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RESEARCH ARTICLE

Potential Use of Potato Peel as a Raw Material for Vermicomposting

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ABSTRACT

Recycling of organic wastes into enriched nutrient supplement for soil as well as plant is a global challenge to formulate and implement .Potato peel (PP) wastes are one of the organic wastes regarded as a potential threat to the environment due to the microbial spoilage. These are usually disposed of locally as animal feed, composted or added to landfill. A large proportion ends up in landfill sites, where it produces methane which is a more potent GHG than CO2. Vermicomposting is a cost-effective economic process, in which earthworms are used to degrade and recycle the futile organic wastes for an ecological purpose. Vermicomposting is a process of biochemical degradation of organic materials by the action of earthworms and microorganisms. A vermicomposting system using cow manure, soil and potato peel was set up to find a variable alternative material for improving the physico-chemical properties of vermicompost after 60 to 70 days. After the introduction of earthworms *Eudrillus eugeniae* to the various setups, the pH, moisture content and electrical conductivities of different setups including control and experimental were recorded at various stages of vermicomposting to analysis the production of vermicompost for sustainable plant growth.

Keywords: Potato peel, Vermicomposting, *Eudrillus eugeniae*

INTRODUCTION

The fourth most important crop following rice, wheat and corn (Wu D., 2016) is potato (*Solanum tuberosum*) as a vegetable plays a vital role in our daily diet in various forms such as chips, snacks, wafers etc. Around 31 million tons of potatoes are produced all over in the world. India is the second largest potato producer in the world after china. About 45.4 million tons of potato produced in India every year which is equivalent to 12% of world

production. (Devrani M, Pal M, Soi S. Potato Waste.) Out of this, about 35% of potato discarded as waste during household usage and industrial processing which are generally unavoidable. These wastes are regarded as a potential threat to the environment due to microbial spoilage. These are usually disposed of locally as animal feed, composted or added to landfill. A large proportion ends up in landfill sites, where it produces methane which is a more potent GHG than CO2. Potato peel waste are rich in starch, cellulose, hemicellulose, polyphenols, lipids and fermentable sugars. So these wastes should be properly and efficiently managed to explore its potential to preserve the health of the environment. Potato peels are used as a source for biogas, ethanol production, low-value animal feed, food preservation, and antimicrobial and antioxidant production (Gebrechristos and Chen, 2018). Till date, very limited study has been reported on the vermicomposting of potato peel.

Vermicomposting is a cost-effective economic process, in which earthworms are used to degrade and recycle the futile organic wastes for an ecological purpose. Vermicomposting is a process of biochemical degradation of organic materials by earthworms and microorganisms. Although microorganisms participate in decomposition of organic matter, earthworms act as a critical driver of this process by comminuting the organic matter, increasing the area of aerobic microbial activity and triggering the enzymatic activity, thus stimulating the decomposition further2) (Huang et al., 2012). This compost can be used as soil amendment, manure for agronomical benefits in place of chemical fertilizers. To promote the ecofriendly use of potato peel, vermicomposting is a sustainable process. Potato peel is rich in organic matter and biodegradable, so earthworms and microorganisms can easily degrade it. Also, abundant availability and biodegradable nature of potato waste makes it a potential source for vermicomposting.

MATERIALS AND METHODS

In this section the information was given about the materials and methods used to conduct the experiment. This enlighten the collection of raw materials such as soil, cow dung and potato peel as well as collection of earthworms for next process.

Collection of Raw Materials

In this study, soil and cow dung were the base materials used for cultural bed preparation. Both the raw materials were collected from Centurion University of Technology and Management, Bhubaneswar Campus, Odisha, India. Potato peel which was used as raw material in vermiculture for nutrition of earthworms, collected from hostel canteens inside the same campus.

Processing (Drying and Sieving Of Raw Materials)

The collected soil and cow dung was carried out for sun drying till one week and after that the sieving was done manually through a sieve of diameter 35mm to segregate hard and uncrushed substances. Thereafter, the soil and cow dung was mixed according to the designed proportion. After exposed to sun drying, potato peels were grinded for proper mixing in an appropriate proportion in soil and cow dung mixture.

Collection of Earthworms

The earthworms (*Eudrilus eugeniae*) were collected from vermicomposting unit of CUTM campus, Bhubaneswar, Odisha, India. Before the introduction of the earthworms into the cultural beds the length and width of the earthworms were measured. This was done to know the impact of the cultural beds environment on the growth of earthworms and estimated the rate of vermicomposting.

Preparation of Experimental Set up

About 6 plastic containers were used for containing the mixture of soil, cow dung and potato peel of various proportions of 20%, 40%, 60%, 80%, 100% for prepare vermicomposting process. The prepared mixture was sprinkled with water at a regular interval of 2 days for maintaining the moist condition. Fresh cow dung was added

as slurry to these mixtures at a regular interval of 7days. The mixtures were subjected to determine PH, moisture content and electric conductivity to compare the characteristics of the mixtures during vermicomposting

Characterization of the Mixtures

Before characterization the mixtures (soil+ cow dung+ potato peel) were properly dried, homogenized and sieved. The moisture content was determined according to the standard ASTM D1762-84. First weighing of the mixtures were done in a weighing balance (aczet CY224) with an accuracy of 0.0001g. Then the sample was put in a hot air oven at a temperature of 105°C for 24h until a constant weight obtained. Then the samples were again weighed to determine the moisture content (weight basis). For measuring pH of the mixture, a slurry was prepared by mixing 2g of sample in 10ml of distilled water (2:10, w/v). The mixture was shaken manually for 1h to obtain a homogenous mixture and allow to cool to room temperature. Then the mixture was filtered through Whatman filter paper to obtain the filtrate. Then pH of the samples were measured by a microcontroller based pH meter at a temperature of 26.4°C (Chemi Line Technologies). The same filtrate was used to measure the electrical conductivity by a digital electrical conductivity meter (pH meter).X-ray fluorescence (XRF) technique was used to determine the type of compounds present in soil, cow dung and potato peel

XRF Analysis of Soil, Cow dung and Potato Peel

XRF results for the collected soil, cow dung and potato peels are depicted in Table 2, table 3 and table 4 respectively. From the analysis, it was found that SiO_2 is the major compound present in soil (67.566 %) and cow dung (48.295 %) while K_2O (57.307 %) is abundant in potato peel. Various compounds such as Al_2O_3, P_2O_5, CaO, V_2O_5, Eu_2O_3, Cl, K_2O, CuO, Fe_2O_3 also present in different concentration.

RESULTS AND DISCUSSION

Designed proportion of soil, cow dung and potato peel in different experimental setup were introduced with 3 number of earthworms (Table-1). By the action of earthworm *E. eugeniae* the potato peel was converted into stabilized nutrient-rich material in the process of vermicomposting. Earthworm activities like metabolism, growth and respiration are greatly influenced by temperature which leads to survive (Hou *et al*., 2005; Qiao *et al*., 2003). During vermicomposting process 40-50% moisture requires for favourable microbial activity and it make easy to feed by earthworm (Sharma *et al*., 2005). The observation and study of different physico-chemical parameter of the present experiment was carried out of each proportion with tables and plotting graphs. Table1.and Table2. explained about the study of different proportional setups and the physico-chemical parameters such as pH, temp, moisture and EC of individual materials was measured. Biomass of earthworm has also been calculated in tabulated form. In Table 2. it was concluded that soil and cow dung were acidic in nature while potato peel was alkaline. After introduction of earthworms to the various setups, the pH of the experimental setups (set-1 to set-4) where potato peels were mixed in various amounts, the pH in alkaline range. The electrical conductivities and moisture content of all setups including control were reduced at various stages of vermicomposting. Greater reduction in electrical conductivity was obtained in experimental setup (potato peel + cow dung) with highest moisture retention capacity (9.8 %). Higher moisture storage also less susceptible to nutrient leaching from soil which will have more agronomical benefits.

Survival rate of earthworm has been calculated in an interval of 15 days up to 3 months by counting the number of earthworms that present and the growth was estimated by measuring length of body and diameter of annules shown in Table-3.The survival rate with earthworm growth was plotted in Graph-1 and Graph -3 presenting that it was possible in very low percentage of potato peel like in set-1 and set-2. During initial treatment the death of earthworm occurred only in experimental set which contained whole PP and in Set-4 it only survived for 2-3 days. The biomass was reduced except set-1 and set-2.The physico-chemical parameters of different sets was measured during precomposting and different time interval of vermicomposting. Except experimental and control the electro-

conductivity was reduced as compared to final reading which increased with alkalinity more in soil. Similarly pH was shown more acidic except set 1 and 2 where it was slightly acidic might have due to bacterial decomposition. The temperature is almost increased in all sets except in control set where it slightly less occurred due to the heat generated during composting and vermicomposting shown in Table-4 and plotted in Graph-2.

CONCLUSIONS

From the present study it was observed and studied that the potato waste taken in the form of peel were highly degradable after introducing vermicomposting technique within 60 to 70 days than natural process of degradation. This experiment was subjected to produce large amount of vermicompost for agricultural activity. The lower proportion of potato peel was considered for proper vermicomposting as it was studied that favoured for both microbial as well earthworm activity. From the XRF analysis, it was found that soil and cow dung is rich in SiO_2 while K_2O is the main component in potato peel. After the introduction of earthworms to the various setups, the pH, moisture content and electrical conductivities of different experimental setups including control were reduced at various stages of vermicomposting. Lowest electrical conductivity and highest moisture content was observed in the potato peel and cowdung mixture which explains the potential of potato peel as a suitable material for vermicomposting and the outcome of it can be used for sustainable plant growth.

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Table 1. Experimental setups of various ratios of potato peel

Experimental setups	Mixing proportion (cowdung + soil)/potato peel)	Percentage of potato peel used (%)
Control	1.0	0
Set-1	4:1	20
Set-2	3:2	40
Set-3	2:3	60
Set-4	1:4	80
Experimental	0:1	100

TABLE 2. Characterization of different experimental setups (before & after vermicomposting)

Experimental setups	pH			Electro-conductivity			Moisture content (%, wb)			Temperature in ℃	
	Initial	Final	Difference	Initial	Final	difference	Initial	Final	Difference	Initial	Final
Contr	6.64	6.98	0.34	0.816	0.810	0.006	12	8.4	3.6	24.8	24.3

ol											
Set-1	7.28	7.50	0.22	0.779	0.754	0.025	12	9.2	2.8	24.2	26.3
Set-2	7.19	7.69	0.50	0.788	0.748	0.04	12	9.0	3.0	24.2	26.1
Set-3	7.24	7.92	0.68	0.764	0.736	0.028	12	8.6	3.4	24.6	26.6
Set-4	7.34	7.96	0.62	0.752	0.720	0.032	12	9.1	2.9	24.7	26.3
Experimental	7.23	8.40	1.17	0.775	0.712	0.063	12	9.8	2.2	25.9	25.5

Table 3. Survival of Earthworm in various proportion of potato peel

Sl.No.	Proportional setup	Initial number of earthworm	Survival of earthworm in 1st 15days	Survival in 2nd 15days/after 1 month	Survival in 3rd 15days	Survival in 4th 15days
1.	Control	3	3	3	3	3
2.	SET-1	3	3	3	3	3
3.	SET-2	3	3	2	2	3
4.	SET-3	3	3	2	1	Death
5.	SET-4	3	2	Death	Death	Death
6.	Experimental	3	Death	Death	Death	Death

TABLE 4. Characterization of raw materials (Soil+ Cow dung +Potato peel)

Raw materials	pH	Electrical conductivity in S/m	Temperature (°C)
Soil	6.58	32.9	23.9
Cow dung	6.83	0.647 m	23.9
Potato peel	7.89	132.1	25.9

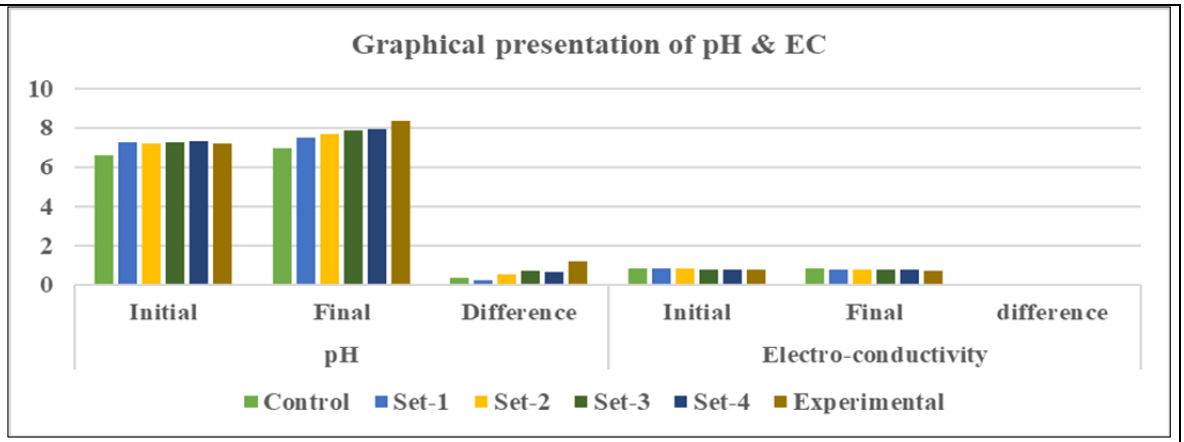

Fig.1 Graphical presentation of pH and EC(electro-conductivity)

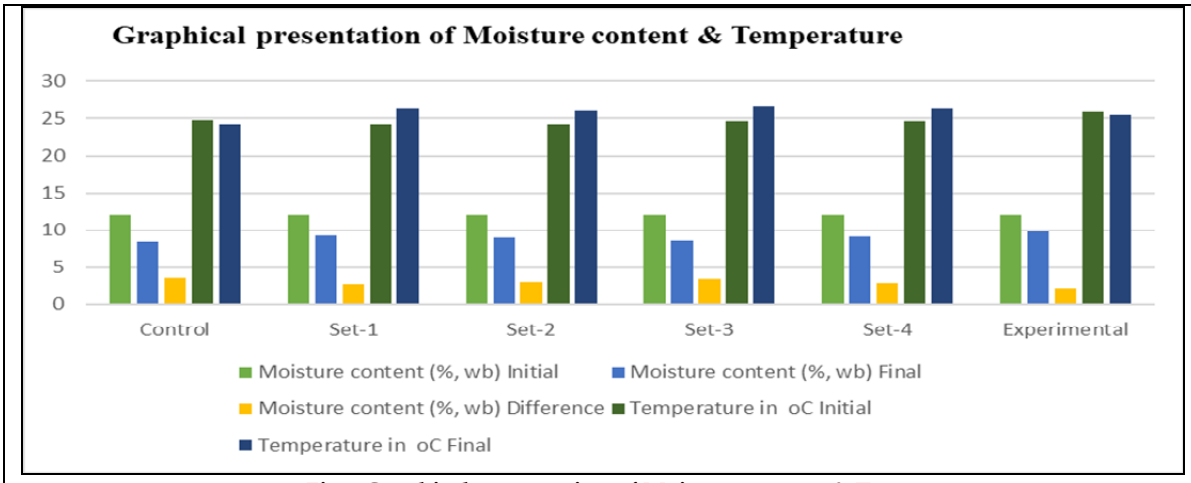

Fig.2 Graphical presentation of Moisture content & Temperature

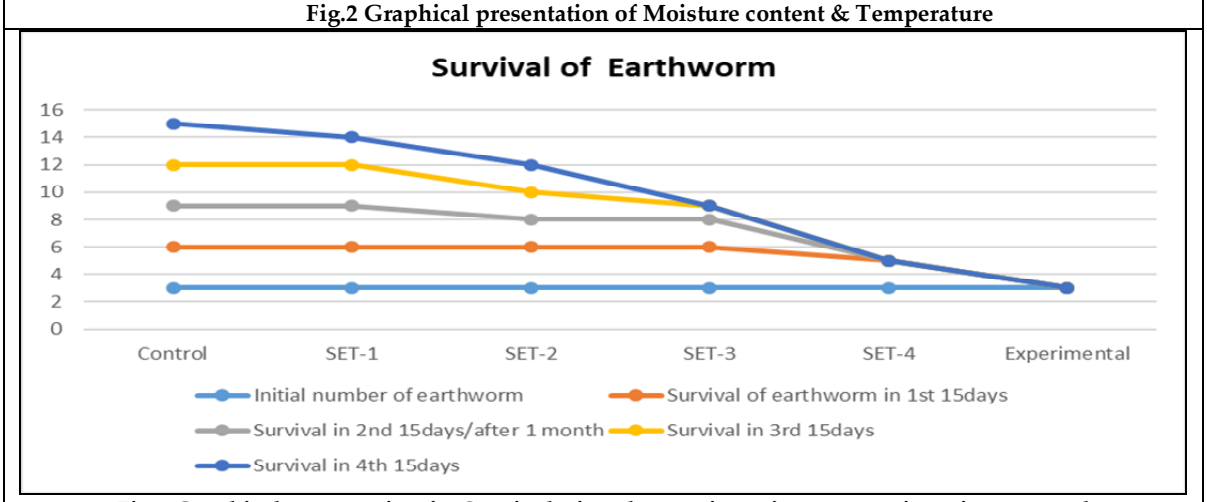

Fig.3 Graphical presentation for Survival of earthworm in various proportion of potato peel

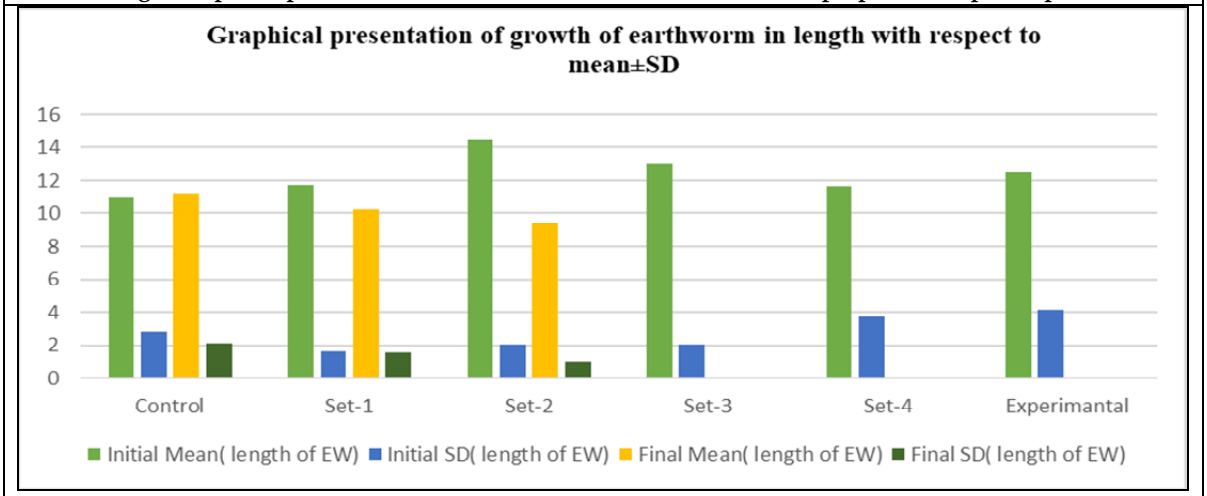

Fig.4 Growth rate of earthworm in various proportion of PP waste

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RESEARCH ARTICLE

A Facile Wet Chemical Approach towards CuS and its Graphene Composite and Determination of their Dye Degradation Efficiency

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ABSTRACT

A simple wet chemical method has been adopted for synthesis CuS and its graphene composite in low temperature. The characterizations of the materials show cubic phase of thus prepared sample and morphology analysis by SEM indicates mono dispersed particle morphology. These materials have been investigated for dye degradation activity and were found to be efficient adsorbant as well as photo catalyst for the decomposition of methyl orange (MO) dye in the presence of sun-light with 70 % degradation efficiency for an exposure time of 140 min which was more in comparison to pure material (CuS). In addition, the composites also exhibit enhanced antibacterial activity towards E.Coli.

