law, these are alluded to as 'essentially biological' and are avoided from patentability. The patenting of seeds encourages monopolisation and biopiracy. In the global market, the demand for drugs like opium and cannabis has increased the incidents of deforestations worldwide along with a loss to ecological diversity and promoting green crimes [19].

Specific Cases Concerning Green Crimes

In the global scenario there has been various instances that exhibits green crimes are being committed. Some of the significant cases that indicates that green crime is causing loss to the ecosystem and humans are mentioned below.

COVID-19 Pandemic Green Crime Case: In a report of United Nations Office of Drugs and Crime, it is depicted that the illegal and uncontrolled trading of wild animals does contribute towards transference of zoonotic infections from wild creatures to humans [20]. These zoonotic infections account to about 75% newly infections, including COVID-19 infection [20]. The green crimes are fading the ecological diversity and further posing threat to human life.

Amazon Tropical Forest Green Crime Case: Amazon region possess rich reservoirs of ecological diversities with numerous conventional medicinal herbs [21]. Green peace organization suggests that human beings have threatened

the ecological diversity of Amazon forest for its diverse plant strains, distinct animal species and different industrial activities [22]. The illegal explorations have increased the deforestation in Amazon region [23]. The threats have also extensively affected the aboriginal societies of this region and their inherent knowledge. The global corporations have encouraged green criminals to invade the ecological reservoirs of the amazon zone.

Flint City Green Crime Case: The Flint town is situated in Michigan in America where hundreds of people were impacted by consuming toxic water owing to the negligence of the authorities governing the water department [24]. The consuming of untreated water become a curse for Flint city populace. In a survey by a not for profit organization, Natural Resources Defense Council, it was highlighted that inhabitants of the Flint town suffered from various types of illness subsequently consuming the untreated Flint River water [25]. This case signifies that green crime can prove to be a disaster to the ecosystem and the humans.

Niger delta green crime case: Shell, an oil corporation has largely exploited the natural gas reservoirs of Niger Delta coast of Nigeria that has caused enormous pollution of air and soil [26]. Amnesty international in a news report suggests that this oil giant corporation shall face a big legal action due to years of exploitation of the ecology and the people of Niger Delta [27].

Canada Oil Sand Green Crime Case: Oil Sand deposits of Alberta in Canada is the third-largest in the globe [36]. In a study, it was observed that the aboriginal people of Alberta region have to face lots of challenges like displacements from their land and injury to their ecological diversity [28]. The greed to occupy the oil sand reservoirs by the corporations have caused a significant impact on the Alberta ecosystem and contributed to green crimes.

Yanomami Green Crime Case: In the northern part of Brazil an aboriginal tribe Yanomami is surviving with a populace of 30,000 individuals [29]. Yanomami area is facing illegal logging and gold isolation activities. The illegal miners are continuously exploring this region and causing huge loss to the ecological diversity of this region. Moreover, it has also been reported that the unauthorized gold miners that have entered this region and communicated Covid-19 infection in the Yanomami individuals [29]. Although the Brazilian government denies such allegations, reports are exposing reality.

Global Biopiracy Green Crime Cases: The earth is rich in reservoirs of ecological diversities and ancestral knowledge. In recent years, biopirates have intruded the ecological diversities worldwide and isolated various vital herbal plants and ancestral knowledge. The biopiracy cases of Maca, Melon, SachaInchi, Turmeric, Neem, Basmati rice variety, Naphal wheat variety, are some of the leading cases of biopiracy committed by green crime offender in the global scenario [30]. The global legal tools have failed to combat the biopiracy from ecological diversities of the globe. Although various patents on ecological resources have been revoked still the green crime offenders are in the queue for the next biopiracy.

Penal Reforms Against Green Crime
The United Nation has collaborated with Africa Prosecutors Association to design a manual of instructions and curriculum concerning prosecution on green crimes [9]. It was established with a motive to help nations to incorporate ecological offences teachings in the training curriculum of police and prosecutors. This shall assist in investigating the green crime and prosecution of green crime cases. Such type of training module has been already been applied in Uganda [9]. Arther Pare in his study on ecological crimes describes a tool referred to as Eco Crime Map [31]. Eco Crime Map tool can be used to report ecological crimes from anywhere in the globe. As far as his report suggests 178 crimes have been reported. Pare described the map with six colours, Red for poaching, Orange for pollutions, Green for illegal isolation, Blue for illegal animal trading, Yellow for sanitary and purple for illegal logging. The International Criminal Police Organisation commonly called as INTERPOL has developed various tools and services against green crime activities [32]. INTERPOL achieves its objectives by using I-27/7 global

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communication method which is used to transmit significant information, using Red, Purple, Blue and Green notice for specific alerts, using of Eco messages for proper message reporting or seizures, using National Environmental Security Task Forces which works on the principle of multi-agency cooperation, using Regional Investigative and Analytical Case Meetings and using Operations to disintegrate the networks of green criminals [11]. Recently the European Union has incorporated the ecological crime as an unlawful act under the 6th Anti Money Laundering Directive or 6AMLD [33]. Moreover, a new Financial Action Task Force 2020 of the European Union shall focus on illegal trading of wildlife [34]. The operation Thunderball 2019 was conducted with the joint association of INTERPOL and the World Customs Organization across 109 global nations to identify illegal wildlife crimes as depicted in Figure 2. [35].

CONCLUSION

Green Criminology Scholars suggest that novel reforms are essential in developing penal legislation against green crime offenders. Observations in this study suggest that global states have been negligent in considering green crimes. The ignorance of ecological diversity and its vitality has been exploited by the biopirates and green crime offenders around the globe that has caused injury to the ecosystem and its living organisms. The repercussions of green crime are not limited but are witnessed by the loss to human lives. In this study, it is examined that green criminology is an umbrella study that has multidisciplinary access or association. The criminologists often find it difficult to tackle green crime issues because of its vast link to different sources. This investigation suggests seeking a serious outlook against the evils of green crime. It is concluded in this investigation that if green criminology is not looked with attention then that shall be an injustice to the ecological diversity and the human populace.

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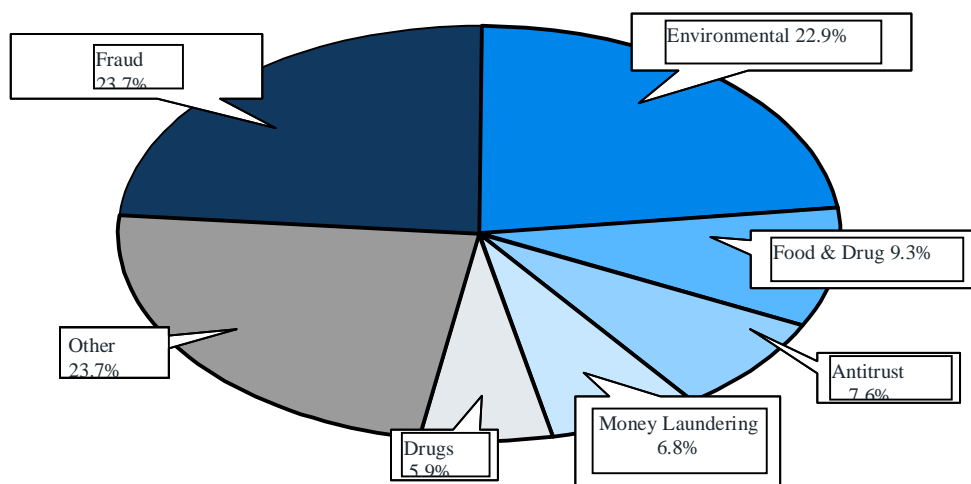
Figure 1. Organized offences percentage in the fiscal year 2019 reported by the United States Sentencing Commission. Image Source: https://www.ussc.gov

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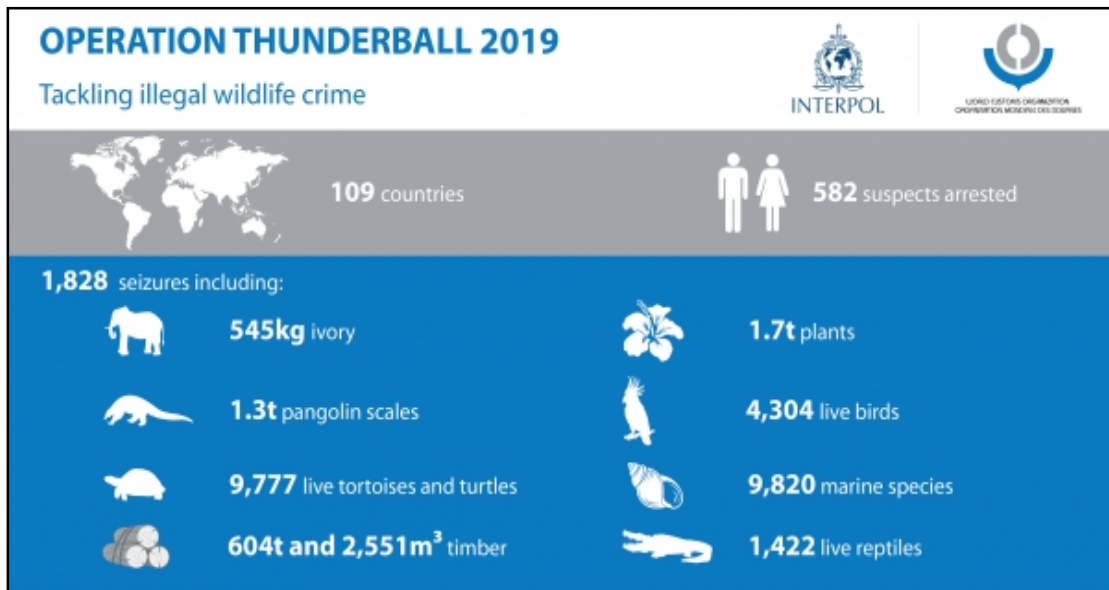**Mahmood Khan Yousufi and Narendra Kumar Thapak**

Figure 2. Operation Thunderball 2019 conducted with a joint association of INTERPOL and the World Customs Organization across 109 nations worldwide. Image Source: https://cites.org

RESEARCH ARTICLE

Analysis of Stress Urinary Incontinence and Awareness of Physiotherapy in Recreational Female Athletes: A Survey

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ABSTRACT

The pelvic floor is a dome-shaped striated muscular sheet that encloses the bladder, uterus, rectum together with anal sphincters. The main role of pelvic floor is in regulating storage and evacuation of urine and stool. Any unintentional urine leakage is known as urinary incontinence (UI) which can be divided into 3 types; stress UI, urge UI, mixed UI. Urinary incontinence is a common problem among females, with a negative impact on quality of life. Thus, the aim of this survey is to find whether any female sports athlete have problems regarding stress UI and pelvic floor performance and their level of understanding regarding physical therapy rehabilitation protocols. An online questionnaire through Google forms were distributed to the female athletes in an around Gandhinagar and Ahmedabad district of Gujarat, India through various social media platforms and email-id. The result obtained in this survey were analyzed using basic statistics through Microsoft Excel and inbuilt Google form calculation. Through this survey we conclude that majority of female athletes who participated in this survey have faced stress urinary incontinence and they feel shy in sharing this issue and are also not aware about any rehabilitation program which can address their stress urinary incontinence issue and enhance their performance and quality of life.

Keywords: Pelvic floor, Urine loss, Stress urinary incontinence, Trunk stabilization, Interferential therapy, urogenital distress inventory.

INTRODUCTION

The pelvic floor is a dome-shaped striated muscular sheet that encloses the bladder, uterus, rectum together with anal sphincters. The main role of pelvic floor is in regulating storage and evacuation of urine and stool [1]. The bladder, urethra, pelvic muscles, and surrounding connective tissues all function together to maintain normal

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continence in women. The pontine micturition center regulates the storage of urine, which is under voluntary supervision. The bladder is stable in the physiological bladder filling range (empty to capacity, usually 500–600 mL) and can handle increased urinary volume without increasing bladder pressure. This mechanical distension is unparalleled in any other organ and is accomplished by specialized function of the detrusor smooth muscle and neurological modulation [2]. Any unintentional urine leakage is known as urinary incontinence (UI) which can be divided into 3 types; stress UI, urge UI, mixed UI. Urinary incontinence is a common problem among females, with a negative impact on quality of life. The prevalence rates of UI in young women aged 15-44 years in the general population range from 6.2% to 12.4% and among them stress urinary incontinence is commonest. Stress urinary incontinence is the most common form of female urinary incontinence, characterized by involuntary loss of urine in response to effort or physical exertion, as well as sneezing or coughing, with prevalence rate varying from 3% to 58.4%. Moderate physical activity has been reported to decrease the odds of having a risk of developing urinary incontinence, strenuous work/ exercise has been listed as a possible risk factor for the condition. The highest prevalence of urinary incontinence during sports involved high impact activities, such as gymnastics and ball games. Regarding the prevalence of urinary incontinence in different sports, the rates vary between 0% in gold players and 88.9% in artistic gymnastics and trampoline athletes [3].

The difference between normal and stress incontinence bladder is shown in figure 1. As mentioned in figure 1, the urine leakage is controlled by external urethral sphincter. where as in stress incontinence the weakening of urethral sphincter muscles and pelvic floor muscles, which are used to keep urethra closed and continent to leakage of urine when coughing, sneezing, laughing, and exercising and other high impact activities which raise the pressure (stress) inside abdomen. When bladder pressure exceeds urethral pressure due to sudden increases in intra-abdominal forces, stress urinary incontinence occurs. Anatomical changes (typically a loss of backstop support at the bladder neck) or neuromuscular compromise to the sphincter itself can cause this increase. Loss of bladder neck support is referred to as bladder neck hypermobility, and treatments are aimed at stabilization and recreation of the backstop support [2]. Urine loss in athletes tends to be due to the extent at which women are exposed to increased intra-abdominal pressure, which is triggered by abdominal muscle contraction in high-impact sports and strengthening of the pelvic floor muscles (PFM) activities without proper awareness. Strenuous physical activity that increases intra-abdominal pressure can overload and chronically damage the perineum and decrease the contraction force of PFM. By continuously maintaining their activity, the pelvic floor muscles help to protect connective tissue from excessive load, relieving stress on the endopelvic fascia and other connective structures. The greater the need for PFM restraint and protection of the pelvic organs, the more often the impact associated with increased intra-abdominal pressure occurs, and the PFM must be trained to maintain their function [4].

To avoid negative impact of UI, athletes with UI symptoms use techniques such as the use of absorbent pads, preventive urination, liquid intake management, athletic technique adaptation, or even a change of sport to lessen the effects of the disease, but they do not commonly seek treatment or professional advice [5]. Physiotherapy is effective for the prevention and management of this condition and is widely recommended as a first-line management option, namely through pelvic floor muscle training, which involves strengthening of the pelvic floor muscles [6]. Exercises for pelvic floor were introduced in 1948 by Kegel are considered as conventional physiotherapy protocol and till date many randomized controlled studies and systematic reviews have supported the efficacy of these exercises. Many researchers have reported that more than 68.4% of the women suffered from SUI while 41.2% of the women reported with mixed urinary incontinence, both showed improvement after 8 weeks of Kegel's exercises [7]. Exercise protocols including other intervention to enhance the muscle contraction like biofeedback, duration and number of contractions per day can also be a cause for difference in results output. Therefore, pelvic floor exercises are accepted as an efficient intervention for SUI [8]. Physiotherapists treating patients with low back pain or sacroiliac joint (SIJ) dysfunction ten years ago may not have found the pelvic floor muscle (PFM) complex, and those teaching PFM exercises for the treatment of stress urinary incontinence (SUI) discouraged the use of the abdominal muscles. These beliefs are now changing. The synergy between the abdominal and PFM, as well as all the muscle groups surrounding the abdominal capsule, has been better understood according

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to the research. The PFM are now considered to have the dual function of providing trunk stability and contributing to continence and elimination of both bladder and bowel [9]. Pelvic floor stimulation is a low-risk stimulation treatment that activates effective pudendal nerve reflexes to stimulate the body's normal function and incontinence mechanism. Pelvic floor stimulation is a non-surgical, drug-free treatment that has the ability to improve patients' lives at a low cost. Pelvic floor stimulation has become a vital tool in the armamentarium of incontinence care as physicians diagnose and treat the large number of patients who suffer from incontinence.

Interferential current therapy uses the idea of intervention to increase the amount of current that reaches the tissues while reducing unnecessary stimulation of cutaneous nerves to a minimum. In order to excite small afferent fibres in the pudendal nerve with a sluggish conduction velocity, urinary incontinence is treated at 5-10 Hz for 15 minutes. Following contraction of the slow twitch pelvic floor muscles, this will result in reflex inhibition of the detrusor [10]. This protocol helps to reduce urine loss and improve quality of life if an athlete has complaint of stress urinary incontinence during sports activity but doing any treatment or any exercises, it is important to know what kind of problem the athlete has. Thus, the aim of this survey is to analyse presence of SUI in female sports athletes and their problems regarding SUI and pelvic floor performance and their level of understanding regarding physical therapy rehabilitation protocols like conventional physiotherapy, trunk stabilization and Interferential therapy in rehabilitation of SUI. We hypothesized that the athletes had concern with stress urinary incontinence which hampered there performance and they will not be aware about various rehabilitation protocol to enhance pelvic floor muscle function.

MATERIALS AND METHODS

We surveyed the professional and recreational female athletes around Gandhinagar and Ahmedabad district, Gujarat, India through Google e-survey online form which was divided into three section in first section consent of the participants was taken, in second section demographic details of participants were taken, and third section included questionnaires for athletes. The survey form was shared on various social media platforms and was also e-mailed to the relevant contacts. The participation in this survey was completely voluntarily which was also informed to all the participants and it was made sure that the information shared would be kept confidential. The collected information does not imply any harm, so the Ethical Review Board was not needed. In the survey questionnaire as show in table 1, questions 1 to 7 were framed to find out what kind of player the athlete is, where does the athlete play, does the athletes has any complaint of stress urinary incontinence, duration of athlete playing the sport. Questions 8 to 14 were related regarding awareness of player related to physiotherapy, and their willingness to take physiotherapy if required. The results obtained were analysed using basic statistics (such as total numbers and percentages) through Microsoft excel and inbuilt Google form calculation.

RESULTS AND DISCUSSION

A total of 153 recreational athletes out of 5400 athletes (response rate2.83%; CI 95%; margin of error 9.64%) completed the survey. The maximum response in this survey was from female athletes in the age group of 18 to 25 which was 73.20% as shown in figure 2. Question 1 and 2 were designed to understand whether the athlete was recreational or professional & where do they play? Figure 3 shows that 86.90% of athletes were recreational and figure 4 shown that 49.7% of athletes were from Ahmedabad and 50.3% of athletes were from Gandhinagar. Questions 3, 4 and 5 were designed to understand the athlete's capabilities in terms of duration of sports and professional coaching. As shown in figure 7 only 11.80% of athletes were taking professional coaching in which 13 athletes were from the age group of 18 to 25 years. Questions 6, 7 and 8 were for get an idea about how many athletes have history of SUI, what they do for SUI and Do they feel shy for sharing those problems? Figure 7 shows 86.30% of athletes have history of SUI in which 96 athletes were from the age group of 18 to 25. Questions 9 to 13 for how many athletes have idea about physiotherapy and different types of physiotherapy management protocol for SUI. Figure

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10 it is clearly suggested that 93.2% of athletes have an idea about physiotherapy but very less percentage of athletes were aware about different types of physiotherapy management protocol for SUI. Question 14 were based on how many athletes really wants to have interest in undergoing a specialized physiotherapy training protocol to improve strength and quality of life. So, according to that 94.10% of athletes were interested for the physiotherapy protocol in which 105 athletes from age group of 18 to 25 which shown in figure 16. Thus, it is clear through this survey that there is predominance of SUI in female athletes and they cannot share their SUI problem easily. Also they are not aware with the rehabilitation protocols which can address their SUI problem. Though the pontine micturition center regulates the storage of urine, which is under voluntary supervision; Rehabilitation protocol which commonly includes pelvic floor exercises which works on strengthening the muscles around the uterus, bladder, and bowel. The exercises can help to regulate the storage and evacuation of urine and stool. The bladder, urethra, pelvic muscles, and surrounding connective tissues all function together to maintain normal continence [2].

Another advancement in rehabilitation is trunk stabilization exercises which has principle of co-activation of the abdominal and pelvic floor muscles. The co-activation can help to strengthen the pelvic floor muscles. The contribution of the pelvic floor muscles to intra-abdominal pressure and trunk stability can be explained by its feed forward activation in response to trunk perturbation, resulting from rapid arm movement. During periods of increased intra-abdominal pressure the pelvic floor muscles activity is increased to prevent or limit displacement of the floor, maintain the position of the bladder neck and assist with urethral and anal closure. Pelvic floor muscle activity may also indirectly contribute to lumbopelvic control via an effect on tension developed in the thoracolumbar fascia; hoop tension of the fascia from contraction of the abdominal muscles is dependent on intra-abdominal pressure. The pelvic floor muscles respond in a similar manner to the other components of the local muscle system including the transversus abdominis the diaphragm and the deep fibers of lumbar multifidus [9].

Additionally electrotherapy modality Interferential therapy has also proven roles in improving strength of pelvic floor muscles by exciting small afferent fibres in the pudendal nerve with a sluggish conduction velocity; by increasing the amount of current that reaches the tissues while reducing unnecessary stimulation. Following contraction of the slow twitch pelvic floor muscles, this will result in reflex inhibition of the detrusor [10]. Thus, there is a strong need to address SUI problems in the athletes and develop a standardised rehabilitation protocol which not only improves the pelvic floor muscle strength but also improves the athlete performance and quality of life.

Limitation of this study was relatively less sample size which can have statistical impact on the outcomes of the study. Also, in order to get maximum responses from the known sample area the survey was kept short and simple and we had no control over the participants responses which can lead to selection bias and majority of the survey participants were recreational female athletes. The response rate was also less due to COVID-19 pandemic. Thus, through this survey we conclude that majority of female athletes who participated in this survey have faced stress urinary incontinence and they feel shy in sharing this issue and are also not aware about any rehabilitation program which can address their stress urinary incontinence issue and enhance their performance and quality of life. We strongly recommend to conduct future trials and systematic reviews on rehabilitation protocols to have a defined rehabilitation protocol for stress urinary incontinence in female athletes.

ACKNOWLEDGEMENT

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Table 1: Description of Questions and Responses in the Survey

Questions	Response
Questionnaire	
Q-1 What kind of Sports person are you?	Professional (District, National, International) Recreational (Club player, Hobby)
Q-2 Where do you play any type of Sports?	Ahmedabad Gandhinagar
Q-3 Are you having any history of stress urinary incontinence?	Yes No
Q-4 What do you do for the stress urinary incontinence?	Physiotherapy Any other treatment Nothing
Q-5 Do you feel shy in sharing urinary incontinence problem with anyone?	Yes No May be
Q-6 Since how many years are you playing sports?	1 Year 2 Year 3 Year More than 3 Year
Q-7 On average, how many hours do you play any sports in a week?	1 Hour 2 Hour 4 Hour More than 4 Hour

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Q-8 Are you at present taking any professional training with a coach?	Yes
	No
Q-9 Have you ever heard about physiotherapy?	Yes
	No
Q-10 Are you taking any or have taken any physiotherapy for the stress urinary incontinence?	Yes
	No
Q-11 Have you heard about strength training of pelvic floor muscles for stress urinary incontinence?	Yes
	No
Q-12 Have you heard about trunk stability training of pelvic floor muscles for stress urinary incontinence?	Yes
	No
Q-13 Have you heard about Interferential therapy of pelvic floor muscles for stress urinary incontinence?	Yes
	No
Q-14 Are you interested in undergoing a specialized physiotherapy training protocol based on evidence to improve strength, Quality of life?	Yes
	No
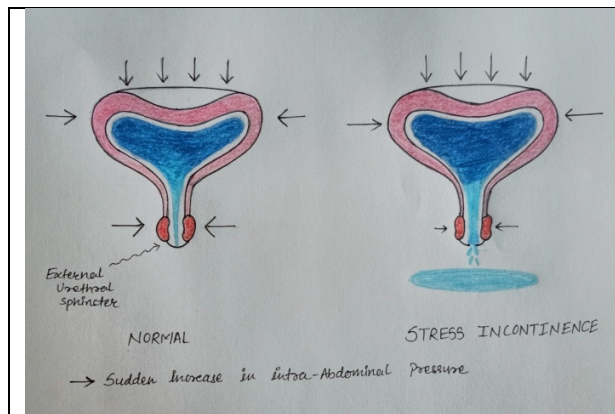
Figure 1: Difference between Normal and Stress Incontinence Bladder
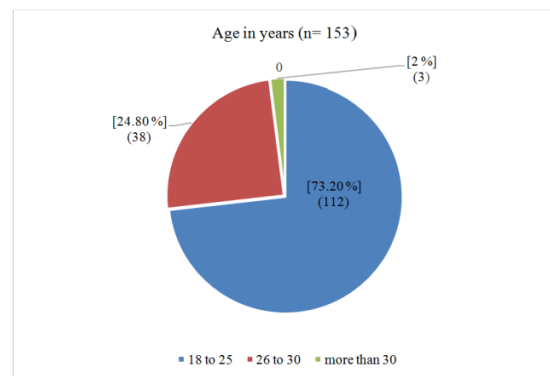
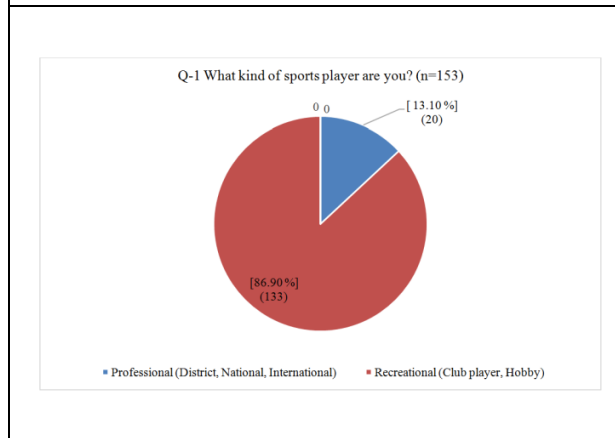**Figure 2: Pie Chart of Participants Age in Years**

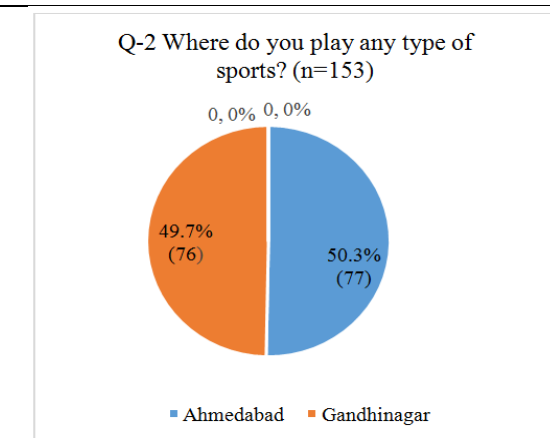**Figure 3: Pie Chart of Participants Responses of Question 1**