Keywords: Nanoparticle, semiconductor, graphene, copper sulphide, photocatalytic properties

INTRODUCTION

Semiconducting materials have been receiving considerable attention for wide range of applications in different field. Such materials have an energy gap which is in between that of conductors and insulators. They do not conduct electricity at low temperature but conductivity increases as the temperature increases Copper sulphide (CuS) is one of such materials which is extensively studied in past few years due to semiconducting and non toxic nature, making their use in wide range of application from energy to biomedical field. The synthesis and studies of the optical and structural properties of CuS nanoparticles that make them useful in light emitting diodes,solar cells,fuel cells,drug delivery and as catalyst for industrial transformations [1]. CuS nanoparticles are also attractive because they exist in different stoichiometric compositions with varying crystalline phase [2-6].CuS are known to be a very important p-type semiconductor due to its versatility, availability and low toxic nature. It exists in different phases ranging from copper rich (Cu_2S) to sulphur -rich (CuS) ,which exhibit wide variation of their direct/indirect band gaps. The electrical conductivity of CuS very much rely on its compositions and decreases from copper poor to copper rich compounds. Considerable attention has been focused on the fabrications of nanostructure CuS with different size, shape and morphologies due to quantum confinement effect. A variety of physical as well as chemical

methods has also been employed in fabricating different nano dimensional 0,1 and 2-D CuS [7-11]. It has been well known that,the nature and different physical and chemical property of nanomaterials largely depend upon their morphology. In the last few years,the synthesis of CuS has become an interesting area of research because of its morphologies like nanospheres, nanowires,nanotubes,nanorods,hollow spheres and especially some complex structures.

During last few decades nanocomposites have been introduced due to their structural characteristics like machinery parts, coatings in scratch resistant and flame retardant cables. Generally, composites refers the materials formed by combining two or more different material possessing different properties to produce a end material having unique properties [12-15. The nanocomposites coatings are engineered to provide attractive and cost effective functional surface coatings with superior properties for anticorrosion, antimicrobial, antifogging and adhesive applications. The unique characteristics of nanocomposite coatings include enhanced mechanical strength, weight reduction, improved barrier properties, and increased heat, wear and scratch resistance for life long performance. Regarding this various innovative and advanced research in graphene bsed composite is going on in recent times. Graphene – based materials and their composite posses different applications in wide range of fields such as, electronics, biomedical aids, flexible wearable sensors,membranes ,and actuators. The presence of graphene can enhance the conductivity and strength of bulk material and help to create composites with superior qualities [16-18]. That's why Graphene can added to metals ,polymers and ceramics to create composites that are conductive and resistant to heat and pressure .Graphene composite applications seems endless,as it has many potential applications like one graphene polymer proves to be light ,flexible and an excellent electrical conductor ,while another dioxide graphene composites was found to be of interesting photocatalytic efficiencies,with many other possible coupling of materials to create all kinds of composites. The potential of graphene composites includes medical implants, engineering materials for aerospace and renewables and much more like researchers from the university of Toronto have shown that graphene is highly resistant to fatigue and is able to withstand more than a billion cycles of high stress before it breaks [19-21] .

In view of this present work is focused on formation of different phases of nano dimensional copper sulphide in terms of their crystal structure and synthetic methods. Development of improved methods for the synthesis of copper nanoparticles is of high priority for the advancement of material science and technology. A variety of synthetic strategies have been employed to prepare nanodimensional CuS of different compositions and phases such as hydrothermal,hot injection,thermolysis, microwave irradiation, electrodeposition and wet chemical methods etc. Among them we have used simple and cost effective wet chemical method to fabricate different nano structures of CuS in a controlled way. Thus, based upon above discussions, we aim at synthesis of CuS and CuS-graphene composite in simple wet chemical technique and test its efficacy in removal of industrial dye from contaminated water by the process of photocatalysis in presence of solar radiation.

Experimental Details

Chemicals Used

Copper chloride ($CuCl_2$), Sodium sulphide (Na_2S), Disodium salt of Ethylene diamine tetra acetic acid (EDTA),sodium dodecyl sulphate, $CuCl_2$ and Na_2S, EDTA were purchased from Loba chemicals. Distilled water was used as solvent for all synthesis purposes. All chemicals were used as such without any further purification.

Synthesis of CuS Nanoparticles

In a typical procedure, 3 mmol of $CuCl_2$ (0.4030 g) was dissolved with 40 mL distilled water taken in a 100 ml. round bottom flask. A green colour solution is formed (indicates formation of a complex). A magnetic bead was put into the flask and after that 3 mmol. (0.87672 g) of EDTA was added to the solution. It is dissolved by constant stirring with the help of the magnetic bead. (0.4030 g) of Na_2S was added to the above solution. A dark green colouration was

obtained. A reflux condenser is then attached to the round bottom flask and the setup was placed on an water bath was put on a hot plate provided with magnetic stirrer. The reaction was carried out for 4 hours with temperature 50^0C. with RPM 200. On vigorous stirring a dark green coloured precipitation was formed which was filtered with the help of a Buchner funnel provided with suction pump. The precipitation was washed for several times for hot water followed drying in the oven for 2 hr in 60^0 C. The powder was taken for further characterization. The same process was repeated under temperatures 70^0C. and 90^0C. respectively keeping other experimental parameters same. The above procedure again repeated with the sodium dodecyl sulphate in place of EDTA.

Synthesis of Graphene Composite

About 12.5 mL of conc.H_2SO_4 was taken in a 500ml of beaker and 0.5g of graphite powder added to it .Then the addition of 0.25g of $NaNO_3$ in to it..It will place in an icebath with continuous stirring for 10 minutes .After that 1.5g of $KMNO_4$ is slowly added .Then stirred the solution for 40minutes fallowed by addition of 40 mL of hot water to it .After that 3-4 mL of 30% of H2o2 was added to it .The contents will allow to settle for 12hours.The final mixture will be centrifugated in the presence of hot water to remove excess acids and soluble impurities (several times).The black pasty mass is allowed to dry in oven at 60℃ for 5-6 days.Now we get graphene oxide. About 0.5g of graphene oxide was taken in a round bottom flask then 50mLof water added to it .Stirred the solution well 0.25g of SDS, 0.2g of Na2S ,0.20g of cucl2 was added to it .then 2mLof hydrazine added to it.Then heat and stir in 90°Cunder reflux condition .after 3-4 hours collect the composites sample by filtration method and dry in oven about 70℃ temperature.

Determination of Dye Degradation Efficiency

The photocatalytic degradation of methyl orange (MO) was carried out in order to evaluate the photocatalytic activity of the as prepared nanoparticles and nanocomposites. 10 mg of prepared samples was dispersed in 50 mL of an aqueous solution of MO with an initial concentration of 10 mg/L. The above mixture was first stirred for 30 min in the dark to ensure that the adsorption-desorption equilibrium was reach. Then, the photocatalytic degradation reaction was carried out under the irradiation of sun light. At every 10 min interval during sun light irradiation, 3 mL of the suspension was collected and subsequently centrifuged. The degraded solution supernatants was measured using a colorimeter by using blue-green filter.

RESULTS AND DISCUSSION

The XRD pattern of as-synthesized CuS nanoparticles with different temperature and different templating agent are shown in Figure. The lattice parameters indicate hexagonal structure [JCPDS file No. 04-0464] having lattice parameters, a = 3.79 Á and c =16.34 Á. all XRD patterns show peaks at 2◎= 28.519, 33.6, 47.358, 56.397, 59.9, 69.406, and corresponds to planes (101), (103), (107), (202), (116) and (207) respectively. The prominent peaks were seen to be broadened indicating the nanocrystallinity of all the samples.

XRD

The analysis of XRD pattern stated that CuS nanoparticles possess the average crystallite size determined using Debye Scherrer's equation,

D=K◎◎◎◎◎cos◎◎◎

Where K, ◎◎◎◎◎◎and ◎◎are Scherrer constant, wavelength of X-ray radiation target used, maximum peak width in half height and angle of diffraction respectively The presented data shows the samples synthesized with EDTA at 90 ^{o}C, 70 ^{o}C, 50 ^{o}C have crystallite size 76, 55 and 44 nm respectively.

The surface morphology of the as synthesized CuS nanoparticles prepared at different temperatures was studied with the help of SEM and has been shown in Figure 2. From the SEM images it is clearly revealed that the CuS has particle type morphology with uniform size distribution in the range of 500-700 nm. In addition it has also been observed that the particle size increases with rise in temperature from 50 to 90 ^{o}C. From the figures, it can be seen

that nanostructures with different morphology is obtained by varying temperatures. Based on the results, the below mechanism was postulated. EDTA which was taken as a templating agent also act as a complexing agent, binds with Cu^{2+} and forms a complex. [22] In this process the release and availability of Cu^{2+} was reduced for which the reaction is slowed down favouring crystallisation and separating the growth step from the nucleation step [23-25]. So, Cu^{2+} ions from Cu-EDTA complex are released slowly and reacts with S^{2-} ions of Na_2S.

At lower temperatures ($50^0$and 70^0), there is slow releasing of Cu^{2+} ions from the complex which reduces the speed of reaction. Hence, the formation of CuS become slow and the growth on the nucleating center is less, so that the size of the particle is lesser. When the reaction temperature increased to 90^0 C., the complex becomes unstable and nearly breaks to generate higher concentration of Cu^{2+} ions in the solution leading to faster growth of CuS nanocrystals to bigger particles. So, the observed particle size of CuS nanoparticles are 75, 90 and 115 nm at temperatures of 50^0, 70^0 and 90^0 C. respectively.

Photocatalytic Activity

The photocatalytic decomposition of aqueous MB solution has been carried out in absence/presence of CuS, acting as catalysts, under dark/UV radiation. These studies show no appreciable degradation of MB either in absence (or presence) of catalysts in absence sunlilght even after 4 h. On the contrary, MB dye degraded very fast in presence of catalysts and sunlight. These data have been used to calculate the fraction of MB left undegraded at different interval of time, from which % degradation of MB has been calculated using the relationship: $D = (C_0-C_t)/C_0 \times 100$. The observations have been shown in Figure 3. These observations suggest that ~ 70% degradation of MB in 240 minute take place in presence of CuS. The same catalyst has also been used for studying the reusability and has been found that the reusability of the CdS drastically decreases after 2nd use. This is possibly because photocorrosion of CuS nanoparticles. The further exposure to UV radiation up to 300 min showed no further sign of any appreciable degradation.

Figure 4 indicates the photodegradation effiency of the graphene composite of CuS nanoprticles. According to which, for a similar degradation (up to 70%) a time period of 140 minutes required (against 240 minutes for CuS nanoparticles), clearly suggesting that the graphene composite do have greater photocatalytic activity in comparison to pure CdS. The higher catalytic activity of composite in comparison to the CuS nanoparticles is because of greater mobility of charge carriers of graphene nanosheets [18]). Reportedly Graphene is a good electron acceptor, which which resistes the recombination of the electron-hole pair in CdS due to enhancement of the electron transfer at the interface [26-30]. Moreover, the two dimensional nanosheets of graphene having very high surface-to-volume ratio and and very high specific surface area, disperses the CdS nanoparticles easily and allows enhanced light absorption on the surface of the catalyst. [31] For reusability accessment, the same photocatalytic study was carried with the used CdS-graphene composite and the observations indicate that the dye absorption on the surface of the catalyst decreases gradually. The percent degradation of the dye decreases by 8 and 17% with subsequent runs, in comparison to the initial run. This also indicates the reusable efficiency is not that much low, due to which the composite can be effective up to 3rd run for a photocatalysis.

CONCLUSION

CuS nanoparticles was successfully synthesised by wet chemical processes. Subsequent characterizations confirms that the cubic phased particles with rise in particle as well as crystallite size with rise in temperature. When studied for photocatalytic activity, it indicated that the photocatalytic activity higher with particles synthesized at higher temperatures. A degradation of 70% achieved under irradiation time of 240 minutes. However, for the similar extent of degradation with graphene composite, 140 minutes required indicating clearly the better efficiency of the graphene composite.

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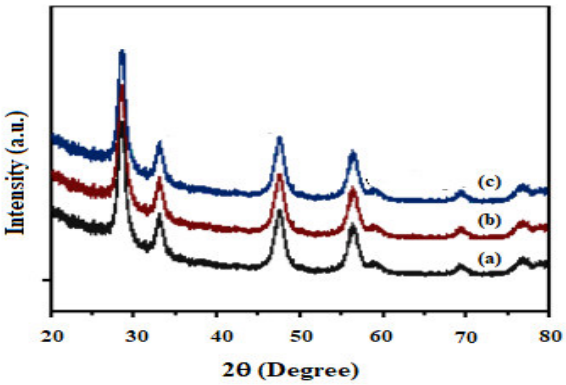

Figure. 1. *XRD pattern of synthesized CuS particle prepared at (a) 90°C, (b) 70 °C and (c) 50 °C.*

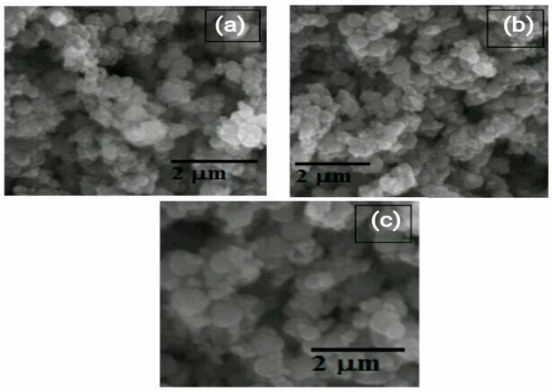

Figure. 2. SEM images of CuS synthesized under reflux condition at (a) 50⁰ C., (b) 70⁰C. and (c) 90⁰C.

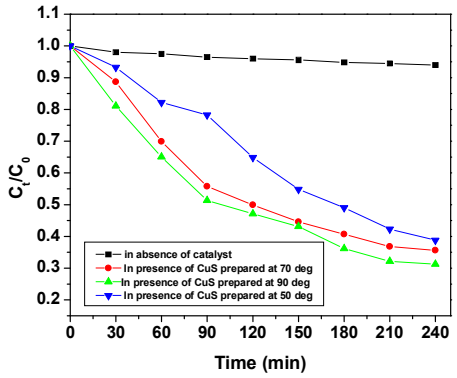

Figure. 3. Percentage of photo degradation of MB vs solar irradiation time in presence of CuS nanoparticles synthesized at different temperatures.

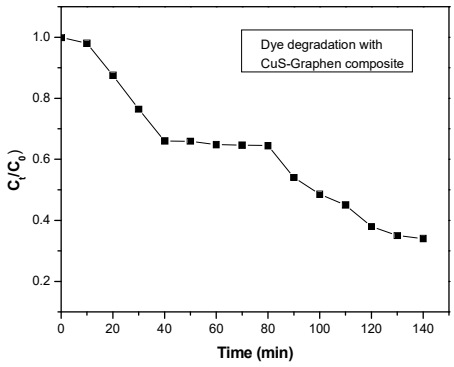

Figure . 4: Percentage of photo degradation of MB vs solar irradiation time in presence ofgraphene compsite of CdS nanoparticles synthesized at 90 ⁰C.