Figure 4: Pie Chart of Participants Responses of Question 2

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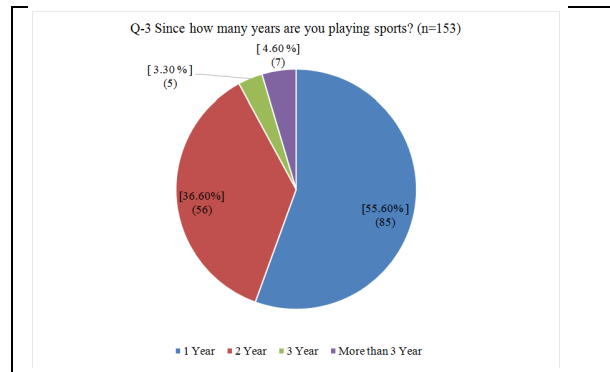
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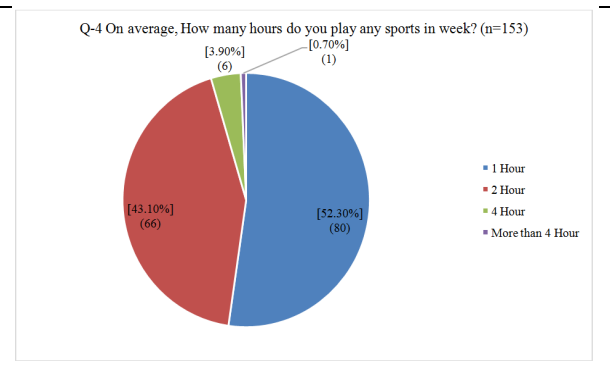**Figure 5: Pie Chart of Participants Responses of Question 6**

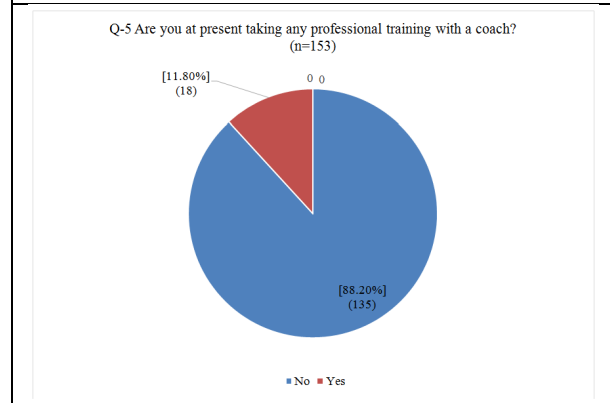**Figure 6: Pie Chart of Participants Responses of Question 7**

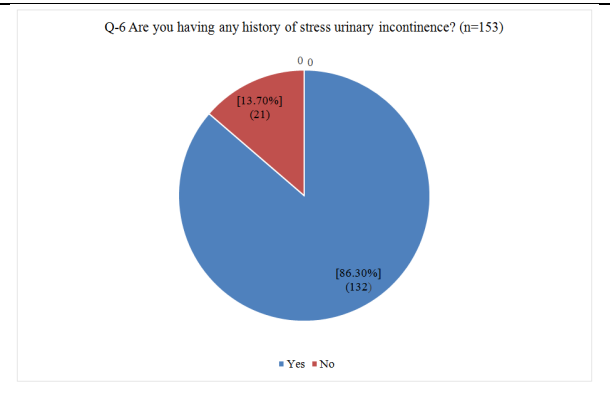**Figure 7: Pie Chart of Participants Responses of Question 8**

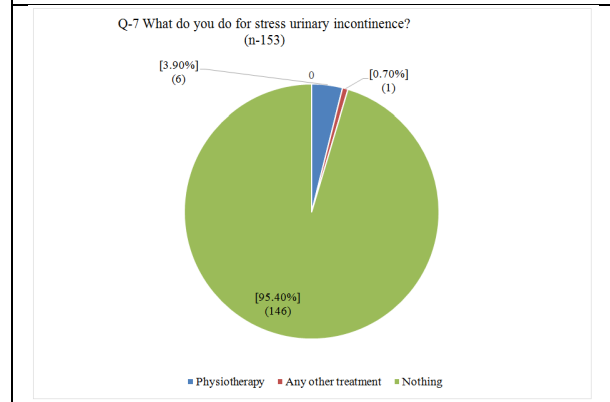

Figure 8: Pie Chart of Participants Responses of Question 3

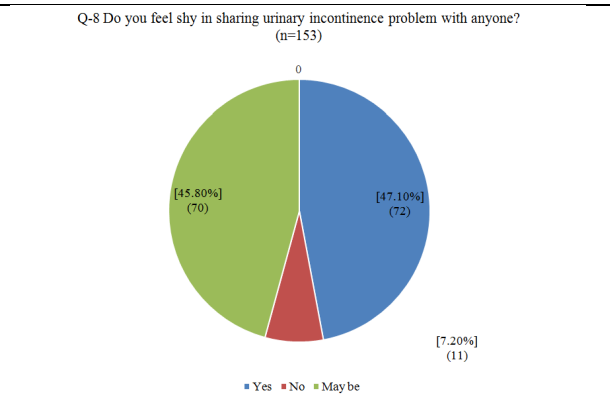**Figure 9: Pie Chart of Participants Responses of Question 4**

Figure 10: Pie Chart of Participants Responses of Question 5
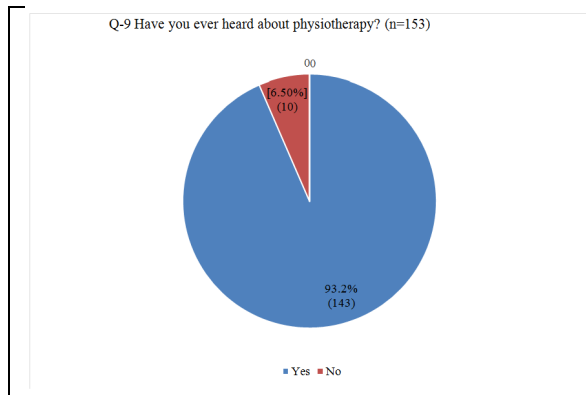
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Figure 11: Pie Chart of Participants Responses of Question 9
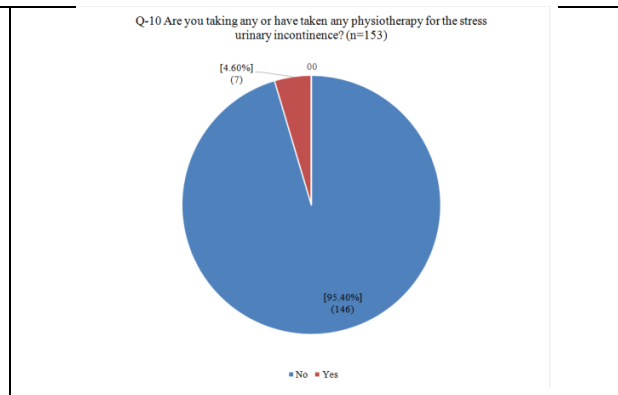

Figure 12: Pie Chart of Participants Responses of Question 10
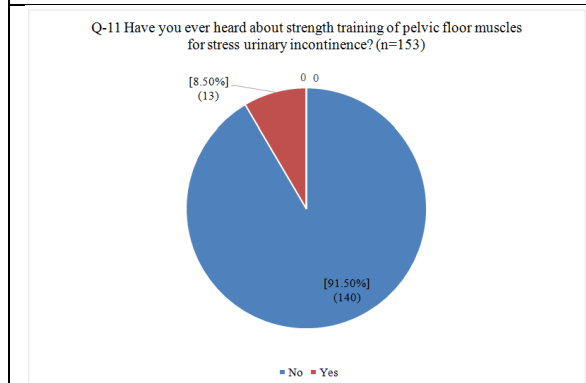

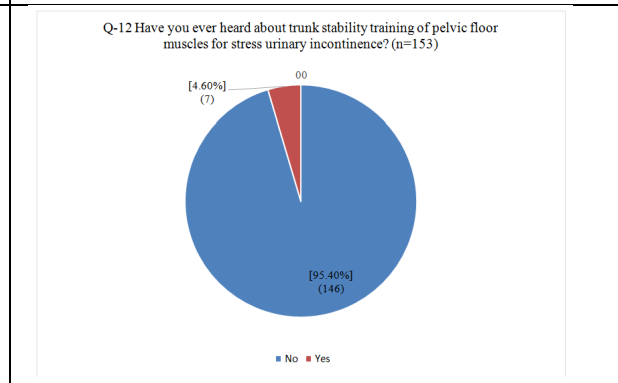**Figure 13: Pie Chart of Participants Responses of Question 11**

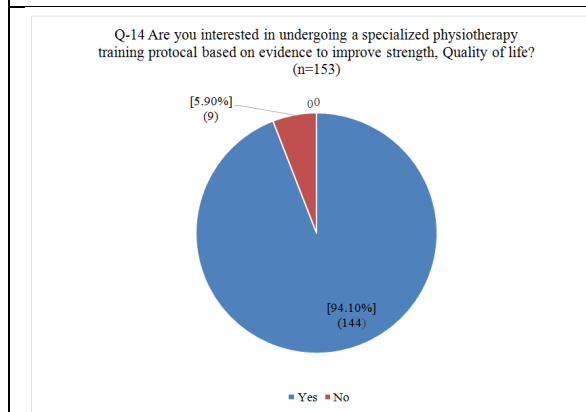**Figure 14: Pie Chart of Participants Responses of Question 12**

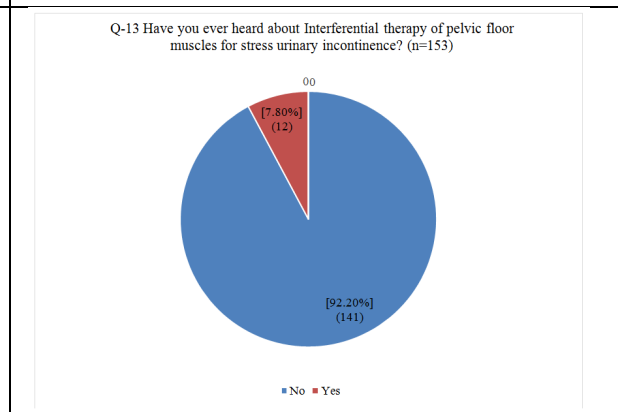**Figure 15: Pie Chart of Participants Responses of Question 13**

Figure 16: Pie Chart of Participants Responses of Question 16

RESEARCH ARTICLE

Seed Priming: An Effective Approach to Improve Seed Germination and Abiotic Stress Tolerance

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ABSTRACT

Changing climatic conditions and repeated incidences of environmental stress exhibit serious threats to crop production and severely hits crop yield. Abiotic stresses severely affect crop development at the germination level and establishment of seedlings. These two very important phases are the vital stages which overall determine the future crop productivity and yield. Among the various abiotic stress, salinity stress and drought stress are most challenging stresses that severely limit the crop productivity by adversely effecting different developmental stages of crop. In the agriculture system uniform seed germination, emergence and successful establishment are important the stages which set the overall future crop development and productivity. Therefore, to work on different strategies and focus on the development of methods that can help the plants to resist adverse conditions without decreasing the yield. Focussing on quick seed germination as well as an early establishment of seedling in the soil could offer an effective approach along with innate development of stress resilience in crop plants to deal with adverse environmental situations. The emphasis on seed priming approaches with different means in recent years become more attractive because of eco-friendly nature and low budget technique. Seed priming involved the pre-treatment of seeds using natural, synthetic priming agents which includes, water treatment, salts, phytohormones, osmolytes, chemicals, nanoparticles etc., that help to boost uniform seed germination, quick establishment and increased tolerance against environmental constraints. Different seed priming strategies are available based on priming agent, and often termed as hydro-priming, osmo-priming, halopriming, hormopriming, bio-priming etc.priming with nanomaterial can also induce faster germination and increase tolerance for adverse conditions. Seed priming methods ameliorate better nutrient managements system and help uniform and fast seed germination process even under limiting environmental condition by mitigating the effect of abiotic stress. This review article is the compilation of several pieces of research adopted the seed priming methods using a variety of priming agents and observed their impact on seed germination, growth and resistance for abiotic stress

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in various crops. This strategy will be helpful for its wide application in agriculture to deal with reducing seed germination barriers, declining crop productivity due to adverse conditions.

INTRODUCTION

Abiotic stress like, salinity, drought, heat, chill etc.,are critical abiotic stresses intensified by changing climate that challenges crop production and quality. Abiotic stress especially drought and salinity are most challenging to present agricultures system leading to limit agricultural productivity. Drought and salinity are intensified by climate change and limit the crop production and quality of the product as well. Rough calculations indicated that around 1.8 billion people will be facing acute water shortage in the first quarter of 21st century while rest of the population will face water crisis to a considerable extent [1]. Among the various abiotic stresses, drought, salinity and temperature are important constraints for declining agricultural productivity worldwide. There is a strong need to deal with the issues of declining crop productivity and agricultural sustainability due to changed climatic conditions. Development of effective methods and technological advances in agriculture system could offer a better solution to deal with the issues of drought and salinity to sustain agricultural productivity. Such strategies can promote crop resilience under abiotic stress and help mitigation under adverse conditions. Moreover, such techniques can only be widely applied in agriculture system if these techniques are low budget and do not adversely affect the ecosystem. They should be based on promoting the tolerance and adaptability of plants under unfavourable environmental conditions. Plants are evolved with different approaches to cope with adverse situations. These strategies enable plants to tolerate the stressfull conditions and can minimize the deleterious effect of abiotic stresses on various physiological pathways and cop productivity. Being a sessile organism, plants developed various mechanisms to respond against adverse conditions. Plant responses to various stress at several levels i.e., physiological level, biochemical level, molecular level, through modulating different pathways to mitigate the negative impact on plants due to environmental fluctuations [2].In the present agriculture scenario, there is a pressing demand for food production, so it is important to look for techniques that can provide a better approach to deal with reducing crop yield due to several stresses. Moreover, the continuous development of technologies such as seed priming, tissue culture, and genetic engineering are needed, which can offer a better approach for improving growth and productivity in plants.

Seed germination is a very important process consisting of several processes and various cascades of reactions at cellular levels that are involved in effective nutrient mobilization and proper development of the embryo [3]. The seed germination starts with a process of water imbibition by seeds, followed by rupture of seed coat and the emergence of the radical [4]. Importantly, germination requires the optimum environment for successful germination. Therefore, the germination process is very susceptible to environmental fluctuations causing poor germination or no germination. The changing climatic conditions and frequent incidences of environmental stresses exhibit the immense pressure on agriculture system by reducing yield and crop production. Non-uniform and poor seed germination, low establishment and poor seedling growth are a major concern in an agriculture system that put a major constraint on agricultural crop productivity due to environmental stress. The initial stages of germination and seedling establishment are critically effected processes under abiotic stress especially drought, salinity, chill, and temperature etc., which severely affects seed germination and exhibit negative impact on crop growth, yield and also associated with economic loss[5,6]. Seed priming is a simple and low cost pre-germination strategy, which can effectively help to get better germination, quick establishment and uniform seedling growth by minimizing the negative effects of abiotic stress on the process. Seed priming strategy is used to reduce the limiting conditions faced during seed germination and emergence even under environmental stressful situations. It also offers quick and uniform germination of seeds by minimizing the inhibitory effects especially developed because of desiccation and salinity stress [7].Seed priming is one of the low risk and low budget technique that has huge potential to deal with

limiting effects of adverse conditions including abiotic stresses faced at the time of germination process and seedling establishment in the soil. The preconditioning of seeds through priming process not only enhances water uptake and utilization but also improves germination, which ultimately enhances crop growth, development and yield [8,9].

Seed Priming Methods

In recent years, more focus on the development of priming methods, identification of various priming agents and processes of priming etc., have seen in the agricultural system. Primarily, in the majority of cases, seed priming involved the controlled moisture imbibition, which triggers the first reversible germination stage without protrusion of radical from the seed coat. The imbibed seeds are further dehydrated again to a plausible level and kept for final sowing [10].Seed priming technique is very much relevant in today's agriculture system for agricultural sustainability and technology development to deal with the adverse effect of environmental stress especially drought, salinity, heat, extreme temperature etc. which greatly limits the agricultural crop productivity and yield[2]. In recent years, the scientific community has put a major focus on developing technological advancements and methods for increasing innate adaptability of crops to develop abiotic stress tolerance. Among the various techniques, the priming technique has come up as one of the promising strategies to develop seed resilience against unfavourable conditions including salt and drought etc., for better seed germination under limiting conditions. Seed priming is a pre-sown technique that helps seeds to develop certain specific physiological state when pre-treated with natural and chemical priming agents. This technique help plants to exhibit better germination, radicle emergence fast growth and also offer improved tolerance against abiotic stress in contrast of non-primed seed through modulating several metabolic pathways [10,11].

There are several approaches utilizes for priming seeds based on the use of priming agent for seed priming purpose, i.e., Hydropriming which use the water as priming agent [12,13], osmo-priming, associated with pre-treatment of seed with compounds like polyethylene glycol, mannitol glycerol etc.[14]. Halo-priming is the process where seeds are primed with salt solutions for certain duration to get preconditioning of seeds before seed sowing [15]. Hormo-priming is one of the strategies, which includes the use of natural and synthetic hormones etc., which imparts a positive effect on plant growth. Furthermore, the bio-priming technique that can induce systemic resistance, and improved plant growth includes, application of microbial agents exhibit plant growth improving properties as priming agent. The seed treatment with plant growth-promoting (PGP) microbes not only enhances seed germination, seedling growth but also induce tolerance against biotic and abiotic stresses [16].The seeds treatment before seed sowing using several priming agents has shown potential importance in inducing abiotic stress tolerance and better germination and seedling growth in plants[17,18]. Crop plants developed from primed seeds exhibit instant cellular response against environmental stress thereby showed better tolerance under stressful conditions whereas it is not so in non-primed seeds. The primed seeds upon germination exhibit a not only quick germination and uniform seedling growth but also improved tolerance to abiotic stresses than seedlings emerged from untreated (non-primed) ones.

Seed priming induces the resistance in plants through regulating the several physiological and metabolic pathways, leading to control effective plant responses against the abiotic stress. Seed priming is the pre-treatment of seeds by natural or synthetic chemicals alone or in different combinations before seed sowing for germination. This not only promotes quick and uniform seed germination but also helps to get better growth in seedlings and induce the plant to react quickly against abiotic stress effectively [19].Application of beta aminobutyric acid on rice (*Oryza sativa* L.) exhibited better seed germination and improved tolerance under (NaCl) salinity stress and drought stress[20]. The seed priming process includes controlled seed hydration that not only increases germination rate and but also induces uniform and quick seedling growth under stress as well as normal situation. The effectiveness of seed priming is governed by different factors, which contribute to improved seed germination. These factors include seed quality, ambient temperature, aeration, moisture etc. along with induction of several cellular processes including activation of various enzymes, and metabolic pathways. Moreover, seed priming helps to overcome seed dormancy barriers and maintain cellular processes including induction of antioxidant enzymes and other cellular defence

responses to initiate seed germination quickly under adverse environmental conditions. Further, the improved antioxidant system helps to strengthen plant tolerance against stressful conditions. The different seed priming methods are currently applied in the present agriculture system to enhance seed germination rate, seedling growth and improved resistance under adverse environmental conditions. Several priming agent natural or chemical agents are used for seed priming purposes including with water (hydro priming), plant growth regulators, beta-amino butyric acid, 5-aminolevulinic acid, osmoprotectant, melatonin, chitosan, plant extract, polyethylene glycol, and inorganic salts [21].

Seed Priming using Plant Growth Regulators

Seed priming using natural and synthetic plant growth regulators one of the methods that have shown huge potential to improve seed germination and other plant growth-promoting processes. This method is also referred to as hormo-priming. Seed treatment with plant growth regulators exhibit not only positive influence on germination and growth but also improved tolerance under abiotic stress conditions. Several plant growth regulators (PGRs) including natural and synthetic are used as a seed priming agent, for example, salicylic acid, jasmonic acid, auxins, gibberellins polyamines etc. Plant growth regulators control the growth and developmental activities in plants by modulating several physiological and metabolic processes including germination and tolerance against abiotic stress [22]. Applications of plant growth regulators also induce antioxidant system in plants leading to mitigate the impact of abiotic stress. The enhanced antioxidant system resulted in improved tolerance of plants against environmental stress. The use of synthetic plant growth regulators have shown improved tolerance in crops under abiotic stress[23]. Apart from natural phytohormones, various synthetic compounds exhibit growth promotion attributes in plants and commonly referred to as plant growth regulators. These synthetic chemicals may regulate different cellular processes at physiological biochemical levels in a plant under adverse environment and induce plants to respond and mitigate the adverse effects of both biotic as well as abiotic stress. Among synthetic plant growth regulators, thiourea (TU) is an important synthetic plant growth regulator, which consisted of 36% nitrogen, and 42% sulphur. Thiourea (TU) has shown its importance in augmenting tolerance in plants against abiotic stresses [24]. Thiourea (TU) priming revealed the improved salinity tolerance in *Brassica juncea*, which is attributed to varying jasmonate and auxin concentration level along with ABA under abiotic stress [25].

Salicylic acid is a well known synthetic phytohormone and its role as seed priming agent along with sodium hydrosulfide has shown enhanced tolerance in maize against lead stress. Seed treated with salicylic acid (SA) and sodium hydrosulfide results into lowering the accumulation of amino acids (like methionine, arginine and proline) and enhanced accumulation of glycine betaine (GB) and nitric oxide under adverse environmental situations in maize [26]. Osmopriming in sugar beet seeds using polyethylene glycol and synthetic plant growth regulators (methyl jasmonate and acetylsalicylic acid) exhibited quick and uniform germination with better seedling growth in sugar beet under low temperature conditions (chill stress), which further strengthen the importance of pre-sowing seed priming technique in germination and tolerance under stress [27]. Increased seed germination and better tolerance level under salinity stress were reported in wheat (*Triticum aestivum* L) by priming seeds with cytokinins. This was attributed to an enhanced level of salicylic acid and polyamines in wheat [28]. Seed priming technology using a diverse group of priming agents have shown better germination rate, quick emergence, faster establishment and uniform seedling growth etc. as reported in sesame plant[29].The role of different synthetic growth regulators in plants i.e., salicylic acid, gibberellic acid and thiourea (TU)and other chemicals like H_2O_2, ascorbic as seed priming agent have exhibited improved seed germination and induced tolerance against environmental stress. The study in sunflower seeds pre-treated with these priming agents have shown better germination, reduced germination time and growth by effective regulation of cellular processes[30].The osmopriming and hydropriming prior to sowing in sorghum seed revealed fast germination and better growth [31]. Osmopriming using PEG solution (-0.4MPa) in addition to gibberellic acid as priming agent increased germination vigour and tolerance under cold stress conditions in corn seeds as compared to non-primed corn seeds[32]. Seed treatment using diverse priming agents in various spices also indicated the improved seed germination and induced antioxidant enzymes that proved to be helpful in acquiring the better tolerance against adverse conditions [33].

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Salicylic acid is a well-known signalling molecule in inducing the plant defence system to biotic as well as abiotic stresses [34,35,23]. Pre-sowing treatment of capsicum seed with salicylic acid have shown better tolerance under drought stress [36]. Recently, it is reported the enhanced tolerance in maize seedlings under chill stress. Chill stress is a major limiting effect on maize germination, seed emergence and seedling growth. Maize (*Zea mays* L.*)* seeds primed with salicylic acid and H_2O_2, exhibits the improved tolerance under chill stress, which is attributed to higher soluble sugar content and increased alpha-amylase activity. Further, enhanced antioxidant system and induced endogenous level of salicylic acid and H_2O_2 level in primed seed provided effective tolerance against chill stress in maize germination and development (*Zea mays* L.)[37]. Seed priming in sweet pepper (*Capsicum annum* L.) using salicylic acid as priming agent have shown enhanced seed germination up to 30% and better seedling growth as compared to non-primed seed germination under salinity stress at 60.0 mM level. The seeds primed with 0.2-0.3mM concentration of SA exhibited the reduced ethylene level and increased level antioxidant enzymes activities [38]. A study in rice (*Oryza sativa.* L) seeds using priming technique reported improved seed germination seedling development under PEG mediated water stress[39].Improved seed germination was observed in pigeon pea (*Cajanus Cajan* (L.) Mill sp when primed with phytohormones including; Auxin gibberellin (GA_3), cytokinin, ethylene (ET, chloroethyl phosphonic acid (CEPA), abscisic acid (ABA) in contrast of non-primed seed as control under cadmium (Cd) heavy metal stress condition[40].Seeds treatment using brassinolide in lucerne (*Medicago sativa* L) has reported improved germination and resistance under salt stress[41]. Recently, Huang *et al.,*(2020)reported the use of brassinosteroid (BR) as seed priming agent on peanut, it was observed that seed priming with BR has shown better germination and more yield under drought stress. Moreover, BR priming also revealed the improved tolerance in peanut against drought stress [42].

Seed Priming using Nanoparticles (Nanopriming)

The several studies conducted on the application of different nanoparticles and combination of nanoparticles, which impart beneficial effect on plants helping to improve plants resilience under abiotic stress and improved agricultural productivity [43]. In recent years, nanotechnology has emerged as potential technology in the agriculture sector. The emergence of advanced seed priming technology using nanoparticles for smart agriculture has provided a new approach to overcome adverse effects of abiotic stress and improving crop productivity. Increasing knowledge of nanoparticles and considering the positive effect of nanotechnology in the agriculture sector. It can help in addressing the issues of plant adaptation under adverse conditions like drought and salinity. Moreover, cost-effective production of nanoparticles using a green method further give impetus its uses in agriculture [44]. Moreover, less consumption of nanoparticles in crop area further makes it more advantageous in the agriculture sector. The effect due to nanoparticles application against abiotic stress i.e. drought and salt is dependent on nanoparticles composition and concentration [45].Enhance activity of antioxidant enzymes were also reported in wheat. Wheat seeds primed with colloidal solution of Zn and Cu nanoparticles were evaluated for abiotic stress tolerance. The study reported the increased level of antioxidant enzymes i.e., SOD, Catalase and reduced level of lipid peroxidation, which clearly indicated the enhance resilience for drought stress in wheat [46]. In recent years several nanoparticle-based studies were conducted on seed germination as pre-treatment agent, and obtained plausible results in term of seed germination, seedling growth and abiotic stress tolerances. The study conducted on treatment peanut seeds nano-sized zinc oxide (ZnO) suspensions of different concentration. The 1000 ppm concentration revealed the improved seed germination, stand establishment seedling, whereas higher concentration exhibit inhibitory effect [47]. Further, ZnO nanoparticles suspension treatment of tomato (*Solanum lycopersicum*) seed exhibited a promotive effect on seed germination in lower concentration however higher concentration imparts inhibitory effect on seed germination [48].

Nanopriming techniques have shown promising results in jasmine rice (*Oryza sativa* L. cv. KDML 105) in terms of germination and seedling emergence. The research reported that rice seeds primed with silver nanoparticle solutions (AgNPs10 and AgNPs20) have shown early seed germination, increased germination percentage and better growth as compared to those of non-primed seed. Moreover, silver nanoparticle priming also exhibited enhanced antioxidant enzyme activities in contrast to non-primed seeds. Since activated antioxidant system plays a vital role

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in inducing tolerance under stress conditions, therefore the application of nanopriming as a tool to enhance seed germination and tolerance under stress could be a potential tool as a pre-sowing method for better tolerance and improved germination under stress [49].