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RESEARCH ARTICLE

Synthesis and Characterization of Reduced Graphene Oxide from Coal Using Black Tea Extract

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ABSTRACT

Synthesis of graphene oxide and reduced graphene oxide from low cost coal and ecofriendly reduction process has been synthesized from powdered coal by modified hammer's method and reduced by treating with black tea extract at 90 ^{0}C for 2 hrs. The graphene oxide(GO) and reduced graphene oxide(RGO) so obtained were characterized by UV, FT-IR, XRD, Raman and SEM.

Keywords: coal powder, ecofriendly reduction, graphene oxide (GO), reduced graphene oxide (RGO), Black Tea

INTRODUCTION

Coal is a natural source of carbon abundantly available in the earth and can be used as an alternative of graphite for production of graphene oxide as well as graphene.[1] Coal may be a good source to replace graphite as the raw materials since it is inexpensive and plentiful. The structure of coal is quite complexes [2-4], its simplified composition contains angstron or nanometer-sized crystalline carbon domains with defects that are linked by aliphatic amorphous carbon. Coal is still mainly used as an energy source, in contrast to crystalline carbon allotropes such as fullerenes, graphene, graphite and diamond that have found applications in electronics, physics, chemistry and biology [5-8].Several literatures reported research on coal such as Synthesis of Graphene Oxide from The Sawahlunto- Sijunjung Coal Via Modified Hummers Method[1], Facile synthesis of few layer graphene from bituminous coal and its application towards electrochemical sensing of caffeine[9], Green Reduction of Graphene Oxide Using Tea Leaves Extract with Applications to Lead Ions Removal from Water[10], Efficient and Large Scale Synthesis of Graphene from Coal and Its Film Electrical Properties Studies[11], Graphene Sheets from Graphitized Anthracite Coal: Preparation, Decoration, and Application[12], Graphene oxide and graphene from low grade coal: Synthesis,characterization and applications[13], Formation of single and multi-walled carbon nano tubes and graphene from Indian bituminous coal[14]. No literature reports synthesis of Reduced Graphene Oxide (RGO) from

coal .So in this research we have synthesized RGO from normal coal using black tea extract an ecofriendly reducing agent that have no toxic effect on the environment .

EXPERIMENTAL

MATERIALS

Coal was purchased from the local market. Sulphuric acid (H_2SO_4),Hydrochloric Acid (HCl) Sodium nitrate ($NaNO_3$), $KMnO_4$, Hydrogen peroxide were of reagent grade chemical from Merck and used without further purification. Black Tea was purchased from local market.

Coal Powder from Raw Coal

The coal powder obtained by hitting raw coal with hammer and then made to 150μm size by rubbing in a sieve was washed with distilled water several times and dried in oven at 120 ^{0}C for 48 hrs

Preparation of Graphene Oxide

Some amount of domestic coal was taken and it was grinded by motar pistol for few times.Then from that 2gm of coal powder was taken and it was added to 150 ml conc. H_2SO_4 and stirred for 2h. Then 2gm of sodium nitrate was added to it and stirred for 2h.The solution mixture was put into ice-bath and ten $KMnO_4$ was added bit by bit about 6gm. Then it was stirred for 24h with the temp. 25°C.Then 200-300 ml distilled water was added to it and stirred for 15min.Then the diluted solution mixture was filtered by using sintered crucible and what Mann filter paper 40 and washed by 200 ml distilled water. After that 20 ml of hydrogen peroxide was added to it and stirred for 1 h. Then it was washed by distilled water and HCl alternatively using the Sintered crucible until the pH was neutral.Then the residue obtained was dried at 110°C for 12 h in oven and the graphite oxide was obtained about 0.53gm or 530mg.The graphite oxide powder so obtained was added to 250 ml of distilled water and the solution was placed in digital ultrasonicator for 3 h and then the dispersed graphene oxides were collected by centrifugation of the solution at 3000 rpm .The graphene oxide so collected was dried in oven at 1000C for 24 hrs over a petridice.

Preparation of Black Tea Leaves Extract

10 gm of black tea was boiled with 100ml distilled water at 90°C for 1h in a 500 ml RBF under reflux condition. Then the solution was filtered to get the extract.

Preparation of Reduced Graphene Oxide

30 ml of graphene oxide solution(0.5mg/Ml) was added to tea leaf extract with 1:1 ratio.(30 mL GO+30 mL tea leaf extract).Then the above solution mixture was taken in a 500 ml RBF and heated at 90°C using the water bath under reflux condition for 2h. After that the solution was heated for 1h at 25°C and stirred also.Then the brown colour solution was changes to dark redish brown which indicates the reduction of graphene oxide. Then the rGO solution was filtered using sintered crucible and dried at 80°C for 24h and the rGO was obtained about0.11gm or 110 mg.

Characterizations

UV-Vis absorption study of the dispersed samples in water were carriedout by perkin- Elmer Lamda 25 spectrophotometer.IR Spectra of the Coal powder , graphene oxide (GO) and reduced graphene oxide (RGO) were recorded on a perkin Elmer spectrometer(Spectrum RX1,Perkin Elmer, Singapore)using KBr pellet technique, in the range 4000-500 cm^{-1} with a resolution of 2cm^{-1} using 4 scans per sample. X–Ray diffraction (XRD) of the composites were carried out with PAN Analytical Xpert Pro Diffractometer with Co Kα radiation (30mA 40kV).The range of diffraction was 5 to 80^0 with a scanning speed of 1^0 per minute. The sample structure was also known by characterizing through analysis of Vibrational modes by means of Ra man Spectroscopy with the help of LabRam

HR800UV Spectrometer using a 633 laser light for excitation of the samples. The surface structure of the nanocomposites were viewed through Scanning Electron Microscope (JEOL 6510 LV, Japan).

RESULT AND DISCUSSIONS

UV-Visible spectra

The UV-Visible spectra of the water dispersed coal powder , GO and RGO were shown in figure-1 .The coal dust gives the absorption peak at 222 nm[15]whereas GO shows two absorption peaks ,one around 237 nm due to π-π* transition of aromatic C=C bonds and the other at 307 nm due to n-π* transition of C=O bonds[16].Reduced graphene oxide(RGO) shows an absorption peak at 270 nm gives an indication of red shift from 237 nm (GO) to 270 nm(RGO) and the absorption peak 307nm is missed due to removal of oxygen from the functional groups.

Infrared Spectra

The FTIR Spectra of the synthesized samples were shown in figure-2.The spectrum of coal showed intense bands at 3448cm^{-1} of OH(s),1638cm^{-1} due to presence of C=O(s) and at 1152 for C-C(s). The GO spectrum shows same bands as that of coal with lower transmittance (%) indicating presence of oxygen groups in the structure due to formation of alcohols,carboxylic acids ,aldehydes, ketones ,ethers and epoxides[17] as it is already reported that GO is formed from oxidation of graphite by insertion of oxygenated functional groups into the structure.Finally the spectrum of reduced graphene oxide(rGO) shows a considerable decrease in intensity of bands compared to GO which is due to removal of oxygen groups by partial reduction[18].So the OH stretching (3125cm-1), the angular deformation of water (1396 cm-1) , C-O-C stretching (1217cm^{-1}) creates in decrease in transmittance and the C=O group has totally disappeared from the spectrum confirming the partial reduction of the GO was successfully carried out using black tea extract as a reducing agent.

X- ray diffraction (XRD)

The results of X-ray diffraction measurements of Coal dust ,GO and rGO are present in figure-3 in a comparative way to identify the presence of crystalline phases of the materials. Coal shows broad amorphous peak but after oxidation a new diffraction peak at 11.54^0 corresponding to (002) plane and interlayer distance of 0.765nm confirmed the successful formation of GO from graphite oxide upon ultrasonication.The reason behind an increase in interlayer distance is due to incorporation of oxygen containing functional groups like epoxy, carboxyl,hydroxyl and carbonyl groups.Another groups at $2\theta = 43^0$ corresponds to turbostatic band of disorder of carbon materials.After phyto chemical reduction of GO by Azadirachta indica (Neem)leaf extract the diffraction peak at 11.54^0 disappeared and a broad peak appeared at 24.6^0 for reduced graphene oxide(rGO) with a corresponding interlayer distance of 0.361 nm confirming the elimination of oxygen containing functional groups from graphene oxide(GO).The broad peak also suggests that the loss of crystallinity decreased as compared to G(R) and GO[19].so the result suggests that Azadirachta indica (Neem)leaf extract is an effective reducing agent for synthesis of rGO from GO.

Raman Spectra

The Raman spectra of GO and RGO was shown in figure-4.The D band represents the breathing of k point phonons A_{1g} related to structural defects and disorder where as the G band represents the first order scattering of the E_{2g} Vibrational mode in graphene sheets(sp^2 atoms)[20].GO shows the D band at 1359 $cm^{-1}$and a G band at 1596 cm^{-1}.After reduction of GO by black tea extract RGO shows D band at 1347 cm^{-1} indicating the disorder in the sp^2 hybridized carbon system and the G band at 1602cm^{-1}.The I_D/I_G value of GO(0.96) is less than I_D/I_G value of RGO(0.98) due to reestablishment of graphene network(sp^2 carbon) .

SEM Studies

The surface morphologies of Coal dust ,GO and RGO was shown in the figure-5.The image of coal dust is in 6(a)with irregular size of the particles. The images 6(b)and 6(c) of GO and RGO respectively show an exfoliation of the graphene sheets by insertion of functional groups into the structure of G(R).

CONCLUSION

The UV-Visble spectra reveals that there is absorption at 237 nm due to π-π^* transition of aromatic C=C bonds and the other at 307 nm due to n-π^* transition of C=O bonds for GO but there is a red shift from 237 to 270nm and missing of absorption at 370 confirming removal of oxygen from the functional groups for RGO. FT-IR data gave a strong evidence of absence of C=O functional group in RGO . XRD data confirmed the diffraction peak at 11.54^0 disappeared and a broad peak appeared at 24.6^0 for reduced graphene oxide(RGO) with a corresponding interlayer distance of 0.361 nm confirming the elimination of oxygen containing functional groups from graphene oxide(GO).Raman study proved that the I_D/I_G ratio of RGO is higher than GO due to restoration of the conjugated graphene network(sp^2 carbon) after removal of the functional groups. The SEM images showed an exfoliation of the graphene sheets by insertion of functional groups into the structure of Graphite obtained after various chemical treatments of powdered coal. So above all studies proved that RGO was successfully synthesized from GO coal by eco friendly reduction using black tea extract cheaply and effectively.

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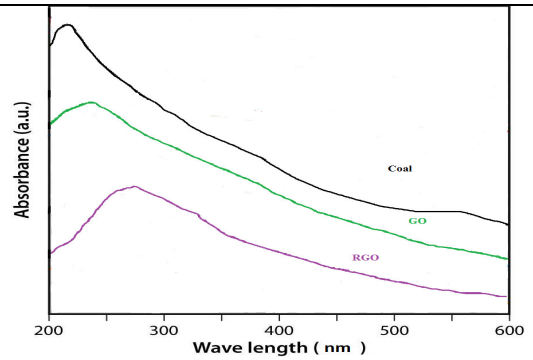

Figure.1: UV-Vis spectra of Coal dust ,GO and RGO.

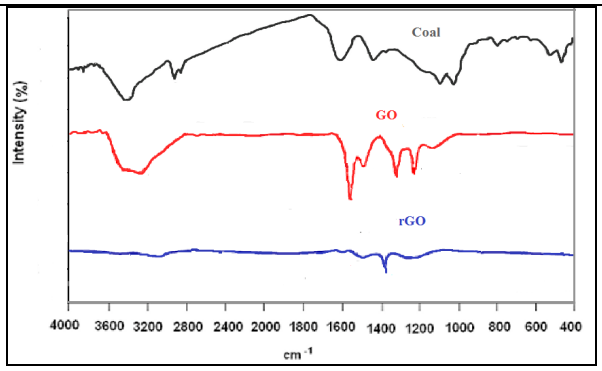

Figure.2: FTIR Spectra of Coal ,GO and RGO.

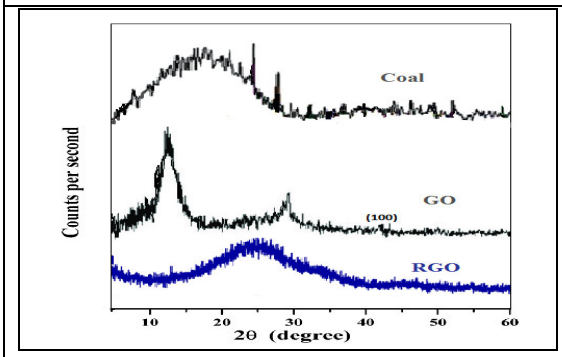

Figure. 3: XRD Pattern of powdered Coal ,GO and rGO

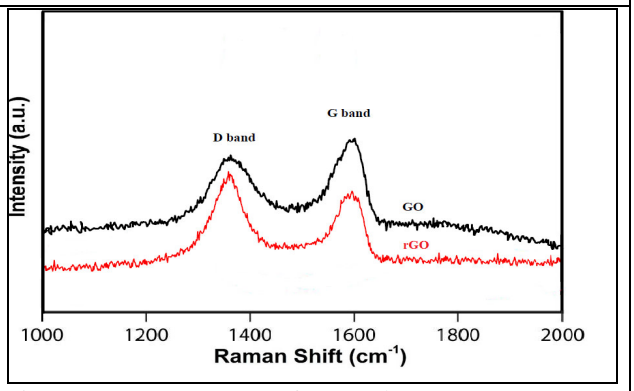

Figure. 4: Raman Spectra of GO and RGO

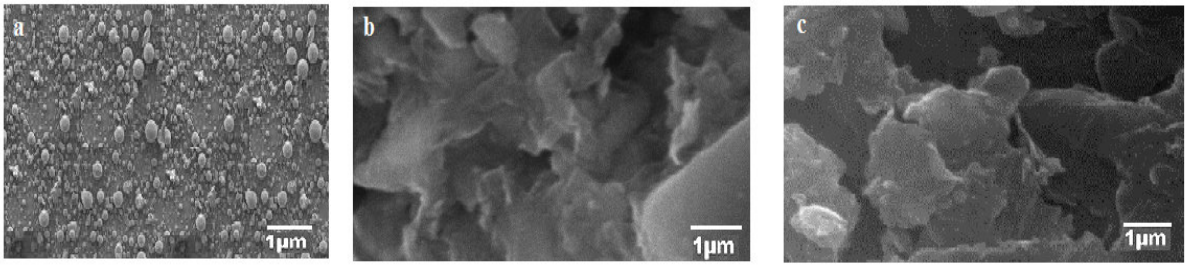

Figure. 5:SEM Image of (a)Coal Powder (b) GO (c)RGO

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RESEARCH ARTICLE

Effect of Lanthanum Doping on the Optical and Antibacterial Properties of ZnO Nanoparticles

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ABSTRACT

The present work deals with the study on pure and lanthanum doped ZnO (La:ZnO) nanoparticles synthesized by co-precipitation method. The effect of lanthanum doping on the structure, morphology and optical properties of ZnO was investigated after heating the sample at 600°C for 2 h. Characterization tools like X-ray diffraction (XRD), Scanning Electron Microscope (SEM), Fourier transform infrared spectroscopy (FTIR) and UV absorption studies were utilized to study the underlying properties of the nanoparticles. The average particle size of the synthesized ZnO and lanthanum doped ZnO nanoparticles were calculated using the Scherrer formula and was found to be 28 nm and 43 nm respectively. FTIR spectra of undoped and doped nanoparticles show the presence of different stretching and bending vibrations of functional groups along with the signature of metal-oxygen bond. The antimicrobial activity of the prepared sample was also evaluated for *E. coli* isolated from pond water. La:ZnO shows improved optical and antibacterial property upon La doping.

Keywords: Optical property, La:ZnO, Antimicrobial activity, XRD, SEM

INTRODUCTION

Metal oxide nanoparticle are outstanding materials due to their characteristic properties and among all zinc oxide play a vital role in industry, medical and packaging area due to the its improved application oriented properties and variety morphology. ZnO is a semiconductor with a wide direct band gap and high excitonic binding energy. Zinc oxide is a semiconductor used for various applications such as gas sensor, piezoelectric transducers, photo catalytic activity and antibacterial activity. It has been synthesized with a range of well defined nanostructures like

nanowires, nanorods, nanotubes and nanobelts [1-2]. ZnO plays a great role in various fields such as optoelectronics, antibacterial, gas sensing and other industrial application [2, 3]. The properties of ZnO material can be controlled by proper doping material [4]. Presently, doping of rare earth elements into ZnO is a focused research area for various applications. Rare earth elements are very important candidates being used in advanced technologies such as photocatalyst, fuel cells, antibacterial activity and luminous materials. Again, different studies reveal that they should be excellent additives to metal oxide semiconductors because of their particular 4f–5d and 4f–4f electronic transitions which are different from the other elements [5–7]. In addition, these elements provide good anticoagulant, antibacterial, anti-cancer, anti inflammatory and anti-tumor biological capabilities [8]. The commonly used lanthanide ions for doping are Pr^{3+}, Er^{3+}, Sm^{3+}, $Eu3^{+}$, Ce^{3+}, Tb^{3+}, Dy^{3+}, Nd^{3+}, Yb^{3+} and Tm^{3+} [9]. So in this study we try to synthesize the lanthanum doped ZnO by co-precipitation method and study has been carried out for its application towards antimicrobial capabilities.

EXPERIMENTAL

Sample Synthesis

In this work, undoped ZnO and La doped ZnO were prepared via co-precipitation method. The chemicals used were Zinc acetate dihydrate Zn $(CH_3COO)_2{\cdot}2H_2O$, lanthanum trinitrate hexahidrate [La $(NO_3)_3.6H_2O$], ammonium oxalte and ethanol of AR grade with 99.99 % purity. Firstly, calculated amount of zinc acetate dihydrate was dissolved in 15 ml of ethanol with 10 ml of ammonium oxalate in a magnetic stirrer to form a clear solution. The mixture was subjected to continuous stirring while heating at 100 °C for 4 hours. The mixture of zinc acetate (0.2 M) and lanthanum trinitrate (0.002 M) was dissolved in 20 ml of ethylene alcohol and the same process was followed for preparation of La-doped ZnO nanoparticles. The pH was maintained between 7 and 8. The prepared particles of pure and doped ZnO were kept for 8 h at 100 °C and further calcinated at 600 °C for 1 h in a muffle furnace and characterized further.

Sample collection and isolation

Water sample was isolated from pond present near the Centurion University of Technology and Management, BBSR Campus, Odisha by submerging the sterile container and then open to fill after which container was closed and brought to the surface. Sample was transported to the laboratory. Nutrient agar medium was prepared and sterilized at 121 °C and 15 psi pressure. Water sample was serially diluted and 50 µL of each dilution was pour plated onto sterilized nutrient agar medium. The inoculated plates were incubated at 37 °C for 24 hours under aseptic condition.

Antimicrobial assays by Agar-well Diffusion method

For antimicrobial assay, Muller Hinton Agar (MHA) medium was prepared and autoclaved at 121^0C and 15 psi pressure. After solidification, the isolated colony was smeared over the medium by using sterile swab. Well was prepared at the center of the inoculated MHA medium by using gel puncture. The synthesized undoped and lanthanum doped ZnO were placed inside the well and the plates were incubated at 37 ^{0}C for 24 hours along with control plate.

Characterization

X-ray powder diffraction (XRD) data was recorded using PAN-analytical X' Pert PRO equipment using CuKα ($1.5418A^0$). The surface and morphology of the samples was investigated by High resolution SEM using (ZEISS, Supra). The optical absorption spectra were recorded by UV-Vis absorption spectrometer (EL Spectrophotometer, Model no 2600). The solid phase FT-IR spectrum in KBr pellet technique was recorded with (FT-IR; PERKIN ELMER, Model 6300).

RESULTS AND DISCUSSION

UV-VIS absorption studies

The optical absorption properties were examined by UV–Vis spectra which are shown in Figure-1. The optical band gap (E_g) is calculated using the following Eqn. [10, 11].

α A(hν-Eg)n/hν……..(1)

Here, *A* and *n* are a constants, equal to 1/2 for the direct band gap semiconductor. The band gap of the undoped and La doped ZnO nanoparticles can be evaluated by plotting the value of $(\alpha h\nu)^2$ against the photon energy (hν) and the intercept of this linear internal of the energy axis at $(\alpha h\nu)^2$ equal to zero gives the band gap (Fig.1b). It has been observed that the lanthanum doping concentration has considerable effects on the band gaps of synthesized NPs. The optical energy band gap (Eg) is found to be 3.02 and 3.82 eV for undoped and doped sample. This difference in band gap may be due to the substitution of La^{3+} ion in Zn^{2+} sites due to larger ionic radius.

Fourier Transform Infrared Spectroscopy Study

Synthesized undoped and La doped ZnO materials were characterized by FTIR in the range from 400 to 4000 cm^{-1} at room temperature and have been given in Fig.2. The FT-IR spectrum contains several bands with remarkable features. The spectral bands at 456 cm^{-1} and 588 cm^{-1} may be due to the presence of Zn-O and La-O respectively. Bands at 1165 cm^{-1} correspond to C-O stretching vibrations. Bands at 1378 cm^{-1} corresponds to C=O and 1580 cm^{-1} indicates C=O stretching vibration. The band at 2934 cm^{-1} indicates CH_2 unsymmetrical stretching vibrations. The band at 751 cm^{-1} observed for undoped ZnO has been shifted to 855 cm^{-1} for La doped ZnO in as illustrated in Fig.2b. This may be due to Zn–O deformation vibration by doping of La^{3+} ions. The presence of bands at 3331cm^{-1} indicates the existence of N-H stretching. The Zn–O/La-O vibrational modes are observed and confirm the doping of La into ZnO nano particles as confirmed from FTIR analysis.

XRD Studies and SEM studies

Fig.3 shows the X-ray diffraction (XRD) patterns of undoped and La doped ZnO nanoparticles. The structural properties of nanoparticles including crystalline size and lattice strain can be obtained from XRD spectra. The obtained peaks reveal the high purity and crystallinity of the as-prepared powder. The diffraction peaks corresponding to (100), (002), (101) and (102) planes indicating the crystalline ZnO with hexagonal wurtzite structure, which are in close agreement with the standard card (JCPDS Code No. 00-005-0664). The calculated values of lattice parameters 'a' and 'c' are well matched with standard JCPDS card values of ZnO. The average crystallite size of nanopowders obtained using Scherrer's formula $D=k\lambda/\beta \cos\theta$, where D is grain size in nm, λ is the wavelength of the X-ray, β is FWHM, and θ is the Bragg angle. The mean crystallite size of the synthesized nanopowder increase with in La doping concentration from 26 nm to 43 nm. The lattice parameters of ZnO nanoparticles with lattice constants a = 3.250 Å, c = 5.207 Å have been found to increase to a = 3.2620 Å, c = 5.2127 Å indicating that La^{3+} ions (1.14 Å) with larger ionic radius has been effectively substituted the Zn^{2+} ions (0.85 Å) in ZnO lattice [12-14].SEM image of La doped ZnO nanoparticles reveals polycrystalline nature of the sample as shown in Fig. 4(a). The figure shows hexagonal nanoparticles of size ranging from 30-60 nm are present. The nanoparticles are found to be agglomerated. The EDAX spectrum clearly indicates the presence of La ions in ZnO lattice along with Zn ions (Figure-4b).

Antibacterial Studies

After 24 hours incubation, different colonies were appeared in nutrient agar plates. The morphological and macroscopic characteristic was observed. Zone of inhibition was observed in the MHA plates and shown in Fig.5. Generally, rare earth elements are used as catalyst in the form of oxides or oxy-salts. It was reported that that surface area and surface defects play an important role in bacterial and microbial activities of metal oxide, which could be ascribed to the variation of the surface area, surface defects and band gap caused by the incorporation. The partial dissociation of zinc oxide (ZnO) particles releases Zn^{2+} ions in aqueous solution that contributes to the

antimicrobial activity of ZnO. This zone of inhibition clearly indicates that the lanthanum doped ZnO nanoparticle possesses significant antimicrobial activity due to their small size, toxicity and high surface area**.** The zone of inhibition was determined for both undoped and La doped ZnO given in Fig.5. It was found to be 13mm for ZnO and 24mm for doped ZnO. So synthesized La doped ZnO nanoparticle having crystallite size of 43nm was found to active for *E. coli* as compare to ZnO nanoparticle.

CONCLUSION

Pure ZnO and La doped ZnO nanoparticles were prepared by co-precipitation method. XRD study reveals the hexagonal wurtzite structure for both undoped and doped ZnO with good crystalline structure. The crystallite size of ZnO increases with La doping. UV–Vis spectroscopy exhibited a considerable rise in band gap after doping of La ions into ZnO nanoparticles. FTIR spectra indicate the Zn-O and La-O bands of vibration. SEM images indicate the polycrystalline, porous, asymmetrical image for La-doped ZnO with successful incorporation of La ions with ZnO lattice. It was observed that La doped ZnO nanoparticles are found to proactive against *E. coli* as compare to ZnO nanoparticle which shows its good antibacterial property

ACKNOWLEDGMENT

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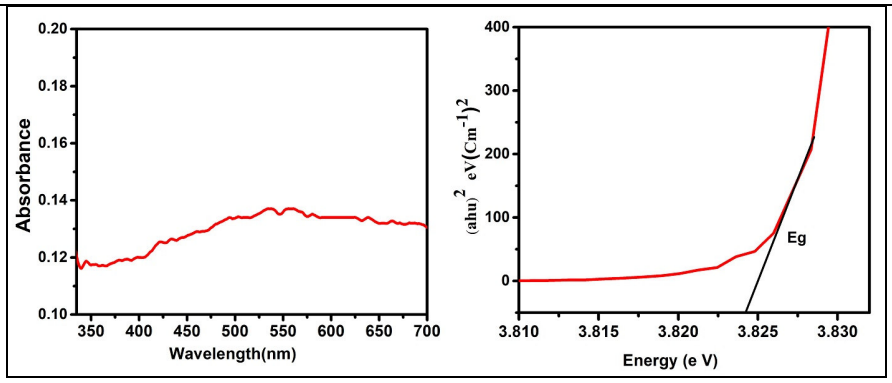

Fig.1: UV–Vis spectra (a) and band gap energy (b) of La:ZnO.

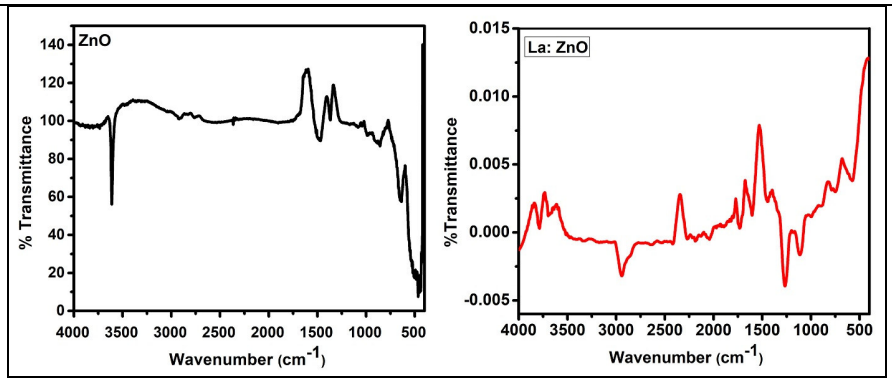

Fig.2: FTIR spectra of a) ZnO nanoparticles and b) Lanthanum doped ZnO nanoparticles.

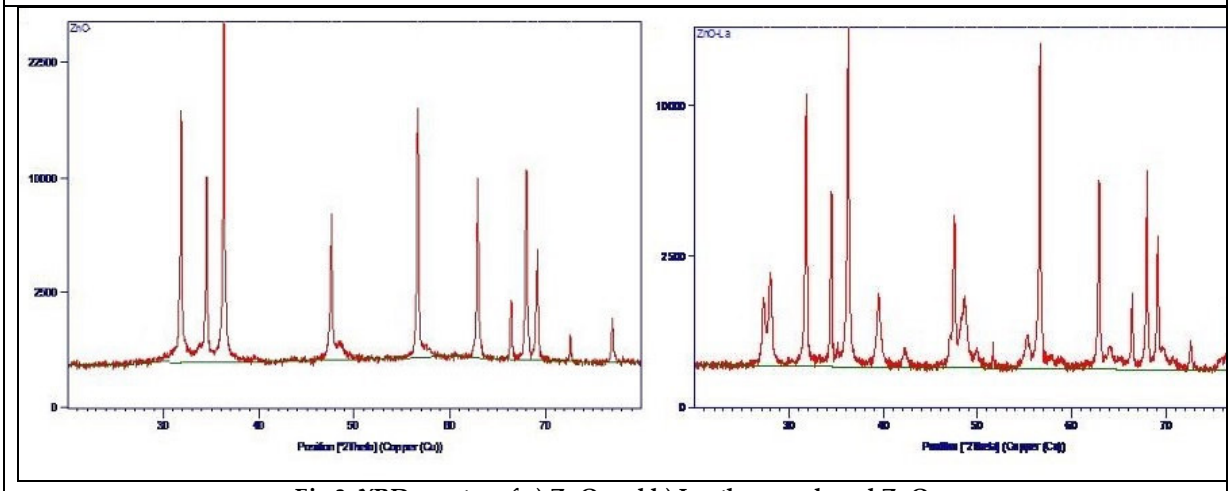

Fig.3: XRD spectra of a) ZnO and b) Lanthanum doped ZnO.

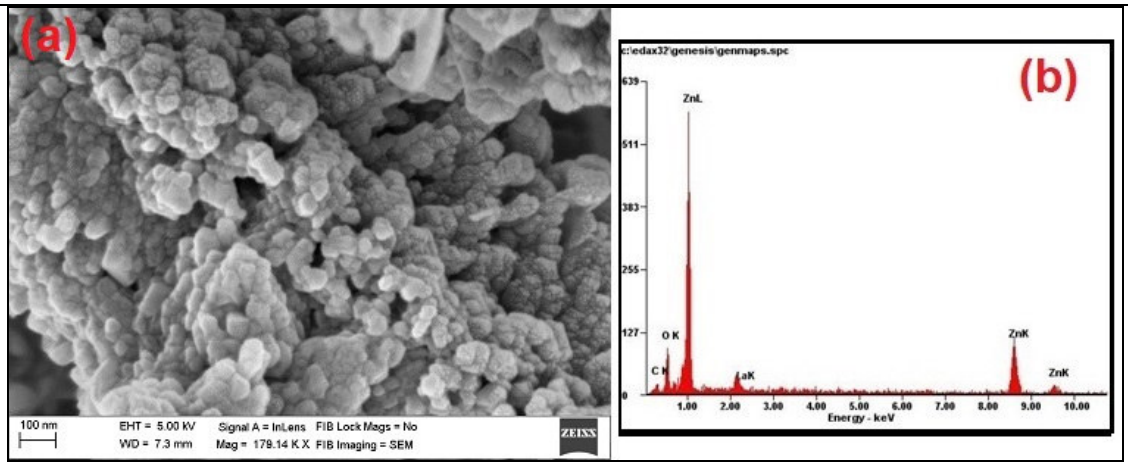

Fig. 4: a) SEM image of La doped ZnO, b) EDAX spectra of La doped ZnO.

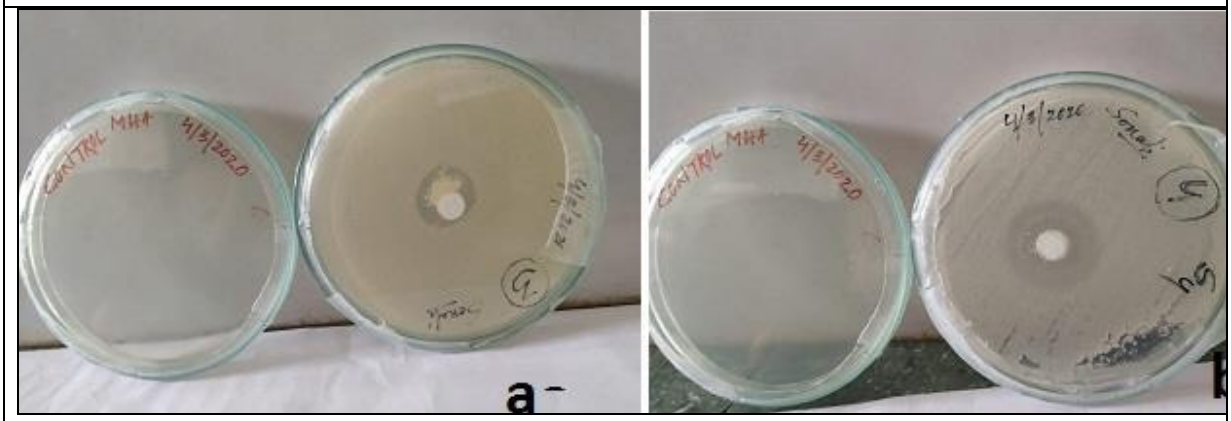

Fig.5: Antimicrobial Activity of ZnO and La doped ZnO

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RESEARCH ARTICLE

Sociolinguistic Profiles and Second Language Acquisition of Diploma Students of Bihar

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ABSTRACT

They are many students from Bihar, who have difficulties while communicating in English. Their lack of proficiency in English seems to be related to various social such as interference of the mother tongue at their home, school, college and society they live in.The aim of this chapter is to 2) identifying English Language skills of diploma students of Bihar b) Analysis of sociolinguistic practices of Diploma students of Bihar) suggestions for remedial measures to hone the skills of Diploma students of Bihar, who do not possess adequate communicative skills in English.The objective of the paper is to identify the current language skills of the Diploma students of Bihar and difficulties they face during the use of four skills such as speaking, writing, reading and listening in English, special attention will be paid to relationship among themselves, sociolinguistic background and their ability to use English during their course. Themushrooming of the corporate houses in India has created employment opportunities for professionals in India, however, lack of proficiency in English and the difficulty in English seems to be a major handicap. Therefore this paper is an attempt to identify the problems faces by Diploma students of Bihar in the use of English language and remedial measures suggested for honing their skills.

Keywords: Diploma students of Bihar,SLA, Sociolinguistic profiles, Speaking, Writing, Reading, Listening, Employment

INTRODUCTION

Learning a language, especially a second language, is influenced by a number of social factors. For instance, learners' competence in the use of English may depend upon the background of their school and college education. Similarly, the location of the educational institution in an urban or semi-urban setting, the medium of education etc. also influences learners' ability to use English. As sociolinguistics highlights such social factors which influence language learning, the study of sociolinguistics becomes significant.

Sociolinguistics and Second Language Acquisition

Learning a language, especially a second language, is influenced by a number of social factors. As Malathy (1995:3) observes, language is not an abstract system of formal, lexical and grammatical features but a social function and as such should be studied as a social phenomenon. Sociolinguistics has brought into sharp focus the differences between learning a second language (L2) . Learning a second language in a native environment is different from learning it inan alien environment. In the former case it is learnt through a process of natural acquisition involving verbal contact with native speakers in a natural environment whereas in the latter case it is taught through instruction in a formal setting. Most of the students from Bihar learn English in a non-native environment, i.e. they are taught English as part of their formal education at school and college. And , learning English through formal education can be influenced by several social factors such as learner attitudes, motivation, school environment and home environment Therefore, it is necessary to discuss (i) whether and how learning a language in educational settings differs from learning it in natural settings such as at home or among friends; and (ii) important social factors which can influence one's second language learning.