ZnO nanoparticle (ZNPs) seed priming in lupine plant exhibited the better seed germination and tolerance under salinity stress in contrast to non-primed seed. The study observed the improved seed germination and enhanced tolerance against salt stress is attributed due to improved antioxidant enzymes level i.e., superoxide dismutase (SOD), peroxidase (POD), and ascorbate peroxidase (APX), and accumulation of osmolytes. Therefore, seed priming with 60 mg L^{-1} ZnNPs concentration can be used as one of the strategy for quick germination and seedling growth and better tolerance under salinity stress [50].The utilization of silver nanoparticles (AgNP) for seed priming has attributed to increased germination and resistance under abiotic stressful conditions in *Vicia faba* bean. Seeds primed using silver nanoparticles solution also induced the antioxidant enzymes and plant vigour [51]. Haghighi *et al.*,(2014) revealed the application of nano-size titanium dioxide (N-TiO$_2$) application as seed priming agents for tomato (*Lycopersicum esculentum* L.), onion (*Allium cepa* L.), and radish (*Raphanus sativus* L.) have shown the improved seed germination in these crops although the concentration of nano-size titanium dioxide (N-TiO$_2$) varies for different crops to imparts its beneficial effect on seed germination. Therefore, the application N-TiO$_2$ as seed priming agent can further be evaluated for other crops also in different combinations to get fast and improved seed germination[52]. In recent years, the application of nanoparticles suspensions as seed priming agent is emerging as a potential technology to get uniform seed germination and enhanced tolerance against abiotic stress. Oat (*Avena sativa* L) seeds primed with different concentration of two nanoparticles namely titanium dioxide (TiO2) and cerium oxide, which exhibited better seed germination and growth [53]. Deepak *et al.*,(2019) revealed the improved effect of nanoparticle on germination and tolerance for abiotic stress in watermelon [*Citrullus lanatus* (Thunb.)] by using iron oxide nanoparticles (Fe-NPs) as seed priming agent. Recently, the positive effect of Fe-NPs as seed priming agents, that reported to modulate the 12-oxo phytodienoic acid (OPDA) level watermelon seedlings in both diploid and triploid verities and induce nonenzymatic antioxidant system using jasmonates-linked defence responses[54]. Acharya*et al.*, (2020) recently, reported the improved seed germination, seedling establishment and yield in watermelons (*Citrullus lanatus*) primed with turmeric oil nano-emulsions (TNE) and silver nanoparticles (AgNPs)[55].

Chemical Seed Priming

Several studies indicated that seed priming with suitable priming agents has an immense positive impact on seed germination, growth and vigour ie., Seed priming study using hydropriming and osmohardening with KCl and CaCl$_2$ in late sowing wheat variety revealed the increase in grain yield as compared to those of non-primed seeds [56]. Cotton seeds primed with potassium nitrate also exhibited improved and quick seed germination and seedling growth, moreover, hydropriming also revealed the better seed germination rates in contrast to non-primed seeds [57]. Seed priming using KNO$_3$(3%) solution as a priming agent in the seeds of different varieties of wheat also revealed superior germination, better growth and yield under sodic soil conditions[58]. Seed priming using calcium chloride (CaCl$_2$) solution also demonstrated better germination rate and induced tolerance in important aromatic rice under salinity stress [59]. Patade, *et al.*,(2011)revealed the seed priming effect in capsicum (*Capsicum annuum L. cv. California Wonder*) causing quick and more germination and better tolerance on subsequent stress exposure. Capsicum seeds were treated with different chemical agents namely, thiourea (TU), hydrogen peroxide (HP, 1.5 mM) or ABA (AB, 100 \iM) for 24 hrs with moderate shaking. The study indicated the improved seed germination and tolerance against salt and cold stress were exhibited by primed seed on germination as compared to control (non-primed) seed, primed seed were more tolerant when subjected to the salt (NaCl, 200 mM) stress or cold (4°C) stress even for 10 days. Moreover, the plants developed from primed seeds were also shown early flowering in comparison to that of control plant developed from non-primed seeds [60]. Osmopriming using 15% CaCl$_2$ on Wheat (*Triticumaestivum*) seeds have reported to have quick and uniform germination and induced tolerance when experienced abiotic stress (drought). The improved tolerance was attributed to reduced lipid peroxidation and more accumulation of osmolytes, thereby maintaining the effective water relation and osmotic adjustment in plants under

drought stress. It is further added that osmopriming gives better output than priming with water only (hydropriming) primarily on seed emergence and induction of drought stress tolerance in wheat [61].

In a comparative study of priming methods using different priming agents like water, plant growth regulator (abscisic acid) and calcium chloride ($CaCl_2$). The findings corroborated to higher accumulation of different osmolytes (i.e., free proline, glycine betaine) and phenolics compounds. Apart from this, the induced activity of antioxidant enzymes (i.e., Glutathione reductase and superoxide dismutase) were also reported in mustard (*Brassica juncea* L,) seedling grown under salt and polyethylene glycol (PEG) induces moisture stress in primed seed as compared to non-primed seeds. This also indicated better abiotic stress resistance in mustard. Moreover, the primed seed also exhibited an increased rate of seed germination rate and better seedling growth in mustard[62].A study in coriander (*Coriandrum sativum*)using salts like sodium chloride (NaCl) and calcium chloride ($CaCl_2$) solutions for priming coriander seeds revealed the better and uniform seed germination and improved seedling growth including enhanced tolerance under salinity stress as compared to unprimed seed, which indicated that halopriming solutions are capable to induce tolerance against salinity stress and prevent slowdown of germination process[63]. Seed priming study in safflower (*Carthamus tinctorius*)seeds also revealed the ameliorative effect in germination tolerance under salinity stress[64].Whereas priming in fennel seeds using polyethylene glycol (PEG) exhibited not only increased seed germination vigour but also enhanced seedling growth attributes including plumule and radicle length, seedling length, fresh and dry mass of seedling [65].Application of glycine betaine (GB) as a priming agent on wheat seed exhibited the improved tolerance in salinity stress. GB application improves the ionic homeostasis [66].Yan M., (2015), conducted the seed priming study in Chinese cabbage (*Brassica rapa* subsp. *Pekinensis*) using the 200 mmol/l potassium nitrate (KNO_3), urea (200 mmol/l) solutions for seed priming. The seeds were allowed to imbibe for 8 h at 20 °C in these solutions. It was revealed that primed seed exhibited improved germination and seedling growth under moisture stress created by using PE solutions of different concentrations, especially in those primed with potassium nitrate (KNO_3) as compared to un-primed seeds [7].

CONCLUSION

Seed germination is a very crucial stage for any crop, which is vital for plant establishment and development which determine the future crop yield. Among the several techniques, approaches and practices available for quick seed germination and crop protection against abiotic stress, seed priming offers the most promising strategy. This approach is not only eco-friendly but also offers low-cost alternative solutions to improve seed germination, seedling establishment in various crops under adverse situations. Studies in several crops using several natural and chemical compounds as priming agents revealed better results on germination rate and induced tolerance under abiotic stress. Priming can alter physiological state in order to improve seed germination vigour and induce tolerance, by inducing several biochemical and metabolic routes involved in defence response against environmental challenges. Therefore, the seed priming (pre-treatment) prior to seed sowing is a very important technique that needs to be developed as a potential technology that can provide the value-added solutions to augment better seed germination, crop yield and adaptability to crops under stress.

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Table 1.Seed priming methods for abiotic stress tolerance in different crops indicated the improved seed germination and tolerance against abiotic stress.

S.No	Crop	Priming agents	Abiotic stress.	Effects	Reference
1.	Capsicum (*Capsicum annuum L. cv. California Wonder*)	Thiourea and hydrogen peroxide	Cold stress and Salinity stress	Improved germination and stress tolerance	Patade *et al.,*2011 [60]
2.	*Brassica juncea,*	Thiourea (TU),	Salinity stress	Improved Germination	Srivastavav *et al.,*2017[25]
3.	Maize (*Zea mays L.*)	salicylic acid and sodium hydrosulfide	Heavy metal (Lead) Stress	Improved Germination, Induced antioxidant system	Zanganeh *et al.,* 2018 [26]
4	Corn	PEG solution (-0.4MPa) in Gibbrellic acid)	Cold stress	Germination. Cold stress	Pallaorao,*et al.,* 2016 [32]
5	Wheat (*Triticum aestivum*)	ZnNPs and CuNPs nanoparticles	Drought stress	Increased level of antioxidant enzymes activities	Taran *et al.,*2017[46]
6	Sweet pepper (*Capsicum annuum L.*)	Salicylic Acid (SA) 0.2-0.3mM	Salinity Stress	Increased level of antioxidant enzymes activities	Ahmed *et al.,* 2020. [38]
7	Lupine plant	ZnO nanoparticle (ZNPs) 60mg/l	Salinity stress	Increased seed germination, and increased antioxidant enzymes activities	Abdel Latef, *et al.,*2017 [50]
8	Rice (*oryza sativa.*L).	Salicylic acid (100ppm)	PEG induced drought stress	Increased seed germination, vigor index, higher soot and root length.	Satapathy*et al.,* 2018 [39]
9	Pea nut	Brassinosteroid (BR)	Drought stress	Improved seed germination, enhanced tolerance	Huang *et al.,*2020[42]
10	Wheat (*Triticum aestivum*)	Calcium chloride (CaCl$_2$)15%	Drought stress	Improved seed germination, enhanced osmolytes accumulation	Tabassum, *et al.,*2018 [61]
11	Wheat (*Triticum aestivum*)	Glycine beatin (GB)	Salinity stress	Improved germination and ionic homeostasis	Salama *et al.,*2015 [66]
12	Chinese cabbage (*Brassica rapa* subsp. *Pekinensis*)	KNO$_3$ (200 mmol/l) Urea (200 mmol/l)	Drought stress	Increased seed germination, and increased antioxidant enzymes activities	Yan M., 2015. [7]
13	Rice (*Oryza sativa* L)	Beta amino butyric acid (BABA)	NaCl (Salt) and PEG induced stress	Enhanced seed germination, and increased antioxidant enzymes activities, MDA content.	Jisha and Puthur, 2016 [20]

Table 2.Beneficial effects on seed germination and seedling growth in nanoparticle solution treated seeds of different crops.

| S.No	Crop	Nanoparticle seed treatment	Effect	Reference
1.	Bean (*Vicia faba)*	Silver nanoparticles (AgNP)	Increased seed germination, and increased antioxidant enzymes activities.	Younis, *et al.,* 2019 [51]
2.	Watermelons (*Citrullus lanatus*)	Turmeric oil nano-emulsions (TNE) and silver nanoparticles (AgNPs)	Increased seed germination, and increased antioxidant enzymes activities	Acharya, *et al.,*2020[55]
3	Jasmine rice (*Oryza sativa* L. cv. KDML 105)	AgNPs10 and AgNPs20	Increased seed germination. Seedling growth. Increased antioxidant system.	Mahakham *et al.,*2017. [49]
4	Oat (*Avena sativa* L)	titanium dioxide(TiO$_2$NP)	Improved seed germination and seedling growth	Andersen *et al.,*2016. [53]
5	Watermelon (*Citrullus lanatus* (Thunb.)	Iron oxide nanoparticles (Fe-NPs)	Nontoxic effect on seed germination, Increased nonenzymatic antioxidant potential	Deepak *et al.,*2019.[54]
6	Tomato (*Lycopersicum esculentum* L.), Onion (*Allium cepa* L.), and Radish (*Raphanus sativus* L.)	Nano-size Titanium dioxide (N-TiO$_2$) 100/200mg/l	Improved seed germination. Seedling growth.	Haghighi *et al.,*2014. [52]
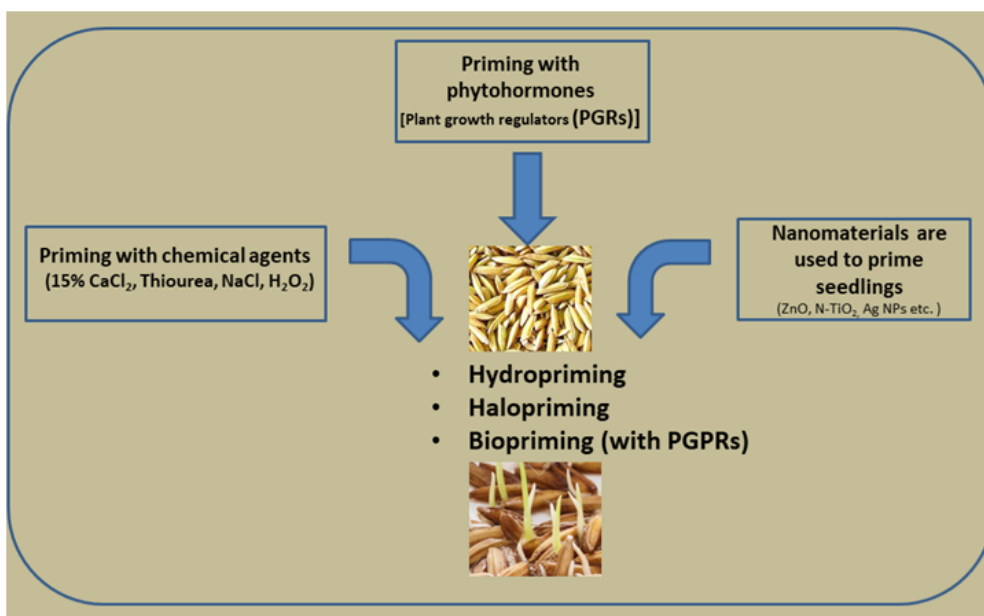
Figure 1.Overall illustrations of seed priming methods using various agents.