The Social Contexts of Second Language Learning: Natural versus Educational Settings:

A majority of students in India learn English in an educational setting as English is a second language in India. But, learning a language in a natural environment is different from learning it in an educational setting. In a natural environment, learners have the advantage of a rich exposure to language in a variety of situations from different sources—at home, through neighbour's, friends and relatives, while shopping, while playing, at the work place, through movies and other extra-curricular activities, etc. in an educational environment, learners' exposure to a second language is very much limited to the educational institution itself. That is, the exposure to English is provided only if teachers and learners use English in and outside the classroom. But, sometimes this exposure may not be available even in an educational institution. This is commonly visible especially in government educational institutions which are located in non-urban settings. There is also a vast difference in the input available in natural and educational settings. In natural environment learners get exposed to a variety of forms of language which include both formal and informal language. On the contrary, the input available in educational settings is mostly formal. In most schools and colleges in Bihar, it is even restricted to reading and writing. There is also a greater emphasis on rules of language in educational settings.

As d'Anglejan (1978) has noted (as quoted in Ellis, R. 1994:215), " *the correlation between educational settings and formal language learning depends on the pedagogic approach*". Both traditional approach and innovative approaches may be followed in educational institutions. In educational institutions where the traditional approach is followed, there is very little exposure to informal learning, because teaching of the second language in a traditional approach is characterized by regimentation explicit rules of the language. Whereas in educational institutions where innovative approaches are followed, informal learning is equally emphasized along with formal learning. That is, teaching is done with the help of learner-oriented tasks and activities which encourage and help learners use the second language as much as possible. It is believed that those who learn a second language in its natural environment tend to pick it up faster and may become more proficient in the use of language than those who learn it in educational settings. It is also believed that those who learn it through formal instruction may gain more grammatical accuracy than those who learn it in natural settings. Moreover, learning a second language in alien environment, i.e. through formal education, can be influenced by various other social factors such as learner attitudes, motivation and medium of education. How these factors influence the learners' competence in the second language is discussed in detail in the following section.

Social Factors and Their Influence On Second Language Learning

There are various social factors which influence learners' proficiency in a second language. These could be personal factors and factors which are related to learners' home, school and job environments.

Personal Factors

Attitudes towards learning English can be influenced in different ways depending upon various factors such as environment, at home and educational institutions. For instance, if parents are educated and are in professions wherein the use of English is important, they may provide an encouraging atmosphere for their children to learn English. They may educate their children in English medium schools, use English with their children, etc. These factors are likely to encourage children to learn English as well. On the other hand , if parents are illiterate and are in occupations which do not demand the use of English or do not reflect the importance of English, their children are less likely to be encouraged to learn English. Further, Ellis, R. (1994:198-9) argues:

Learners manifest different attitudes towards (1) the target language, (2) target language speakers, (3) the target-language culture, (4) the social value of learning the L2, (5) particular uses of the target language, and (6) themselves as members of their own culture. These attitudes are likely to reflect the particular social settings in which learners find themselves. Learner attitudes have an impact on the level of L2 proficiency achieved by individual learners and are themselves influenced by this success. Learners with positive attitudes, who experience success, will have these attitudes reinforced. Similarly, learners' negative attitudes may be strengthened by lack of success. Sometimes , it is also found that learners who begin with positive attitudes but who, for one reason or another, experience inadequate learning opportunities, fail to progress as they expected, and consequently , become more negative in their outlook.

Motivation can be instrumental in learning a second language. It is generally assumed that learners who have pressing need to learn English may have high motivation to learn it. That is, motivation is directly related to the purpose for which the language is learnt. Motivation may also depend upon learner's age, inclination and availability of time. In general, the younger the learner, the more motivated he is, though this may not necessarily be so. Time also plays a role in learner's motivation. Though there is a need to learn English, if the learner does not have enough time to focus on learning, he may not be motivated enough to do so. Similarly, the learner may have the motivation to learn a language for personal interest though he may not require using the second language for communicative purposes.

Age seems to be one of the important social factors which could especially influence one's motivation and the way one learns a second language. A young business executive may not have acquired sufficient job experience, but he may strongly wish to achieve something in his area of work. So , he may wish to gain a prospective job for himself and is highly motivated to learn or improve his English. However, a business executive over the age of forty or forty-five who is secure in his job, is very unlikely to have a strong motivation to learn or improve his English.

Home Environment

One's home environment also plays a key role in one's competence in the use of English. One's mother tongue , social class and influence of parents on children are all related to the home environment. For instance, one's mother tongue may have an impact on one's learning a second language. This is more likely if the learner begins to learn a second language during his adulthood. That is , an adult whose proficiency in a second language is inadequate and wishes to improve it , may also find it difficult to learn the second language because of the influence of his mother tongue.

Another factor which is closely related to the home environment is social class. As Ellis, R (1994:204-6) argues, "An individual's social class is typically determined by means of a composite measure that takes account of income, level of education and occupation. There is evidence of a relationship between social class and L2 achievement. The general finding in second language research is that children from lower socio-economic groups are less successful educationally than those from higher groups. In the home environment, parents' role in their children's learning a second language cannot be ignored. Parents' attitudes towards the second language, their education, etc. may encourage or discourage their children's learning the second language. It is very likely in India that children whose parents are graduates and above, receive more encouragement to learn English. Usually, literacy of parents and their

occupation, social and financial status are closely interrelated. These help educated parents provide a more conducive atmosphere for their children to learn English at home. These factors also help parents educate their children in the best school possible.

School Environment

School environment is one of the significant social factors which plays a vital role in one's proficiency in the use of English. For instance, medium of instruction at school and college levels may affect the ability of one's use of language. Students who study in regional medium schools and colleges are deprived of the rich language exposure in terms of listening, speaking, reading and writing in English. Later , they may find it difficult to use English fluently at their work place. Even if they gain some proficiency in the use of English grammar, they may need a couple of years of exposure to English to appreciate the communicative functions and discourse features of the language.

One cannot claim with certainty that one can gain competence in the use of English just because one happens to have had one's education in the medium of English. The learner is more likely to gain proficiency in English, if there exists an environment of English in the educational institution in which the learner pursues his studies. That is , he can learn to use English well, if his teachers, classmates and school mates also use English. But , in India, such an environment of English usually prevails only in certain privileged schools and colleges which are owned and run by private individuals. On the other hand, in most of the government schools and colleges, though the medium of English is available, the use of English seems to hardly prevail in these educational institutions. Even the students studying in English medium in this government educational institutions usually communicate in their mother tongue or the regional language. Therefore, it is not just the medium of education but also the type of educational institution- a privileged private institution or a government institution- which influences one's proficiency in English.

Often, it is also observed that even in an English medium environment in a private educational organization, especially in a non-urban area, there may not exist an environment of English in the educational setting. That is, the location of educational institution also plays a vital role in learners' proficiency in the use of English. For, most of the educational institutions, both managed by private as well as government bodies, which are located in the non-urban settings usually lack an environment of English. People in such areas communicate in their mother tongue or the regional language. The regional language is the only language which is commonly used at schools and colleges, in the offices and at all the important public places such as shopping centers and railway offices. Therefore, the learner has hardly any exposure to English either at the educational institution or outside it. Such a learner is less likely to gain the expected competency in English at the time of completion of his education at these schools and colleges. Later, as a result, he may find it difficult to communicate in English on his job. Especially so, if he has to function as a business executive in an urban environment.

The general educational situation in Bihar then is far from satisfactory though both the recent strides forward and the scale of the challenge in a system with 24.7 million students should be acknowledged within this general educational context challenges abound for the teaching of English as a subject in schools in Bihar.Research conducted under the auspices of the BLISS project indicates a prerequisite for successful teaching of a language. , that is teachers who are themselves proficient in the language is sadly lacking. Baselines survey of secondary school English teachers' language levels conducted in 2014 and 2015 with samples of 330 and 388 teachers respectively revealed that more than half had levels below B1 on the Common European Framework of Reference (CEFR) i.e. they were at 'basic user' level. Baseline studies were also conducted of teaching skills through standardized observations of 156 teachers in 13 districts which indicated.

That the vast majority of untrained teachers adopt a highly traditional approach in which teacher talking time is very high, as is use of regional language as opposed to English.Activities, games and the use of pair and group work are

rare, with rows of passive students who are occasionally –asked a question to which they reply with short utterances (British Council, 2016b,p.58). English language tests were also conducted on teachers selected for and training as teacher educators.These teachers as one would expect had higher baseline levels at the start of the project but what is more significant is the improvement that they made after receiving project training with 57% of a random sample moving upon CEFR band and one percent more than one band. This indicates that both language proficiency gains and skills development are possible. If teachers receive high quality, targeted training and are given adequate support as they develop their new language and teaching skills.

It is difficult to see how state-wide equality in English teaching-learning can be realised in practice with the current language and skill levels amongst English teachers. Though English has been a compulsory subject of study from standard 1 since 2006, it has not been a compulsory examination subject at standard 10 since the late 1960s. Known as the Karpoori Doctrine after the education minister who implemented the policy, it has been a source of continuing controversy with calls for it to be reversed increasing in recent years. It is somewhat a paradox that the number of private English- Medium schools in Bihar has been increasing at a phenomenal rate. In the absence of any prior research on attitudes to English in Bihar, one can only infer that there are an increasing number of parents who see enough value in English to enroll their children in English medium schools, thought he majority still do not. From a focus group discussion undertaken, it seems that parents would like to support their children's learning but do not know how to go about it, are generally ill-informed about the education their children are receiving and were divided on the value of learning English.

The medium of education in Bihar always used to be English till 1967 when the then newly appointed Education Minister Karpoori Thakur made English Language non-compulsory and hence thereafter the quality of English learning witnessed a sharp fall. Perhaps it was among the few decisions that ultimately backfired and stalled the very progress of English (the global language) education in Bihar. - Prerna - July 11, 2008. English syllabus has been revised by the State Council of Education Research and Training (SCERT), Bihar recently and new panel of experts have been working to bring new changes in English for Bihar. The last English book was written in 1977 and that was the basis for English learning in Bihar for 30 years. It was simple and was made in such way that any students from Bihar could read and understand the language easily. The English language can influence our cultural, social, political, and economic life at large. So to strengthen Bihar, there is an urgent need to make this subject compulsory and students should be allowed to do more speaking and listening and exposed to other types of English spoken in Gulf and South Asian countries. - Dr. SanjeevDhari Sinha, Germany - July 15, 2008

CONCLUSION

Because of the social and technological changes rapidly taking place in business environment today, there have been significant changes in the language need of students . Therefore, it is felt that along with speaking and writing skills, reading and listening skills are also equally important for students. Further as sociolinguistic factors considerably influence one's second language learning , it is also felt that the language needs of these students' would vary according to their sociolinguistic backgrounds.

According to Ellis and Johnson (1994), what English learners need to acquire could be broadly summarized as follows:

- Develop confidence and fluency in speaking
- Acquire skills for organizing and structuring information
- Work on sufficient language accuracy to be able to communicate
- An awareness of appropriate language and behavior for the cultures and situations in which they will operate.

In order to develop their communication skills, teacher has to do lots of activities in the class. Teacher has to create a friendly or informal environment so that students will not fear to speak. In this context we have seen that students most of the time struggle to speak. Students face problems for basically three reasons:

a) He/she has no knowledge of grammar.
b) He/she has never experienced speaking in public
c) He/she has shortage of words/vocabulary.

To overcome of this, the teacher must overlook grammatical accuracy in the beginning. Teachers have to encourage students to speak, and the same activities should be done for repeated times so that students will make a habit of speaking and gradually students will overcome of the fear of speaking in public. In later stage just give hints about what is right instead of finding their mistakes. Teacher sometimes do some exercises on simple vocabulary like name of Vegetables, Stationeries, Fruits, Animals and Body parts etc. besides classroom activities, Teachers are required to give some simple written task on their routine work, hobbies and favourite games. Most useful activity would be making short videos on interviews, role plays, presentations of the students in the class. It will boost their confidence when they will watch themselves in videos in the class room. Teachers are required to conduct lot of activities like ,role plays, youth parliament, JAM ,in order to provide enough exposure to English and communicative skills.

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RESEARCH ARTICLE

Ethno-Medicinal Studies on Plant Resources of Gandhamardan Hill Ranges, Odisha, India

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ABSTRACT

The present paper enumerates an account of 30 plant species traditionally used by the most populous ethnic tribe of Gandhamardan hill range against various diseases and health issues. The first hand data collected through several surveys and field visits among 4 major tribal groups of the Gandhamardan hill range on the Bolangir districts. An outcome of the ethno-medicinal investigation is described with their botanical names, families along with their local names, place of collection and mode of administrations. The paper put a light on the unique diversity of this hill range and also mentioned some measures of threat to its plant resources.

Keywords: Gandhamardan hill, Ethnic tribe, Ethno-medicines,

INTRODUCTION

The Gandhamardan hill ranges is a sacred regions situated in Bolangir-Bargarh district of Odisha. This ancient hill range accommodates a unique ecological environment and regarded as the treasure house of plant sources with a wide diversification of medicinal and aromatic timber or non-timber plants [1]. The ethnic diversity and the perennial sources of water favours livelihood of the forest dwellers in its surrounding regions. Gandhamardan is reported as a tribal dominated region with the populous races Kandh, Gond, Binjhal and Saura [2]. These people fully depend upon the hill range for their sustenance. They have an intimate relationship with their surrounding and use various plant and animal products found in the forest of hill range for therapeutic activities to treat diseases and aliments. Ethnobotanical properties of the plants and diversity from this area were previously discussed in works of

several workers [3-16]. The present report is an account of 30 plants species used as curative measures by the tribal of Gandhamardan hill on Bolangir district.

Study Area

Gandhamardan Hill is located between 20°.52'.26" North latitude and 82°.50'.34" East longitude on the Odisha-Chhattisgarh border near Paikmal on the Bargarh and Bolangir district's borders. It is a rich source of indigenous medicinal plants. Over 200 vaidyas or traditional ayurvedic medicine practitioner are work in this region to collect medicinal plants and treat a number of diseases. Locals here believe that over 500 species of medicinal plants can be found here. IT shows a remarkable floristic composition in its diversity by a healthy rainfall of 1400mm annually by North- Eastern monsoon. Climate is extreme in this region due to its altitude (1065m above MSL). Depending upon the local climatic and geographical features the vegetation of Gandhamardan can be divided into two distinct categories between the foothills (30 m above MSL) and the plateau (1065 m above MSL): dry deciduous and semi-evergreen forests. About 912 vascular plant taxa pertaining to 142 families and 556 genera have been documented so far from here.[@7-1] Many ethnic tribes are located in its surroundings because of its grand greenery and water sources.

MATERIAL AND METHODS

Both primary and secondary sources were visited for documentation of the traditional knowledge from the tribal of respective study site during the field investigation. The ethno-medicinal information about different plant species to cure diseases and ailments were recorded through semi-structured questionnaires by personal discussions, interviews with focused groups combined with field visits, voice recordings and photo documentation by consulting traditional knowledge holders or vaidya. Several field visits were conducted to all the two study sites in the year 2019-2020.Personal Interviews of each Key informant and Focus Group Discussions involving 25 Tribal peoples of 10-12 villages, of the study sites was made to codify the folk knowledge. Information on local plant names, uses, disease to be treated, methods and mode of medicine preparation etc. were gathered by developing a structured questionnaire. The GPS readings were taken to identify and map the habitats of both plant species and the tribal habitats of the survey sites for geo referencing. Analysis of the collected data was conducted by taking comparative study and verified by cross checking and other observational studies. Field guides like Hooker, 1877; Haines, 1921-25; Saxena and Bramham, 1989; 1994-96 were followed for the plant species identification [19-21]. The herbarium was prepared by following The "Handbook Of Field and Herbarium Methods" by S.K Jain & R.R Rao, 1977 [22] and the herbarium specimens of the identified plants with accession numbers, date and place of collection is submitted to Centurion University Of Technology And Management, Bhubaneswar, Odisha.

Enumeration

30 species of plants belongs to 28 families are arranged alphabetically by their scientific names and families in parentheses, followed by their Ethno-medicinal data, vernacular names and collection places. The curative uses of each plant mentioned with the mode of administration briefly.

1) *Abrus precatorius* (Fabaceae)
Vernacular name: Gunja
Place of collection: Gandhamardan hill
Administration mode: Crushed root mixed with water rubbed on scalp before hair wash for a healthy hair growth. Mouth ulcer and throat infection can be treated by chewing a handful leaves of the plant.

2) *Acacia nilotica* (Mimosaceae)
Vernacular name: Bamur
Place of collection: Baidapada
Administration mode: The gum resin of plant is taken orally to reduce the swelling of the uterus.

3) ***Achyranthes aspera*** **(Amaranthaceae)**
Vernacular name: Kukurdanti
Place of collection: Harishankar
Administration mode: The plant root crushed with water and given orally to cure Bone breakage of cattle.
Fresh leaves are rubbing externally to get relief from Muscular Sprains.
Plant root paste with black pepper is taken orally to get relief from Diarrhoea.

4) ***Aloe barbadensis*** **(Liliaceae)**
Vernacular name: Gheekuanri
Place of collection: Junanibahal
Administration mode: Small pieces of the plant boil and administered orally to cure Arthritis and various Liver problems.