RESEARCH ARTICLE

RP-HPLC Method Development and Validation for Estimation of Rivaroxaban in Pharmaceutical Dosage Forms

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ABSTRACT

Rivaroxaban, an anti-clotting medication, acts at a crucial point in the blood-clotting process and stops the formation of blood clots. In this study, RP-HPLC method was developed for the determination of Rivaroxaban in tablets. A new simple, precise method was developed for Rivaroxaban by using RP-HPLC. The compound was separated by using column symmetry -C18,250 mm x 4.6 mm x 5μm, Flow rate was 1.0 mL/min; wavelength of 250 nm, Mobile phase was A:B = 40:60 (v/v).Solvent;A, Acetonitrile :B 0.1% phosphoric acid. The injection volume was 20μL and Run time 20.0 minutes. The retention time of Rivaroxaban was 6.12 min. The percentage purity was found to be 98.30. The validation parameters Specificity, Accuracy, linearity, LOD, LOQ and Robustness were studied. The developed method was validated according to the ICH guidelines and found to be linear within the range 16 – 24μg/mL^{-1} with good Correlation coefficient Value of 0.9994. The method was Accurate, Precise, Robust and rapid.

Keywords: RP-HPLC, Rivaroxaban, Validation and Method Development.

INTRODUCTION

Rivaroxaban sold under the name Xarelto among others, is an anticoagulant (blood thinner) used to treat and stop blood clots [1] Specifically it's used to treat deep vein thrombosis and pulmonary emboli and stop blood clots in fibrillation and following hip or knee surgery. It's taken orally [1]. Chemically it's (S)-5-chloro-N-{(2-oxo-3-(4-(3-

oxomorpholin-4-yl) phenyl)oxazolidin-5-yl)methyl} thiophene-2-carboxamide. The formula of Rivaroxaban is C19H18CIN3O2S with its relative molecular mass 435.88g.mol-1. Common side effects include bleeding and other serious side effects may include spinal hematoma and anaphylaxis [1]. It's unclear if use in pregnancy, and breastfeeding is safe [1] Compared to warfarin it's fewer interactions with other medications [2] it works by blocking the activity of the clotting protein factor Xa [1]. Rivaroxaban was patented in 2007 and approved for medical use within the use in 2011[3]. Rivaroxaban inhibits both free Factor Xa Factor Xa bound within the prothrombinase complex [4]. It is a highly selective direct Factor Xa inhibitor with a rapid onset of action .Inhibition of Factor Xa interrupts the intrinsic and extrinsic pathway of the blood coagulation cascade inhibiting both thrombin formation and development of thrombi. Rivaroxaban doesn't inhibit thrombin (activated Factor II) and no effects on platelets are demonstrated [5]. it allows predictable anticoagulation and dose adjustment and routine coagulation monitoring[5]. dietary restrictions aren't needed [6] Unfractionated heparin (UFH), Low relative molecular mass heparin (LMWH) and fondaparinux also inhibit the activity of factor Xa, indirectly, by binding to circulating antithrombin (ATIII) and must be injected, whereas the orally active warfarin, phenprocoumon, and acenocoumarol are vitamin K antagonist (VKA),decreasing sort of coagulation factors, including prothrombinase [7] Rivaroxaban has predictable pharmacokinetics across an honest spectrum of patients (age, gender, weight, race) and features a flate dose response across an eightfold dose range (5-40mg) [8]. The oral bioavailability decreases with higher doses and increases when crazy food [9]. Rivaroxaban bears a striking structural similarity to the antibiotic linezolid: both drugs share the same oxazolidinone-derived core structure. Accordingly, rivaroxaban was studied for any possible antimicrobial effects and thus the likelihood of mitochondrial toxicity. which can be a known complication of long-term linezolid use. Studies found that neither rivaroxaban nor its metabolites have any antibiotics effect against Gram-positive bacteria. As for mitochondrial toxicity, in vitro studies published before 2008 found the danger to be low [10]. The reported methods are RP-HPLC [11-16] In this study, it had been aimed to develop an accurate, precise, robust, rapid and selective HPLC method for determination of Rivaroxaban in tablet dosage forms. the stableness of Rivaroxaban was evaluated and also a forced degradation procedure was applied under stress conditions like heat, acidic-alkali conditions, and irradiation with UV light. The developed method was fully validated according to the ICH (ICH,2005) guidelines and observed that it had been capable of determining Rivaroxaban within the presence of forced degradation products. Therefore, it would be concluded that this method could be proposed for the quality control process of Rivaroxaban in pharmaceutical industry. The structure of Rivaroxaban are given in Figure.1

MATERIALS AND METHODS

All solvents were HPLC grade and Reagents were Analytical Grade. Acetonitrile from RANCHEM, 0.1% Ortho phosphoric acid from Merck. Rivaoxaban were procured from Glenmark Pharmaceuticals Mumbai. The method was developed in Waters HPLC symmetry **C18**, 250 mm x 4.6 mm,5µm or equivalent. The Mobile Phase consists of acetonitrile: 0.1% ortho phosphoric acid, water solution (40:60), The injection volume was 20 µl with flow rate of 1.0 ml per minute and wavelength was 250 nm. The analysis was performed at constant column temperature at 30° C. Mobile Phase was used as Diluent

Method development
Selection of Wavelength
Isobestic point Rivaroxaban was determined by dissolve it in Acetonitrile and scanned between 200 - 400nm and the Isobestic Point was found to be 250nm

Preparation of Standard Stock Solution
Standard Stock solution preparation
Accurately weigh about 10mg of Rivaroxaban reference standard (or working standard) into 100ml volumetric flasks. Make up to volume with sample solvent and sonicate for a minimum of 15 minutes until completely dissolved.

Assay standard solution preparation for Rivaroxaban 20 mg tablets
Transfer 2.0 ml of standard stock solution to a 10ml volumetric flask. make up to volume with sample solvent and sonicate for homogenization.

Assay test stock solution for 20 mg tablets
Accurately weigh the drug powder mixture equivalent to 20 mg Rivaroxaban (103mg) into a 100ml volumetric flask. Add sample solvent and sonicate for around 15 minutes. Cool down to room temperature and bring to volume with the same solvent. Centrifuge until a clear liquid is obtained.(The solution concentration is equivalent to 200ppm Rivaroxaban).

Assay test solution for 20mg tablets
Transfer 1.0 ml of the Assay test stock solution into a 10ml volumetric flask. Make up to volume with the sample solvent and sonicate for homogrnization.(The solution concentration is equivalent to 20 ppm Rivaroxaban).

VALIDATION
This method was validate according to the ICH Guidelines, the following parameters were studied

Accuracy or (Recovery)
The accuracy or recovery of the method was determined by adding standard solution of Rivaroxaban to an aliquot of placebo solution prepared with placebo of Rivaoxaban tablets (20mgstrengths).This solution was then treated as test solution and the amount of Rivaroxaban was determined against a standard solution. The results of % recovery of Eight samples were shown that a good recovery of Rivaroxaban from the samples matrix. True value is embraced by the 95% confidence interval, thus ,the obtained results of recovery close to true value and the method is accurate for the assay of Rivaroxaban tablets. The Accuracy were carried out by 80%,100%,120% to determine the recovery study.

Linearity
Linearity test result gives assurance that method is valid for its intended use throughout the specified ranges. Incremental concentration of standard solution for active substance was prepared in the working range i.e. about 50% 100%,150% to 350% of the analyzing concentration (target concentration) to verify that the response is proportionately linear. Solutions of Rivaroxaban standard of different strength were prepared and chromatograph; corresponding peak areas were recorded and the calibration graph was drawn for Rivaroxaban by plotting response (peak area) against concentration. The final concentration in the range of (16.0 mg/ml to 24.0 mg/ml in which method were linear.

Precision
Repeatability of (Day 1)
The precision of the assay method was determined by analyzing 6 test samples prepared as directed in the test method. The %RSD of 6 results of assay should not be more than 2.0%.The % of relative standard deviation of six test results are within the acceptance limit, indicating that the good precision of the test method.

Intermediate precision (Day 2)
The precision of the assay method was determined by analyzing 6 test samples prepared as directed in the test method in another lab. The % RSD of 6 results of assay should not be more than 2.0%.The % of relative standard deviation of six test results are within the acceptance limit, indicating that the good reproducibility of the test method.

Robustness

Robustness is a measure of the methods capability to remain unaffected by small, but deliberate variations in method parameters. The selected parameters for study presentation are stated in table.3 and the results are presented in table 3(a) and table.3 (b). Robustness study was done by changing the Column temperature, mobile phase ratio changes. The % RSD was not more than 2 as per ICH guidelines.

Stability of Standard solution and sample

Run solutions of samples and standard kept at room temperature (25°C±5°C) in transparent flasks and in fried conditions (6°C±2°C),respectively calculate % recovery from initial test point registered to Repeatability test. The % Recovery =98-102% for all tested solutions.

System Suitability

A). System Analysis

The HPLC system was equilibrating with the mobile phase, injection of system suitability solution is performing. Replicate injections were made with standard solutions from table.4. Symmetry (Tailing) is close to 1.0 and will suffice for peak symmetry acceptance.

B). System Precision

The system precision is assessing using standard consecutive injections.The %RSD of the peaks is noted.table.5

LOD and LOQ

Limit of detection was carried out in Rivaroxaban the value was found to be 3.7µg/ml. Limit of quantification was carried out in Rivaroxaban the value was found to be 10.12% .

CONCLUSION

In the present study, an attempt was made to develop a simple, accurate, selective and sensitive RP-HPLC method of Rivaroxaban in pharmaceutical analysis. This method is the only reported method up to date for the determination of Rivaroxaban in pharmaceutical dosage forms. The method was validated for selectivity, accuracy, linearity, precision,(inter-day and intra-day), sensitivity, robustness and ruggedness in accordance with ICH guidelines. The results from stress testing, including Separation of the degradation product and quantification of rivaroxaban after exposure to stress conditions show the method is stability-indicating and capable of determining Rivaroxaban in presence of its degradation products. This indicates the selectivity of the method. A simple mobile phase without preparation of any buffer solution or adding ion-pairing agents and a short run times are advantageous and make this method suitable for routine analysis of large number of samples per day.

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Table : 1 .Assay of Rivaroxaban

Commercial Formulation	Drug	Standard area	Sample Area	Label Claim (mg)	% Purity
Rivaxon 20 mg	Rivaroxaban	1249909	1212622	20 mg	98.30

Tab :2. Linearity of Rivaroxaban

S.No	Rivaroxaban	
	Conc (µg/ml)	Mean area
1	16	1011.1
2	18	1140.1
3	20	1269.3
4	22	1388.6
5	24	1508.7
Correlation Coefficient (R^2)		0.9994

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Table: 3-Robustness of Rivaroxaban

Parameter	Method reference conditions	variation	Acceptance Criteria Assay
Mobile phase	A :B= 40:60	A:B=42:58 A:B=38:62	%Recovery=98-102 %Recovery =98-102
Column temperature	30°C	32°C 28°C	%Recovery = 98-102 %Recovery = 98-102

Table : 3-(a) –Mobile Phase

	A:B = 42:58	Method reference A:B =40:60	A :B = 38:62
Solution 2 vs Solution II	100.2	100.4	100.2
% Recovery	99.8		99.8
Drug substance assay solution 4 vs solution IV	98.7	97.8	98.0
%Recovery	100.9		100.2
Drug product 20 mg assay solution 13 vs solution IX	98.6	99.6	97.6
%Recovery	99.0		98.0

Table : 3-(b) –Column temperature

	32°C	Method reference 30°C	28°C
Solution 2 vs Solution II	100.1	100.4	100.0
% Recovery	99.7		99.6
Drug substance assay solution 4 vs solution IV	99.2	97.8	98.4
%Recovery	101.4		100.6
Drug product 20 mg assay solution 13 vs solution IX	97.6	99.6	97.0
%Recovery	98.0		97.0

System Suitability
Table : 4. System Analysis

Solution	parameter
Solutio II	T = 0.95
Drug substance Assay	N = 5789
Solution VIII	T = 0.97
Drug product 20 mg dose Assay	N = 6085

Table : 5. System Precision

Injection No	Peak Area solution II	Peak Area solution VII
1.	14776.5	1212.6
2.	14784.9	1212.4
3.	14789.3	1210.5
Mean	14783.6	1211.8
%RSD	0.04	0.10

Table :6 . LOD and LOQ
Limit of detection (LOD) and Limit of quantification (LOQ) of Rivaroxaban

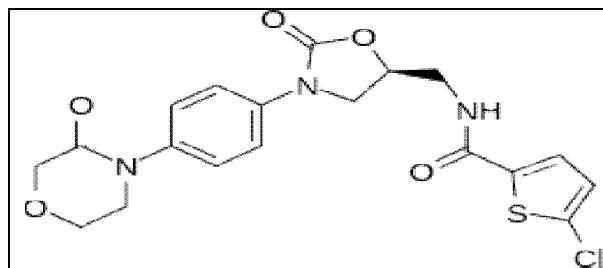| S.no	Parameters	Rivaroxaban
1.	LOD	3.7
2.	LOQ	10.12
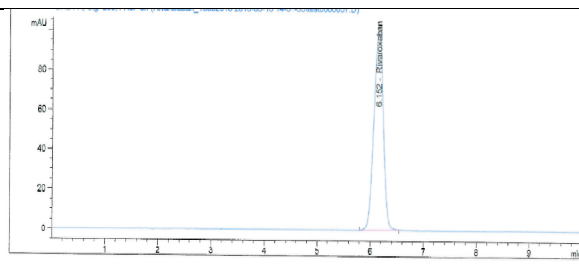
Fig.1.Rivaroxaban	**Fig. 2. Chromatogram of Rivaroxaban**
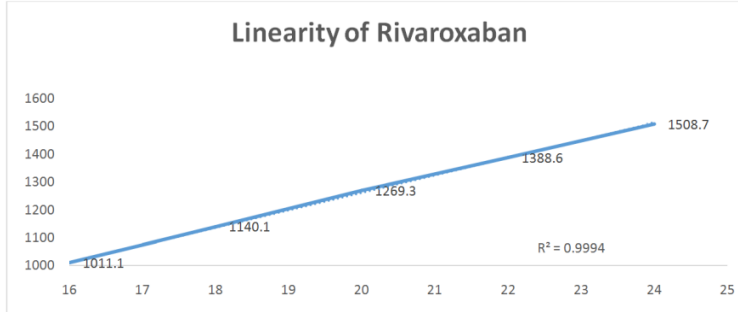
Fig.3.Linearity of Rivaroxaban

RESEARCH ARTICLE

Occurrence and Species Diversity of Butterflies in Southern Part of Eastern Ghats (Pachamalai Hills)

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ABSTRACT

The present study demonstrated the occurrence and diversity of butterflies in different habitats of the Pachamalai hills in Eastern Ghats during the period of four months from December 2018 to March 2019. A total of 105 butterfly belonging to 5 families, viz. *Hesperiidae* (5), *Papilionidae* (8), *Pieridae* (5), *Lycaenidae* (5) and *Nymphalidae* (5)were recorded during the study from four different locations such as deep forest, road side, water body and agriculture field.