5) ***Alstonia scholaris*** **(Apocynaceae)**
Vernacular name: Chatiana
Place of collection: Harishankar
Administration mode: Bark powder is taken orally to cure Arthritis.
Root paste applied on the affected area to treat preliminary Leprosy.

6) ***Anacardium occidentale*** **(Anacardiaceae)**
Vernacular name: Lankabhalia
Place of collection: Harishankar
Administration mode: Bark juice applied on tooth to get relief from toothache.
Seed oil massaged externally on affected area to treat Elephantiasis.

7) ***Andrographis paniculata*** **(Acanthaceae)**
Vernacular name: Bhuinneem
Place of collection: Harishankar
Administration mode: Leaf juice taken orally to control sugar. It also applied for treatment of ring worm and Malaria.
Bark juice mixed with honey administrated orally to the diarrhoea patient for 3 times a day.

8) ***Argemone Mexicana*** **(Papaveraceae)**
Vernacular name: Deng vejri
Place of collection: Salangipada
Administration mode: One teaspoon milk of the plant administered orally for treatment of jaundice.
Fruit juice rubbed on bald area for hair growth.

9) ***Asparagus racemosus*** **(Asparagaceae)**
Vernacular name: Iswarjata
Place of collection: Gandhamardan hill
Administration mode: Root paste applied locally on lower stomach of pregnant women for easy delivery.
Tuber paste mixed with cold water rubbed on head of sun-stroked patient to get instant relief.

10) ***Bacopa monnieri*** **(Scrophulariaceae)**
Vernacular name: Jalbramhi
Place of collection: Kandrabhata
Administration mode: Leaf paste is applied on head during headache to get relief from pain.
The plant extract is administered orally for 4-5 months in a treatment of Epilepsy.

11) *Boerhavia diffusa* (Nyctaginaceae)
Vernacular name: Chaulia, Gadha saga
Place of collection: Salangipada
Administration mode: Leaf grinded with cold water is taken orally for 7-8 days to treat cold, cough and Eosinophilia.
Leaf grinded with warm water is given orally for extraction of cough from body.

12) *Butea monosperma* (Fabaceae)
Vernacular name: Palsa
Place of collection: Gandhamardan hill
Administration mode: 10-15 gm of bark juice with a pinch of pepper powder is taken with milk for once in a month to dissolve Kidney stone.

13) *Calotropis gigantea* (Asclepiadaceae)
Vernacular name: Dhala arakha
Place of collection: Salangipada
Administration mode: One tablespoon of root paste is taken orally with a cup of warm water twice a day for a month to cure piles.
Latex of the plant helps in reducing skin infection caused by water.

14) *Cassia fistula* (Caesalpiniaceae)
Vernacular name: Sunari
Place of collection: Harishankar
Administration mode: Juice of root administered orally to cure bleeding during Urination.
The plant root is tie in body during Nasal bleeding to stop bleeding.

15) *Cinnamomum camphora* (Lauraceae)
Vernacular name: Karpur
Place of collection: Harishankar
Administration mode: Powder of bark taken orally during headache for an instant relief.
It is also helpful for Acidity and Throat infection.

16) *Cissampelos pareira* (Menispermaceae)
Vernacular name: Akanbindhi
Place of collection: Baghjharan
Administration mode: Root powder taken orally to treat is health issues such as Toothache and Acidity.

17) *Cocculus hirsutus* (Menispermaceae)
Vernacular name: Dahidahiya
Place of collection: Gandhamardan hill
Administration mode: The leaf powder taken orally with water daily morning to cure urine infection.

18) *Cocos nucifera* (Arecaceae)
Vernacular name: Nadia
Place of collection: Baidapada
Administration mode: The leaf scale of plant burn and the smoke inhaled to stop nose bleeding.

19) *Curculigo orchioides* (Hypoxidaceae)
Vernacular name: Talmuli
Place of collection: Gandhamardan hill
Administration mode: Tuber paste of the plant mixed with curd and administrated orally for thrice to Regularized menstrual cycle.

20) *Elephantopus scaber* (Asteraceae)
Vernacular name: Mayurchulia
Place of collection: Gandhamardan hill
Administration mode: Root paste taken orally with honey to treat Dysentery and Vomiting.
Whole plant part (dry) powder with honey is taken orally by licking to reduce Cough.

21) *Entada rheedii* (Mimosaceae)
Vernacular name: Hanuman lata
Place of collection: Gandhamardan hill
Administration mode: Fruit powder mixed with warm water made into paste and applied on joint as treatment of Arthritis.

22) *Gymnema sylvestre* (Asclepiadaceae)
Vernacular name: Gudmari
Place of collection: Baghjharan
Administration mode: The plant leaf powder and Myrobalan powder mixed with alovera juice taken orally thrice a day to treat Diabetes.

23) *Hemidesmus indicus* (Periplocaceae)
Vernacular name: Sugandhi
Place of collection: Baghjharan
Administration mode: Root powder is given orally twice daily for a week in treatment for Asthma.

24) *Hibiscus cancellatus* (Malvaceae)
Vernacular name: Jharbhindi
Place of collection: Harishankar
Administration mode: Dry root grinded with help of a stone and made powder of it. The powder is given orally twice daily for 2-5 days to prevent Miscarriage during pregnancy.

25) *Justicia adhatoda* (Acanthaceae)
Vernacular name: Basanga
Place of collection: Baghjharan
Administration mode: The plant leaves together with Vitex negundo leaf and honey given orally to prevent and cure toothache.
Leaves are heated a little and are used to relief back pain by applied externally at the affected area.

26) *Madhuca longifolia* (Sapotaceae)
Vernacular name: Mahula
Place of collection: Salangipada
Administration mode: Oil extracted from seed used in treatment of scabies and shingles.

27) *Oroxylum indicum* (Bignoniaceae)
Vernacular name: Phanphana
Place of collection: Harishankar
Administration mode: 1 teaspoon juice of bark taken orally with a cup of milk twice a day to cure rheumatism.

28) *Piper longum* (Piperaceae)
Vernacular name: Pippali
Place of collection: Gandhamardan hill
Administration mode: Fruits are chew by older people to cure Cold.
The fruits fried in ghee are taken orally by children to cure Cold and Cough.

29) *Terminalia arjuna* (Combretaceae)
Vernacular name: Kha, Arjun
Place of collection: Jamunapali
Administration mode: Powder of the whole plant part is given orally to the person in morning for 21 days for treatment of bone fracture.

30) *Tragia involucrate* (Euphorbiaceae)
Vernacular name: Bichhuati
Place of collection: Harishankar
Administration mode: Paste of the whole plant part is used to heal cattle wound.
The plant twig hang on cattle shed to avoid Insects and Ring worms.

RESULTS AND DISCUSSION

The present ethno-medical survey revealed that the tribes of the study area are possessing good knowledge of herbal drugs and health care system. These unique healthcare systems have negligible side effects and base upon traditional beliefs of these indigenous people. The present study enlightens curative potential of 30 species of 28 families for treatment of different diseases. The indigenous medicine system prioritize drug formation from different parts of plant such as root, bark, leaf, flowers, fruits, seeds and whole plant etc. The present survey of the study areas shows a great diversity containing numbers of plants species with rare and endangered status. The indefensible activities of urbanization and modernization create a serious threat to the potential meditative plant sources of these regions. Therefore, a long term conservation measure is needed for the protection and retention of the diversity of this region with the ethnic knowledge of the tribes for the reference of the future generations. [16]

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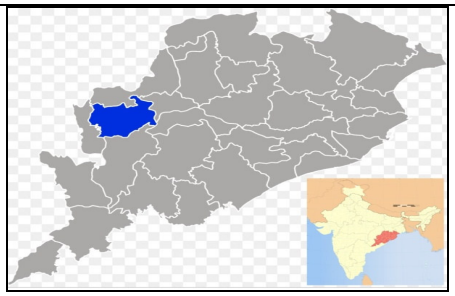

Fig.1.Map showing Bolangir district in India and Odisha

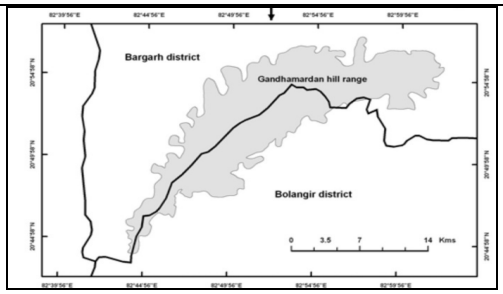

Fig.2.Map showing Gandhamardan Hill Range

Fig.3.*Abrus precatorius*

Fig.4.*Acacia nilotica*

Fig.5.*Achyranthes aspera*

Fig.6.*Aloe barbadensis*

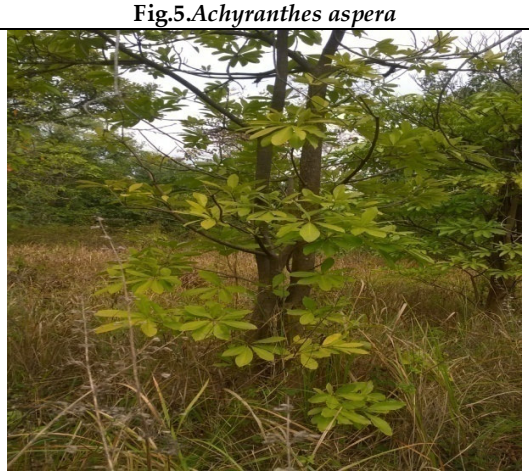

Fig.7.*Alstonia scholaris*

Fig.8.*Anacardium occidentale*


Fig.9.*Andrographis paniculata*


Fig.10.*Argemone mexicana*

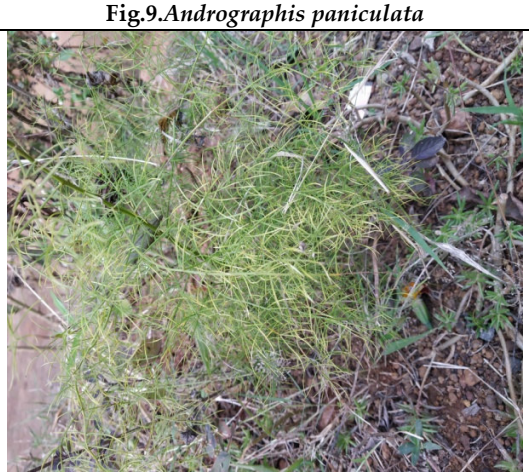
Fig.11.*Asparagus racemosus*


Fig.12.*Bacopa monnieri*

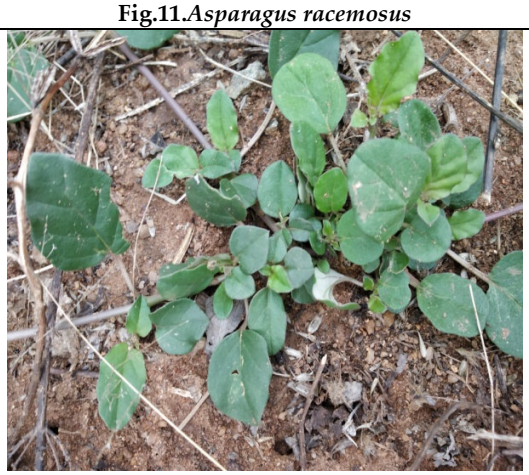
Fig.13.*Boerhavia diffusa*


Fig.14.*Butea monosperma*

Fig.15.*Calotropis gigantea*

Fig.16.*Cassia fistula*

Fig.17.*Cinnamomum camphora*

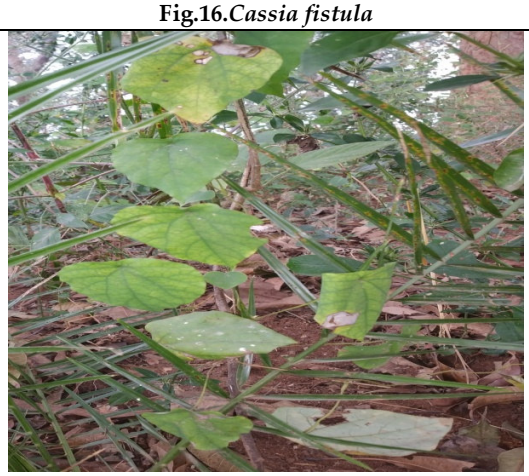

Fig.18.*Cissampelos pareira*

Fig.19.*Cocculus hirsutus*

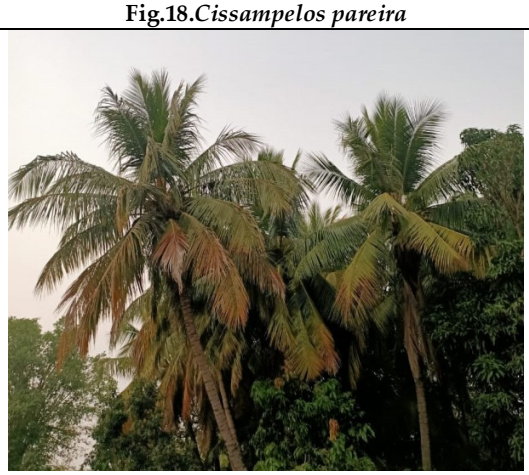

Fig.20.*Cocos nucifera*

Fig.21.*Curculigo orchioides*

Fig.22.*Elephantopus scaber*

Fig.23.*Entada rheedii*

Fig.24.*Gymnema sylvestre*

Fig.25.*Hemidesmus indicus*

Fig.26.*Hibiscus cancellatus*

Fig.27.*Justicia adhatoda*

Fig.28.*Madhuca longifolia*

Fig.29.*Oroxylum indicum*

Fig.30.*Piper longum*

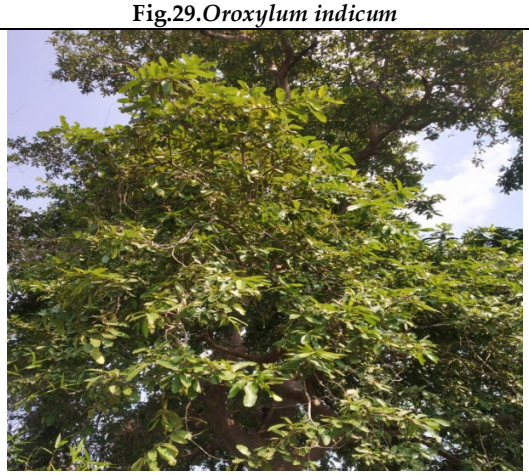

Fig.31.*Terminalia arjuna*

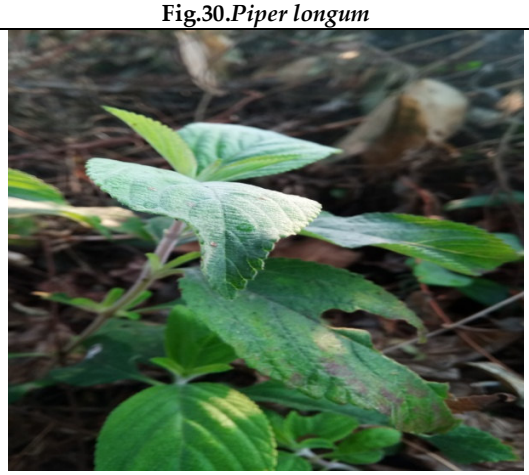

Fig.32.*Tragia involucrate*

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RESEARCH ARTICLE

Application of PLC and SCADA to Smart Cooking Machine

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ABSTRACT

With the advancement of technology, the need of automation is also increasing gradually. Hence, the control system has to be designed in such a way that it can be easily programmed, should be flexible, robust and cost-effective. In today's world due to rapid increase in inventions of machines based on automation, it has gained its importance in every sphere of life. In this paper an automated cooking range has been proposed. The main idea behind this project is to make cooking easier, simple and less time consuming. This machine can make food as close as food that can be prepared by a human manually with the advantage that it prepares hygienic food at faster rate without the interface of the human being. For communication of the user with the machine, a HMI interface has been installed through which command is given to the machine in order to control the working process . This machine can be used in our day to day life and even in industries for mass production of certain food products.

Keywords: Automation, PLC, Smart cooking, Arduino, HMI

INTRODUCTION

Food automation is the one among the fast growing technology, there by food making machines are most popular and most of need. The Automated food maker machine is a pioneering concept in food manufacturing since it is designed to cook more than one kind of dishes. In today's day to day busy life making food manually is a challenging task. Automation in food manufacturing has been a primary solution in improving the consistency, safety and accessibility of food in major consumer markets. Quality of food prepared by different individuals differ in the taste but it is overcome in case of a machine, we can create the same quality of food every time. We can minimize errors and wastage of food in case of a machine. The machine provides quality food, reduction in cooking time and less supervision is required by the user. Industries uses automation process in case of production of food products over a large scale. This paper, is organised into different sections as in Section II, represents the objective of

the paper. In Section III system design has been discussed. In Section IV, hardware implementation has been explained. Section V describes the project analysis. Conclusions are mentioned in Section VI.

Objective

Automation as the word implies doing things automatically. Hence, the major advantage is that it decreases the man power. This smart cooking machine will perform its functions with atmost hygiene. This machine has following objectives:-

- It performs the task automatically without any intervention of human being.
- A large number of receipes can be stored in this machine, thus giving a scope to make wide range of receipes.
- There is no wastage of food as the quantity of food is decided by the machine depending upon the number of people.
- Time consumption is less.
- Burning of food due to human mistake is eliminated.

Taste of receipe remains the same for a particular item as there is no involvement of human beings.

Designing of System

This system primarily serves for three main functions that is, the food menu, cooking, heating and food serving function. In the food menu function, the user can add data as per the menu he wants to cook into the database engine along with the details of cooking process. This process is shown in the following figure: Next is the cooking function where the user can do complete the process by entering the ingredients and seasoning. After that the dish is selected from the database. Then the machine automatically cook the food and the progress bar is displayed while cooking on machine to display the status of cooking. Last is the heating function where the user can warm the food. The way is only by entering the food to be heated into the machine. After that the user set the length of time to heat up.

Hardware Implementation

This machine basically based on mechanical and electrical parts with programming of PLC as shown in the block diagram:

Electrical Parts

PLC:- In our project PLC should programme for operations of induction control, motor control, oil and water control, limit switches control and different indicating functions like stand by ON, power ON, induction ON, cooking in process, food served etc.

HMI :- The Human Machine Interface is connected to the PLC using serial communication via RS232 cable. It is a Graphical User Interface (GUI) created using Screen Editor 2.00.23 software. The HMI is used to select the recipe and hence control the flow of cooking mechanism. It is used for communicating with the machine.

SMPS :- SMPS is the Switched Mode Power supply circuit which is designed for obtaining the regulated DC output voltage from an unregulated DC or AC voltage. In our project we used two SMPS that is convert AC voltage into regulated DC voltage for using two purposes that is, One SMPS is 12 volt, 20 Amp which is used to running all the DC motors. Second one is 5 volt, 12 Amp which is used to giving the supply to Arduino Board.

Power Supply :- DC power supply is required for the continuous and smooth operation of the DC motors which are used along with Ingredients containers. +5 Volts is connected to Arduino Uno micro controller, +12 Volts is connected to PLC to control the output devices. Relay units is connected to Geared DC motors and induction cooker during the circuit Operation.

Limit Switches :- In our project limit switches are used to control the rotation of spice dispenser and control the rotation of moving disc which is carried out the recipe after complete the cooking.

Mechanical Parts

Induction cooker :- It provides the required temperature for cooking as per the recipe. In our project the induction motor is connected with ARDUINO UNO through 24 volt relay module .

Shafts: - A shaft coupler is a device used tconnect two shafts together at their ends for the purpose of transmitting power. The primary purpose of couplings is to join two pieces of rotating equipment while permitting some degree of misalignment or end movement. Motor with reduction gear box: - Gearbox reduces the speed and increase rotary torque.

Automated cooking base :- Automated cooking base is design by using the mechanical hardware like V- angles, channels, alluminium threading rods, alluminium sockets to hold the motors, nuts and bolts. It designed with fully automatically movement of disc through vertical and horizontal threading by the help of DC motors. It also designed to hold the induction cooker.

PROJECT RESULT ANALYSIS

- As per the experimental verification, following results are obtained;
- Taste remains same for a particular receipe.
- Time consumption is less.
- The receipe can be edited as many times required and can also be saved.
- Reduction in manpower.

CONCLUSION

This paper mainly concentrates on concept development and trials to ensure electronic control parts operation. Hence the design is considered mainly for easy prototyping, keeping this the containers and other parts such as motors, vessel and induction cooker are directly brought and integrated into the system to conclude the prototyping build provides all operation and functionality of the Automated Cooking Range. However the design part can be reviewed to make more aesthetic and raged to fit into kitchen environment

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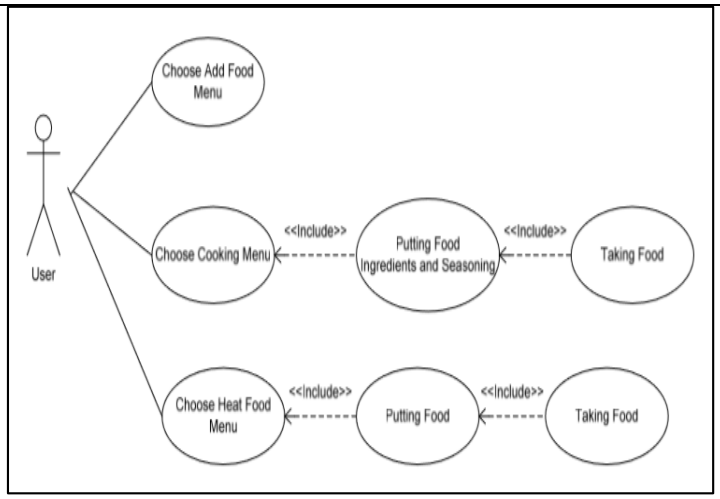

Fig. 1 Smart Automated Cooking System

Fig. 2 cooking function

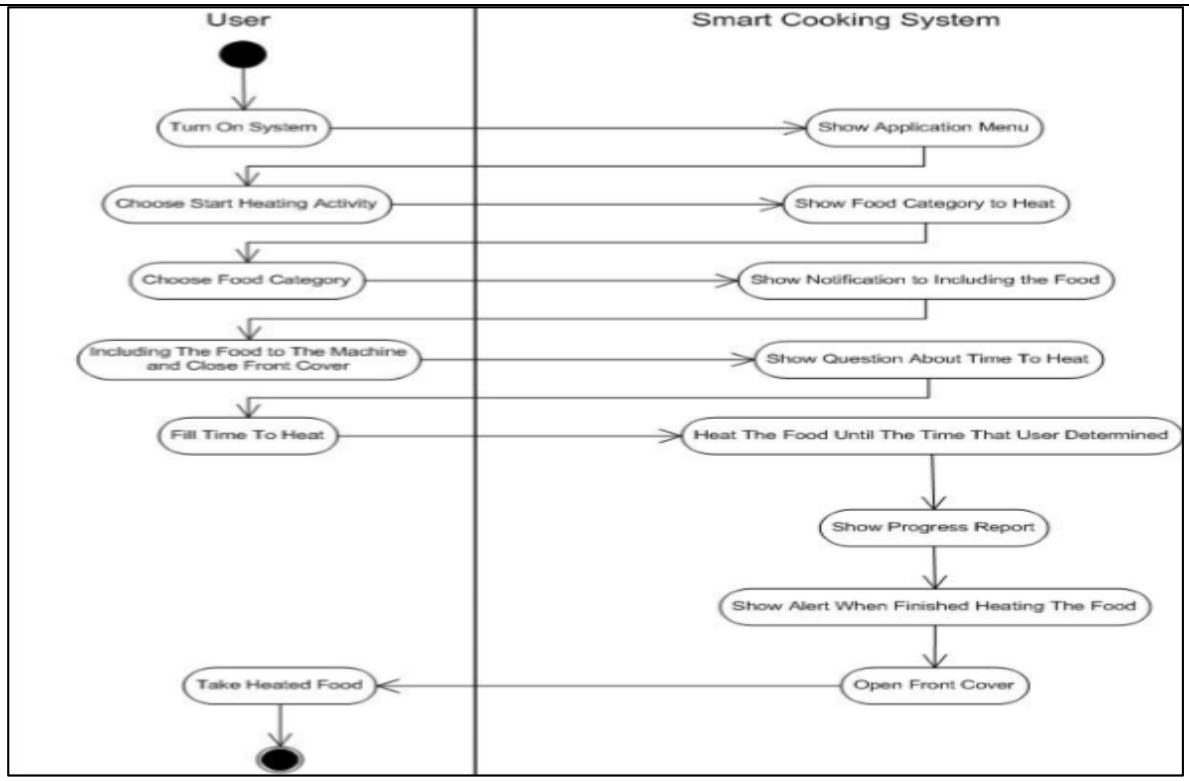

Fig 3. Heating function

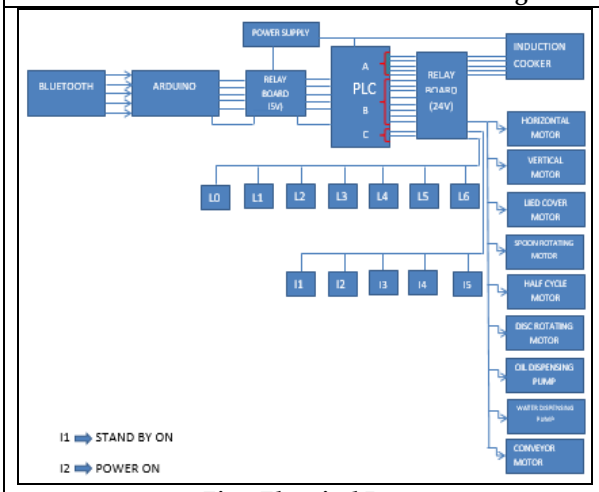

Fig.4 Electrical Part

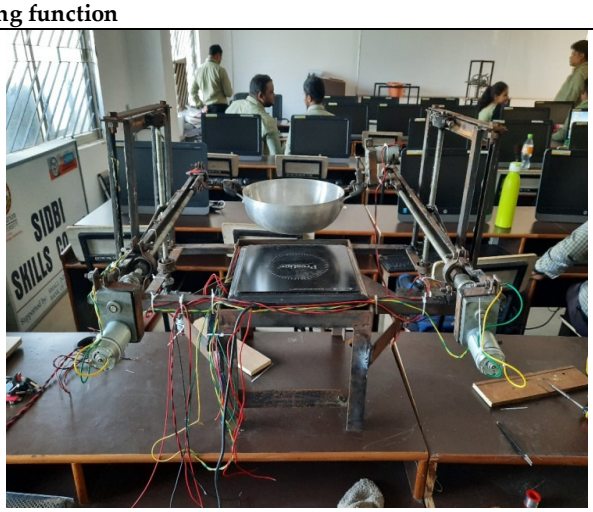

Fig.5 Mechanical Part

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RESEARCH ARTICLE

Transformer less Railway Traction Drive using Cascaded Multilevel Converter

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ABSTRACT

Electric railways have been introduced due to its increased efficiency and less environmental impact as compared to the diesel engines. Generally, in an electrified railway system, with the help of a transformer, the three phase, 25kV, 50 Hz AC supply is stepped down to three phase, 400 V , 50Hz to be used by the traction motors. The problem that lies with this conventional transformer is bulky weight operating at reduced efficiency. This paper presents replacement of the conventional transformer with the cascaded multilevel converter in the railway traction drive. An inverter has been designed to step down the input voltage as supplied to a voltage level that is required by the induction motor drive. The inverter is designed using IGBT and cascaded upto eleven levels. Due to this there is no need of transformer for change of voltage characteristics and this also reduces the Total Harmonic Distortion. In this cascaded eleven level inverter Selective Harmonic Elimination modulation scheme has been emphasised.

Keywords: Electric Traction, Cascaded Multilevel Inverter, Transformerless Traction Drive, Induction Motors, Selective Harmonic Elimination Technique

INTRODUCTION

In earlier days most of the railway engine operated by using diesel as the source. The main issue of this is its environmental impact. Apart from this reliability & efficiency of diesel engine is another concern. In order to overcome this we must think of source of energy having no environmental effect or very less impact on environment also efficient and reliable one. In this context application of electrical energy for traction purpose is an efficient and reliable method. The advantage of electric traction is that it can transform power to traction motor in an efficient

way. As electric traction has high power to weight ratio hence higher the number the better is the performance of the engine. As the performance is increased hence the engine will have more accelerated value. It will travel the same distance with less time as compared to diesel engine. We can further increase the efficiency through regenerative braking.. In order to meet the high voltage demand in industrial applications, several power apparatus are used in series or parallel mode. But their inherent characteristics will differ and will damage these power devices. Thus the multilevel inverters have been introduced as a solution to this. They synthesize almost sinusoidal voltage waveform from several dc sources with almost no electromagnetic interference and common mode voltage [2,3,4]. This prevents the motor damage and eliminates the need of bulky transformers. This in turn also boosts the performance and decreases the cost of drives. Another advantage is that their switching frequency is lower than the conventionaltwo level inverter which results in low switching losses. Among the three basic types of multilevel inverter, the Cascaded H Bridge (CHB) multilevel inverter is best suited for high power applications with low rating devices. Because of the modular structure, it has optimised packaging and circuit layout. One of the most important features is that they can be efficiently integrated with various renewable sources of energy and can also operate with one DC source failure. It needs a large number of DC sources[2,5].IGBT is commonly used in CHB multilevel inverter due to easy switching and reduced power loss [5]. Nowadays, induction motors are preferred in electrified railway traction system develop traction force to run the train sets due to its better torque characteristics , high reliability, low cost and less weight [7]. In this paper, an IGBT based eleven level cascaded multilevel inverter has been modelled to be implemented in traction drive of railway train as shown in Fig.1. A three phase, 25kV, 50Hz supply is stepped down to three phase, 400kV, 50 Hz to be used by the induction motors. Four induction motors are used to generate the required tractive force in the railway traction. DC dynamic braking has been used for electrical braking in the motors.

Cascaded Multilevel Inverter

In a cascaded multilevel inverter, single phase H-bridge inverter units are connected in cascade as shown in Fig. 2 and Fig. 3. Three different voltage outputs , $+V_{dc}$, 0, $-V_{dc}$ is obtained by each inverter unit , by various combinations of four switches S_1, S_2 , S_3 and S_4[5]. The number of units in cascaded multilevel inverter is decided by its operating voltage. The ac output voltage of each full bridge inverter is series connected to generate a synthesized voltage waveform. This waveform is the sum of all of the outputs of individual inverter unit i.e. $V_{AN} = V_{A1} + V_{A2} + V_{A3} + \cdots$ .The number of output phase voltage levels *m* in a cascade multilevel inverter is given by $m=2s+1$, where *s* is the number of DC sources in each phase[5]. Only odd level of voltage can be obtained from the cascaded multilevel inverter.

As for an eleven level inverter (m=5),

$$V_{AN} = V_{A1} - V_{A2} + V_{A3} + V_{A4} + V_{A5}$$
$$V_{BN} = V_{B1} + V_{B2} + V_{B3} + V_{B4} + V_{B5}$$
$$V_{AB} = V_{AN} - V_{BN}$$

Where V_{AN} = voltage of phase A w.r.t N

And V_{AB} = Line voltage

The poor quality of current and voltage fed to the motors is due to the presence of lower order harmonics. So in order to reduce the THD of the output voltage of the inverter, these lower order dominant harmonics has to be eliminated. This can be done by using an appropriate switching algorithm known as Selective Harmonic Elimination (SHE) technique[6]. In SHE method, the lower order harmonics are eliminated and higher order harmonics are filtered out. As in case of a 11 level cascaded inverter, the Total Harmonic Distortion (THD) of the output voltage waveform is less than 5% while each active device being switched only at fundamental frequency. This method results inequalising the current stress in each devices as they conduct for 180°.

The Fourier Series expansion of the stepped output voltage waveform of the multilevel inverter is :

$$V(\omega t) = \sum_{n=1,3,5,\ldots}^{\infty} \frac{4V_{dc}}{n\pi} (\cos(n\theta_1) + \cos(n\theta_2) + \cdots + \cos(n\theta_s)) \sin(n\omega t) \qquad (1)$$

Where V_{dc} is the magnitude of the dc voltage source and s is the number of dc sources.
For a desired fundamental voltage V_1, the switching angles $\theta_1, \ldots, \theta_n$ are to be determined so that $V(\omega t) = V_1 \sin(\omega t)$ satisfying the following condition: $0 \leq \theta_1 < \theta_2 \ldots < \theta_s \leq \pi/2$ as shown in Fig. 4.
Here, the first harmonics is made equal to the desired fundamental voltage V_1 and specific higher harmonics of $V(\omega t)$ equal to zero, i.e

$$\frac{4V_{dc}}{\pi}(\cos(\theta_1) + \cos(\theta_2) + \cdots - \cos(\theta_s)) = V_1 \quad (2)$$

$$\cos(n\theta_1) + \cos(n\theta_2) + \cdots + \cos(n\theta_s) = 0 \quad (3)$$

Where n = 5,7,11,13….
Various techniques likes Newton Raphson method, theory of resultant of polynomials, genetic algorithm etc can be used to solve these equations [6].
In a three phase motor drive, the 3rd harmonics automatically cancel out in the line to line voltage [6].Here, the 5th, 7th, 11th, 13th order harmonics has to be eliminated as they have a great impact on the THD.
Thus, the following equations need to be solved:

$$\cos(\theta_1) + \cos(\theta_2) + \cdots + \cos(\theta_s) = \frac{(m-1)}{2} M_I \quad (4)$$

$$\cos(5\theta_1) + \cos(5\theta_2) + \cdots + \cos(5\theta_s) = 0 \quad (5)$$

$$\cos(7\theta_1) + \cos(7\theta_2) + \cdots + \cos(7\theta_s) = 0 \quad (6)$$

$$\cos(11\theta_1) + \cos(11\theta_2) + \cdots + \cos(11\theta_s) = 0 \quad (7)$$

$$\cos(13\theta_1) + \cos(13\theta_2) + \cdots + \cos(13\theta_s) = 0 \quad (8)$$

Where M_I is the Modulation Index and is equal to the ratio of the fundamental output voltage V_1 to the maximum obtainable fundamental voltage V_{1max}.
On solving (4) to (8) by applying Newton Raphson method, with m=5 and M_I =0.8 for an eleven level cascaded inverter, the switching angles were obtained to be $\theta_1 = 6.57°, \theta_2 = 18.04°, \theta_3 = 27.18°, \theta_4 = 45.15°, \theta_5 = 62.24°$.
To solve the transcendental equations with *n* number of unknowns is quite a tedious task. But to eradicate the specific low order harmonics from the output voltage waveform, offline calculations for switching angles can be done. The switching is performed at the fundamental frequency and hence the switching losses are reduced.