Keywords: Eastern Ghats, Pachamalai Hills, Species Diversity, Butterfly.

INTRODUCTION

Butterflies are plant dependent group of insects compared to other mega-diverse insects (Kristensen and Skalski, 1999). Butterflies are considered as beneficial insects due to their service inplant pollination and they acts as the indicators of environmental quality and are greatly appreciated for their aesthetic value (Chakravarthy et al. 1997). The life history of butterflies reveals that lepidopetra are exposed to a wide range of environmental conditions and are highly sensitive to the climatic changes including the varying temperature, humidity and light (Erhardt 1985; Warren et al. 2001). Butterflies are good indicators in terms of anthropogeneic disturbances and habitat quality (Kocher and Williams, 2000).Particularly in forest ecosystem when habitats are fragmented, butterflies that shift from one habitat to other have increased change of exposure to predators and are vulnerable to disturbances associated

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with human activity. The effect of habitat lose can be seen clearly with the declining population of butterflies. Moreover, the butterflies that are displaced after habitat loss disappear subsequently. Climatic changes impact the diversity of species were expected to exacerbate the ecosystem (Scott et al. 2005). The changes in parameters of temperature, rainfall patterns, and extreme weather conditions such as heat waves, prolonged drought or excessive rainfall, have to be taken into consideration. Deletion of nectar and desiccation of host plants cause direct mortality and induce migratory behaviour. Agricultural intensification is widely accepted as a cause of biodiversity decline. It is however a broad concept encompassing many factors, such as the loss of semi-natural habitat, fragmentation of ecosystem, use of heavy machinery and increased input of insecticides, pesticides and herbicides. Mainly chemical pesticides potentially affect development of butterfly larva and nectar producing plants which adversely affect adult butterfly diversity. Developments of agriculture fields in forest ecosystem endanger many species throughout the world; at present extinction rates are estimated to be 100 to1000 times the natural rate depending on the taxonomic group.

It has been reported that different types of butterflies are present in the Eastern Ghats due to the unique climatic conditions and tropical temperature with very high rainfall throughout the year (Larsen 1988), which are favourable for the rich variety of many species. In the present study, diversity of butterfly communities has been documented in Pachamalai hill that situated in the Eastern Ghats along the state of Tamil Nadu in South India and the dominance and evenness of butterflies across four different habitats were investigated in order to correlate with the anthropological activity, availability of host plants and their nectar source.

MATERIALS AND METHODS

Sampling location and sampling period
The study was conducted in the Pachamalai hills, a part of Eastern Ghats located in Tamil Nadu, South India. The four study area covered in this study includes deep forest, road side, water body and agriculture field and four sampling sites were selected from Eastern Ghats. The butterflies were observed in the area for a period of 4 months (December 2018-March 2019). Each study site was visited once in a week and transects were observed from early morning to afternoon (7am to 5pm) during good weather.

Sampling Techniques
The butterflies were observed and recorded directly in the field following the Pollard Walk method (Pollard, 1977; Pollard and Yates, 1993) with modifications. For each site there were five transect plants (1000m each) in 500-m gap Individuals were counted on either side of the path (at a distance of 2.5m). Thus, there were a total 5km (1000m × 5) transect for each site each week. Photographs of all the butterflies were taken using digital camera during the present survey and preserved for taxonomical documentation.

RESULTS

A total of 105 butterflies consisting of 28 species belonging to 5 families were observed in the present study at Pachamalai hills. The list of butterflies has summarized in Table 1 and Figure 1 represents the photomicrographs of each butterfly species identified. There was a significant difference in number of species between different habitat types. Species richness was greater in deep forest (266) than in other three habitats like road side(260), water body(238)and agri field(81). The average number of various butterfly species in each families that were recorded from different habitats were plotted in figure 2-6.

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DISCUSSSION

Butterflies in all the habitats have flight periods, and their abundance strongly correlates with their different flight periods (Leather 1984; Norris 1935). Almost all butterflies are abundant in short peak in particular seasons, and may or may not appear in other seasons. Diversity and abundance of butterflies correlate with the flowering phenology of plants (Gutierrez and Mendez, 1995; Watt et al. 1974; Kunte 2000). Among the habitats studied, less abundance was recorded in the Agri field area habitat of Eastern Ghats which could be due to non-availability of host plant. This needs to be studied further. Presence of butterfly species at a particular habitat depends on a wide range of factors; the availability of food and microclimate are considered most important (Janzen and Schoener, 1968). In our results, the river bank habitat has the greatest abundance of butterflies but lower species number than the forest and crop area habitats. The living environment of the river bank habitat is diversified with vegetation, rocks, sand, animal dung, mud, with water that attracts more butterflies (Janzen and Schoener, 1968), and thus the river bank habitat has the greatest abundance of butterflies. The Agri field habitat is less diverse (81species) than other three sites, which may be due to the non-availability of host plants and human activities.

CONCLUSION AND RECOMMEDATIONS

It can be concluded that the butterflies' diversity and abundance have significantly declined in the Agri field area habitats than the other three habitats, road side, waterbody and deep forest habitat. This is probably due to the destruction of host plant in Agri field area habitat, use of chemical pesticides, and human disturbance. Fragmentation of forest for forest area could certainly destroy the host plant and could greatly influence the biodiversity of butterflies. Biodiversity laws alone cannot create awareness and conserve butterflies. It is very important to understand the relation between host plant and the butterflies to protect them as they have co-evolved. Eastern Ghats being one of the biodiversity heritage sites need more attention for effective conservation of butterflies.

ACKNOWLEDGMENT

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Table 1. List of butterflies present in the study area

| Name of the Family	S. No.	Common Name	Scientific Name
Papilionidae	1	Common Jay	*Graphium doson*
	2	Tailed Jay	*Graphium agamemmnon*
	3	Common Mormon	*Papililo polytes*
	4	Lime Butterfly	*Papililo demoleus*
	5	Common Mime	*Chilasa clytia*
	6	Blue Mormon	*Papilio polymnestor*
	7	common Rose	*Pachliopta aristolochiae*
	8	Crimson Rose	*Pachliopta hector*
Pieridae	9	Common Wanderer	*Pareonia valeria*
	10	Common Gull	*Cepora nerissa*
	11	Common Jezebel	*Delias eucharis*
	12	Psyche	*Leptosia nina*
	13	Pioneer	*Belenois aurota*
Nymphalidae	14	Blue Tiger	*Tirumala limniace*
	15	Striped Tiger	*Danaus genutia*
	16	Plain Tiger	*Danaus chysippus*
	17	Common Baron	*Euthalia aconthea*
	18	Common Castor	*Ariadne merione*
Lycaenidae	19	Apefly	*Spalgis nublius*
	20	Indian Sunbeam	*Curetis thetis*
	21	Monkey Puzzle	*Rathinda amor*
	22	Slate flash	*Rapala manea*
	23	CommonSliverline	*Spindasis vulcanus*
Hesperiidae	24	Brown Awl	*Badamia exclamationis*
	25	Common Banded Awl	*Hasora chromus*
	26	Indian Skipper	*Spialia galba*
	27	Common Grass Dartlet	*Taractrocera maevius*
	28	Rice Swift	*Borbocinnara*
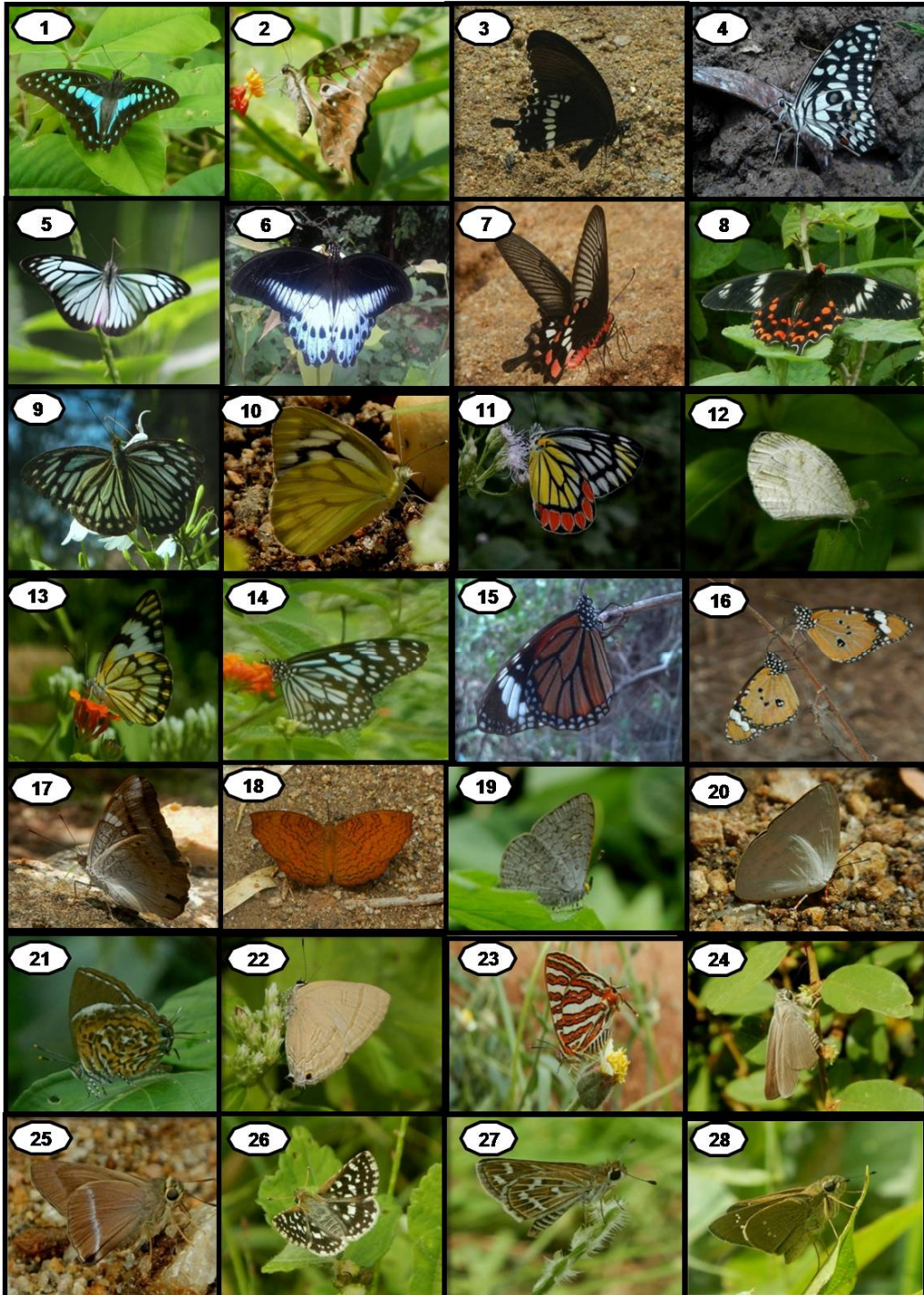
Fig. 1: Photographs of butterflies identified from the Pachamalai hills
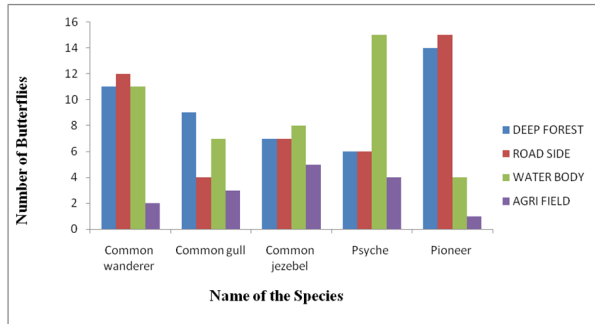
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Fig. 3: Butterflies of Pieridae family present in different fields of Pachamalai hills.
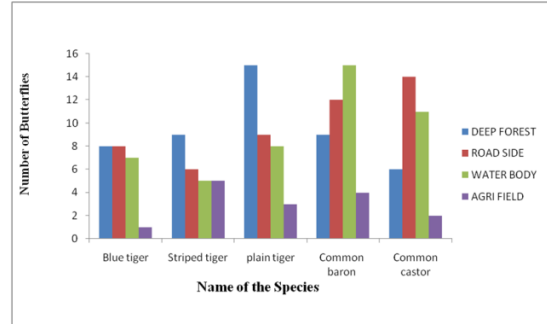

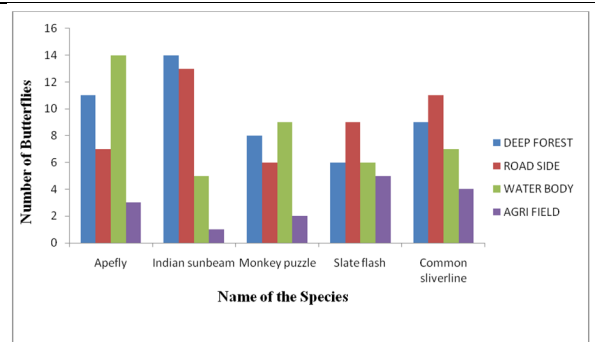**Fig. 4: Butterflies of nymphalidae family present in different fields of Pachamalai hills.**

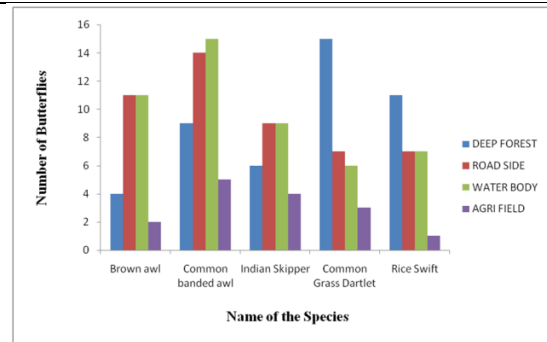**Fig. 5: Butterflies of lycaenidae family present in different fields of Pachamalai hills**

Fig. 6: Butterflies of Hesperiidae family present in different fields of Pachamalai hills

RESEARCH ARTICLE

Evaluation of Antimicrobial Activity of Ethanolic Extract of *Quisqualis indica* Linn

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ABSTRACT

The plant *Quisqualis indica* Linn is an ethnopharmacologically important plant. The present study was emphasized on evaluating the antibacterial and antifungal potential of the crude extract and different solvent extracts of leaves and flowers of *Quisqualis indica* Linn using agar well diffusion method. Antibacterial activity was evaluated by using pathogenic bacteria *Staphylococcus aureus*, *Klebsiella pneumonia, Pseudomonas aeruginosa* and *Bacillus subtilis*. Antifungal activity was evaluated on *Aspergillus niger* and *Candida albicans.* Ethanol extract showed best activity against pathogenic bacteria and fungi. In case of gram-positive bacteria *S. aureus* and *B. subtilis* inhibition zones of 14mm and 11 mm was seen respectively and in case of gram-negative bacteria 15 mm and 11 mm of inhibition zone was seen against *P. aeruginosa* and *Klebsiella pneumoniae* respectively at a concentration of 800 mcg/ml. Ethanolic extract of *Quisqualis indica* Linn (800mcg) showed a zone of inhibition of 13mm against *Candida albicans.*

Keywords: *Quisqualis indica* Linn, Anti-bacterial, Anti-fungal.

INTRODUCTION

Wide spread use of antibiotics has many side effects and also cause drug resistance. Therefore, the scientific world is in search of natural drugs which exhibit antimicrobial properties. Since long time, aromatic plants have some role in preserving food against microorganisms. The protective effect of these types of plants may be due to the presence of secondary metabolites such as phenolic compounds in their essential oils. Many essential oils posess significant activity against insects and microorganisms. (Sahraei, Mohkami &Golshani, 2014)

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In recent years multiple drug resistance in human pathogenic microorganisms has developed due to indiscriminate use of commercially available anti-microbial drugs.(Karaman, Sahin &Gulluce, 2003). So, there is a need for development of natural strategies to manage microbial infections. This situation leads to the search for new antimicrobial agents from plants. (Bhattacharjee, Chatterjee, & Chandra, 2006).Recently the scientific world is in search of medicinal plants with antibacterial properties. (Mukherjee, Bhattacharya & Chandra, 2015;Rawani, Pal& Chandra, 2011).

Quisqualis indica Linn (Family - Combretaceae,) is an evergreen creeping shrub, which can be as much as 70 feet long in tropical climates.The leaves of *Quisqualis indica* Linn are opposite and has a length of about 7 - 15 cm. Its flowers have a faint sweet aroma and they bloom in the spring, early summer or mid fall. Leaf decoction significantly reduces abdominal pain and the leaf juice has alleviating effect on boils and ulcers. The leaves are used for the treatment of skin diseases where as the roots are effective in rheumatism and diarrhoea. (Welsh,1998). Fruits of *Quisqualis indica* Linn have curative effect in as cariasis and oxyuriasis. Decoction of the fruit helps to reduce tooth pain and renal disorders. The roasted ripe seeds of *Quisqualis indica* Linn has therapeutic effect on diarrhoea, fever and rickets. Seeds infusions are used to alleviating parasitic skin infestations. (De Padua, Bunyapraphatsara & Lemmens, 1999) Besides, the plant extract has been found to be anticoccidial for veterinary purposes. (Youn & Noh, 2001). The methanolic leafextract of *Quisqualis indica* Linn exhibits antipyretic activity against Brewer's yeast induced pyrexia model in rats. (Singh et al,2010).The ethanolic flower extract of *Quisqualis indica* Linn significantly reduce the gastric acidity, and esophagitis (Sarita et al, 2017).Petroleum ether and methanol extract of leaves of *Quisqualis indica* Linn exhibited moderate antioxidant property. (Zahidul, 2017). Yashraj *et al.* evaluated the anti-inflammatory activity of hydroalcoholic extract of *Quisqualis indica* Linn in Wistar rats and this gives justification for the use of this plant as an anti-inflammatory agent. (Yash raj, Mohanty, &Kasture,2011).

The antihyperlipidemic effect of methanolic and aqueous extract leaves of *Quisqualis indica* Linn. was investigated in rats and concluded that methanolic extract was more effective than aqueous extract showed effects comparable antihyperlipidemic as that of standard atorvastatin. (Jyoti, Pushpendra & Balkrishna, 2012)Analgesic activity of hydroalcoholic extract of *Quisqualis indica* Linn. leaves was evaluated in wistar rats at 100 and 200 mg/kg p.o. and concluded that the hydroalcoholic extract possessed dose-dependentanalgesic activity against experimentally induced pain.(Kavita , Hemlata & Avantika (2017).Petroleum ether extract of leaves of *Quisqualis indica* Linn. used against experimentally induced diarrhoea at the doses (100, 200 mg/kg, p.o) and concluded that possessed dose-dependent antidiarrheal activity. (Nitu , Govind, Rajesh & Gnaneshwari,2013) Bairagi *et al.* investigated the antidiabetic potential of *Quisqualis indica* Linn. flowers using alloxan-induced diabetes models and concluded that plant extract significantly decreased the blood sugar level.(Bairagi , Sadu , Senthil Kumar & Ahir , 2012). Antiparasitic activities of different leaf extracts of *Quisqualis indica* Linn. were studied separately on adult Indian earthworm (*Pheretima posthuma*). Studies indicates that methanolic extract and aqueous extract of *Quisqualis indica* Linn. showed anti-helminthes activity at a concentration of 60 mg/ml of each. (Sarma et al, 2015). The aim of the present study was to investigate the antimicrobial potential of different extracts of *Quisqualis indica* Linn. against different strains of pathogenic bacteria and fungi. Antibacterial activity was evaluated on *Staphylococcus aureus*, *Bacillus subtilis, pseudomonas aeruginosa* and *Klebsiella pneumoniae.* Antifungal activity was evaluated on *Aspergillus niger, candida albicans.*

Materials and methods

Plant material
The leaves and flowers of *Quisqualis indica* Linn. were collected from Thanjavur in the month of September 2019. The plant identification and authentication was done bythe botanist Dr.A. Balasubramanian. The authenticated plants were used for preparation of extracts.
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Extraction

The cleaned and powdered leaves and flowers of *Quisqualis indica* Linn. was used for extraction purpose. 300grms of powdered material was evenly packed in the Soxhlet apparatus. It was then extracted with various solvents from non-polar to polar such as petroleum ether (60 - 80^{0}C, distilled water and ethanol 90% v/v (75 – 78 ^{0} C) by Continuous hot percolation process.

Culture medium and inoculum details

The susceptibility of microorganisms to antibacterial agents was tested on Mueller Hinton Agar M173 HI Media. For the preparation of media, suspend 38 grams in 1000 ml distilled water. Dissolve the medium completely by boiling. Sterilize by autoclaving at 15 lbs. pressure (121°C) for 15 minutes. Cool to 45-50°C. Mix the medium and pour into sterile petridish. Inoculums were procured from The Microbial Type Culture Collection and Gene Bank (MTCC) Chandigarh.

Rose Bengal agar M842 HI media used for determination of susceptibility of fungal strains to antifungal agents. Suspend 31.55 grams of media in 1000 ml distilled water. Dissolve the medium completely by boiling. Sterilize by autoclaving at 15lbs. pressure at121°C for 15 minutes. Cool to 45-50°C. Mix well and pour into sterile petri dishes. Inoculums were procured from The *Microbial* type Culture Collection and Gene Bank (MTCC) Chandigarh.

Experimental method

Antimicrobial activity of the plant extracts is usually evaluated by agar well diffusion method. For evaluating antibacterial activity, 15-20 mL of Mueller-Hinton agar was poured on glass Petri plates of same size and allowed to solidify. Wells were prepared aseptically on each plate using asterile cork borer. The wells have a diameter of 8 mm and they are 20 mm apart from one another. Standardized inoculums of the test organism were uniformly spread on the surface of these plates using sterile cotton swab. A volume (50 µL) of the extract solution at desired concentration was added to the wells and one well with Gentamyc in maintained as positive and DMSO as a negative control. Then, the agar plates were incubated under suitable conditions depending upon the test microorganism. After incubation, clear zone was observed. The zone of inhibition of the bacterial growth was measured in mm. For the evaluation of antifungal activity, 15-20 mL of Rose Bengal agar was poured on glass petri dishes of same size and allowed to solidify. Wells of diameter 8 mm (20 mm apart from one another) were punched aseptically with a sterile cork borer in each plate. Standardized inoculums of the test organism were uniformly spread on the surface of these plates using sterile cotton swab. A volume (50 µL) of the extract solution at desired concentration was added to the wells and one well with Clotrimazole maintained as positive and DMSO as a negative control. Then, incubation of the agar plates was done under suitable conditions depending upon the test microorganism. After incubation, clear zone was observed. The zone of inhibition of the fungal growth was measured in mm.

RESULTS AND DISCUSSION

In the present investigation, in vitro antibacterial and anti-fungal activity of the ethanolic extracts of *Quisqualis indica* Linn. was quantitatively evaluated on the basis of zone of inhibition. The two different concentrations of ethanolic extracts of *Quisqualis indica* Linn. studied in the present investigation exhibited varying degree of inhibitory effect against the selected bacterial and fungal pathogens. The ethanolic extract of *Quisqualis indica* Linn. exhibited anti-bacterial activity against *Staphylococcus aureus, Bacillus subtilis, Pseudomonas aeruginosa* and *Klebsiella pneumonia.* Ethanolic extract of *Quisqualis indica* Linn. EEQI 400mcg (T1) and EEQI 800mcg (T2) sample were produced the zone of inhibition of 11mm and 14mm respectively against *Staphylococcus aureus. Bacillus subtilis and Klebsiella pneumonia* showed a zone of inhibition of 11mm at 800mcg/ml concentration. EEQI 400mcg(T1) and EEQI (800mcg) T2 sample were produced a zone of inhibition of 12mm and 15mm respectively against *Pseudomonas aeruginosa*, Gentamicin was taken as the reference standard. It produced a of zone of inhibition of 30mm. The results were presented in the table 3 and 4and figures1 to 4. From the results, we concluded that EEQI (800mcg)

more significant anti-bacterial activity against *Pseudomonas aeruginosa, and* the extract showed the high zone of inhibition at 800mcg.

CONCLUSION

The present study reveals that the ethanolic extract of *Quisqualis indica* Linn. has antibacterial and antifungal properties. Hence the ethanolic extract of *Quisqualis indica* Linn. can be used as a source for isolation of potent antibacterial and antifungal agents.

Conflict of interest
There is no conflict of interest among the contributing authors.

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Table 1: Inoculum details

S.no	Bacteria	MTCC No	Incubation condition
1	*Staphylococcus aureus*	87	37^{0}C for 24 hours
2	*Bacillus subtilis*	2413	37^{0}C for 24 hours
3	*Pseudomonas aeruginosa*	424	37^{0}C for 24 hours
4	*Klebsiella pneumonia*	109	37^{0}C for 24 hours

Table 2: Inoculum details

Fungi	MTCC No	Incubation condition	
Aspergillus niger	281	27^{0}C	For 48 hours
Candida Albicans	227	27^{0}C	For 24 hours

Table 3: Antibacterial assay by agar well diffusion method

Antibacterial assay			
Organism name		*Staphylococcus aureus*	*Bacillus subtilis*
Sample	Concentrations of sample	Zone of inhibition(mm)	
EEQI	Standard Gentamycin (80mcg)	25	30
	Negative control	-	-
	T1 (400mcg)	11	-
	T2(800mcg)	14	11

Table 4: Antibacterial assay by agar well diffusion method

Organism name		*Pseudomonas aeruginosa*	*Klebsiella pneumonia*
Sample	Concentrations of sample	Zone of inhibition (mm)	
EEQI	Standard Gentamycin (80mcg)	28	25
	Negative control	-	-
	T1 (400mcg)	12	-
	T2(800mcg)	15	11

Table 5: Anti-fungal assay by agar well diffusion method

Antifungal assay			
Culture		*Candida albicans*	*Aspergillus niger*
Sample	Concentration of samples	Zone of inhibition(mm)	
EEQI	Standard Clotrimazole (200mcg)	26	22
	Negative control	-	-
	T1 (400mcg)	07	-
	T2(800mcg)	13	-

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Figure 1: *Bacillus subtilis*	**Figure 2:** *Klebsiella pneumonia*

Figure 3: *Pseudomonas aeruginosa*	**Figure 4:** *Staphylococcus aureus*

T₁-Ethanolic Extract of *Quisqualis indica* **Linn 400 Mg T₂-Ethanolic Extract of** *Quisqualis indica* **Linn 800Mg Standard – Gentamycin(80mcg)**

Figure 5: *Candida albicans*	**Figure 6:** *Aspergillus niger*

T₁-Ethanolic Extract of *Quisqualis indica* **Linn 400mcg T2 -Ethanolic Extract of** *Quisqualis indica* **Linn 800 mcg Standard – Clotrimazole (200mcg).**