Traction Mechanics

The speed- time curve of a train moving on a main line is shown in Fig. 5 [1].
The curve has five different periods :
1.Notching Up period (t_0=0 to $t_1$hr) :
During starting, there is a fluctuation in the motor torque developed and tractive effort. But the average tractive effort remains same resulting in constant acceleration. Therefore the speed time curve is a straight line.
2.Acceleration on speed curve (t_1 hr to t_2 hr) :During this duration there is a reduction in acceleration with speed.
3.Free running period (t_2 hr to t_3 hr):The speed of the train is constant in this period.
4.Coasting Period (t_3 hr to t_4 hr):During coasting period, the supply to induction motors is disconnected and train runs under its own momentum. There is a gradual decrease in the train speed because of its own resistance.
5.Braking Period (t_4 hr to t_5 hr) :To stop the train, brakes are applied at the end of the coasting period.
The time considered here has been assumed arbitrarily.

SIMULATION RESULTS

The switching angles so calculated earlier were used in the cascaded eleven level inverter and a 100V DC source was given to each H-bridge unit. The line voltage and phase voltage waveforms so obtained are as shown in Fig. 6. The THD of line to line voltage of the inverter was found to be 4.56%. On implementing SHE technique to the eleven level cascaded rectifier inverter configuration , the line and phase voltage waveform so obtained is shown in Fig. 7(a) and 7(b). The THD of the line to line voltage of the converter

was found to be 0.27%.
The speed –time curve so obtained can be considered to comprise of five regions as such :

i. notching up period from 0 sec to 1 sec
ii. acceleration from 1 sec to 2.2 sec
iii. free running period from 2.2 sec to 4 sec
iv. coasting period from 4 sec to 5 sec
v. braking period from 5 sec to 5.7 sec

During starting period the torque developed was high. The supply was disconnected at time t= 4 sec. Hence the torque developed decreases and approaches to zero. The dynamic breaking was enforced at time t = 5 sec due to which again the torque becomes negative.

The supply voltage for railway line is 25 KV. Hence we have to stepped down to 400 V for the electric traction purpose. Fig. 10 shows the stepped down of voltage from 25 KV to 400 V. When the electric supply was discontinued the voltage becomes zero. A constant DC voltage is applied during this braking period. Fig. 11(a) and Fig 12(a) shows the active power and the reactive power consumed by each motor unit respectively. Fig. 11(b) shows the active power consumed by each unit of induction motor during coasting period. An overshoot in power consumption can be observed when supply is cut off. This overshoot is because of the power required by the motor to meet its losses.

During starting when there is no load the starting current is high. This high starting current is required for the flux generation. This results in massive active power and reactive power on starting as shown in Fig. 11(a) and 12(a). In Fig 12(b), it can be seen that during the coasting period, the value of reactive power decreases continuously and finally attains zero value. DC dynamic braking was initiated at 5 seconds in order to stop the train. Fig. 14 shows the variation of breaking current with respect to time when the DC dynamic braking is applied.. When braking is applied the braking current becomes negative..

CONCLUSION

The cascaded multilevel converters designed in this paper can be used in the traction drive of the railway system to step down the catenary voltage to the voltage rating of the induction motors. Hence it results in a transformerless railway traction drive. Use of this transformerless traction drive has many advantages like less floor space, low cost and increased efficiency of the system. So the drive is useful and meet the voltage requirement of a traction drive.

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Appendix

The traction drive is simulated in MATLAB/ SIMULINK using four number of the induction motors whose specifications and parameters are as follows:

Power	5HP
line to line voltage	400 V
Frequency	50Hz
Speed	1445rpm
Stator Resistance R_s	7.34 Ω
leakage stator inductance L_{ls}	0.021 H
mutual inductance L_m	0.5H
Rotor resistance R_r	5.64 Ω
leakage rotor inductance L_{lr}	0.021 H
moment of inertia J	0.16 kg-m^2
friction factor B	0.035 kg-m^2/s.

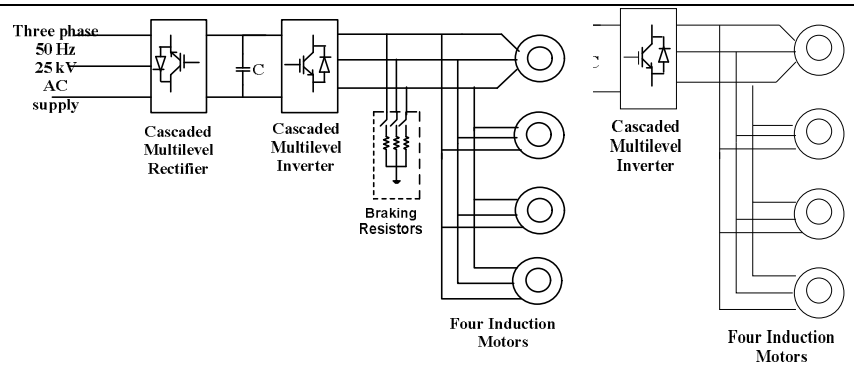

Figure. 1. Schematic diagram of Cascaded Multilevel converter based induction motor traction drive for railway train

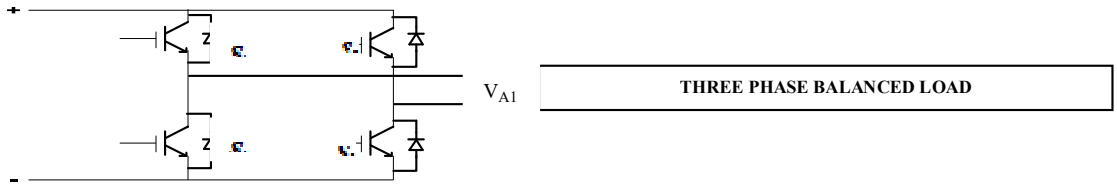

Figure. 2. Single Phase H-Bridge Inverter Unit

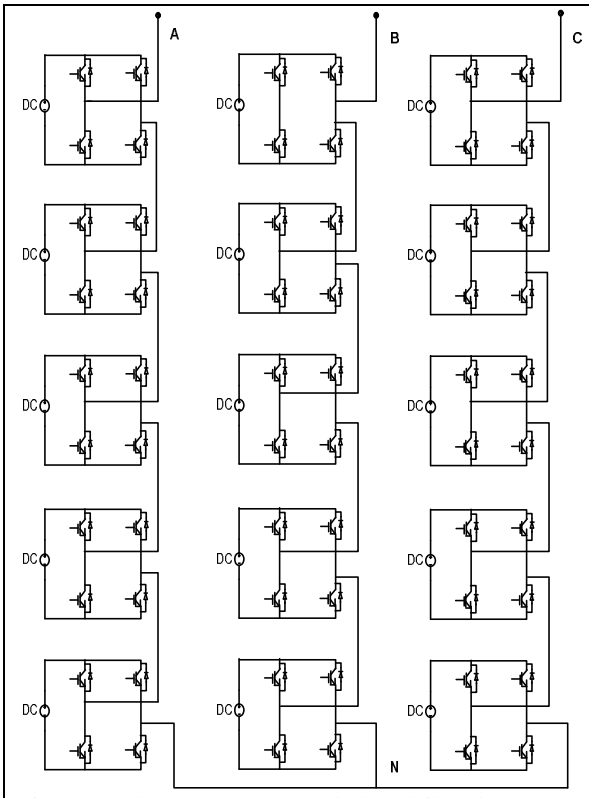

Figure. 3. Eleven Level Cascaded Multilevel Inverter

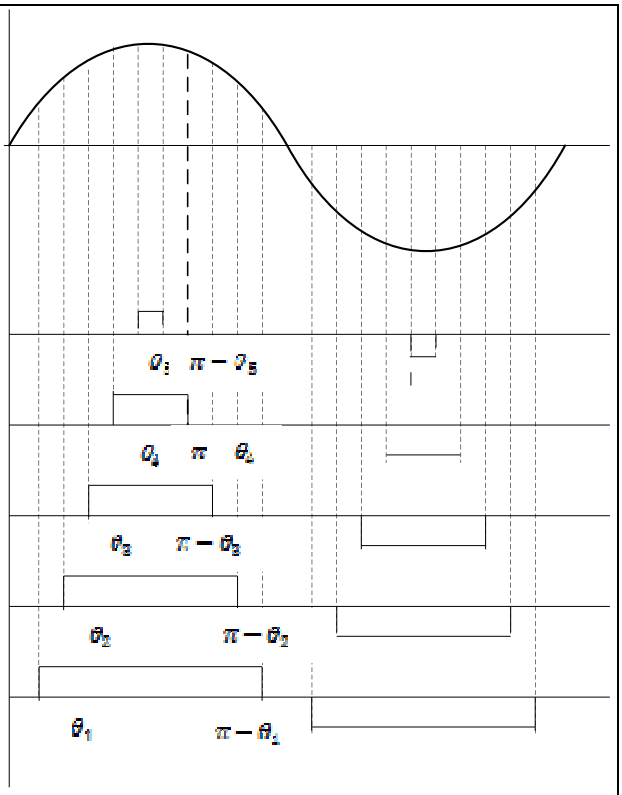

Figure. 4. Selective Harmonic Elimination modulation technique for eleven level cascaded inverter

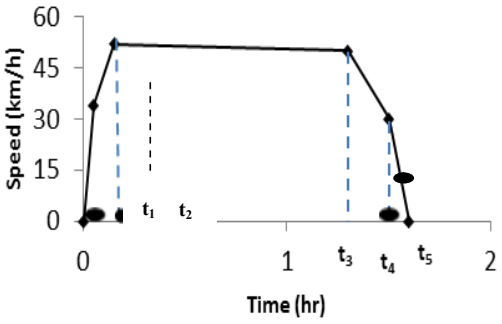

Figure. 5. Speed time curve of a train

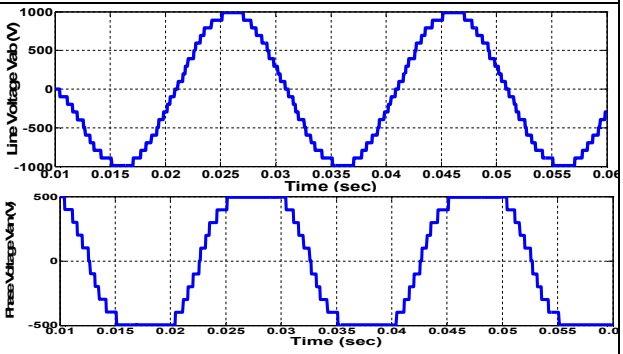

Figure. 6. Line voltage waveform and phase voltage waveform of a cascaded 11 level inverter

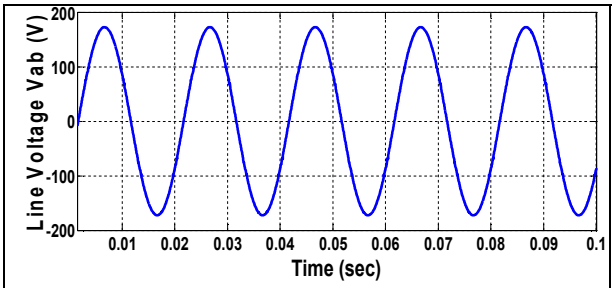

Figure 7(a). Line voltage of an 11 level cascaded converter (rectifier-inverter)

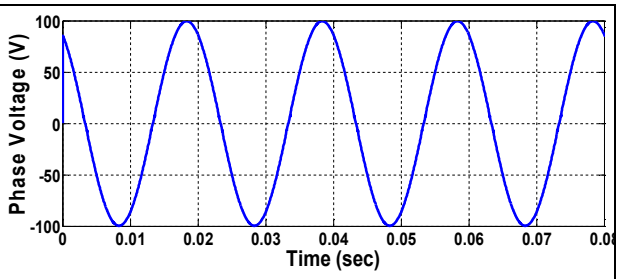

Figure 7(b).Phase voltage of an 11 level cascaded converter (rectifier-inverter)

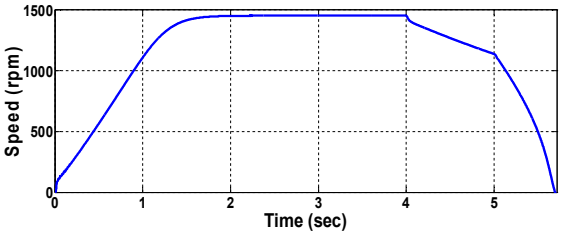

Figure 8. Speed time curve of the traction drive

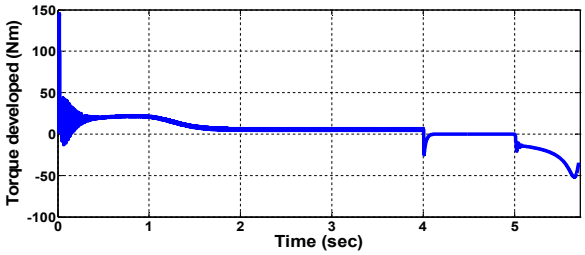

Figure 9. Torque developed by the induction motor drive

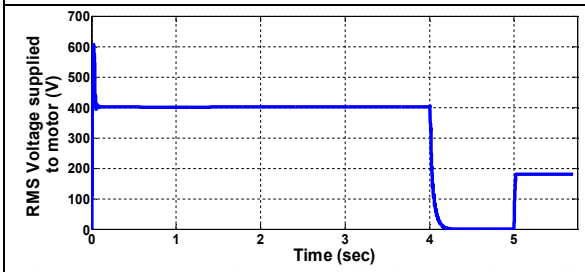

Figure 10. rms voltage supplied to each parallel connected motor

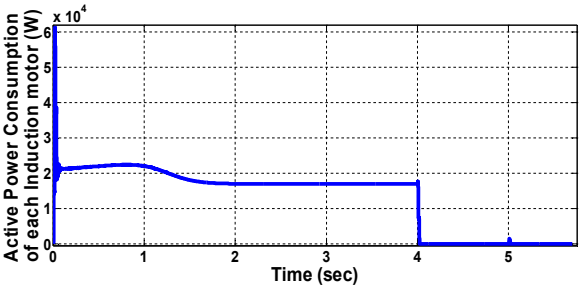

Figure 11(a). Active power consumption by each induction motor

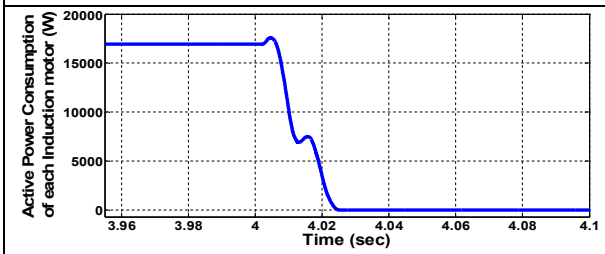

Figure 11(b). Consumption of active power by each motor during coasting period

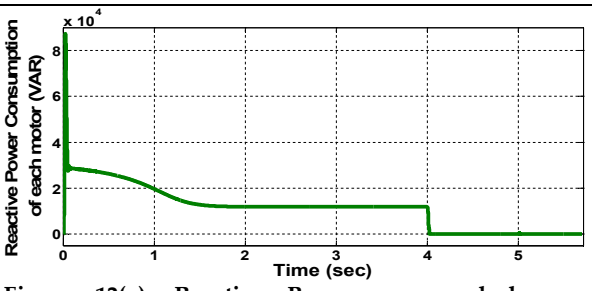

Figure 12(a). Reactive Power consumed by each induction motor

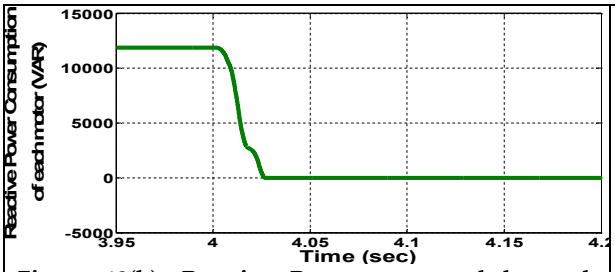

Figure 12(b). Reactive Power consumed by each induction motor

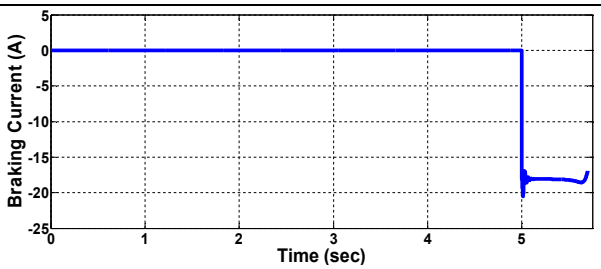

Figure 14. Braking current through braking resistor during braking period

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RESEARCH ARTICLE

A Tourist Guide To Spiritual Guide: Transformation and Redemption of Raju in R K Narayan's the Guide

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ABSTRACT

This paper seeks to understand how Raju, a tourist guide playing the central role in R. K. Narayan's The Guide is transformed into a Spiritual Guide – ethically & conceptually-- a tourist guide is not expected to misguide the tourists but in The Guide Raju, instead of showing the right path to the tourists followed the wrong means to guide his visitors. However, this unethical approach didn't last long and consequently he was convicted of forging Rosie's signature. It was his imprisonment that made a turning point in his life and the turning phase of Raju's life is the point of study in this paper. Raju, after released from prison, was mistaken for a spiritual guide and later made to sacrifice his life to save the lives of a large community. Raju's life seems to correspond to the lives of many Indian mythical sages. This study attempts to show R K Narayan's portrayal of Raju and his two different Avatars i.e A Tourist Guide & A spiritual Guide.

Keywords: Spiritual, Consequently, imprisonment, mythical, community

INTRODUCTION

R. K. Narayan's *The Guide* (1958) was a completely unique written in such a socio-economic context when India was still a practice based country where people were mostly uneducated, gullible and superstitious. Children used to hear great stories and myths of many gods, goddesses and sages, that entered their intelligentsia and developed their aesthetic senses and moral values. Narayan himself might have heard many such stories from her grandmother and thus might have had a firsthand experience of these believes of the village people. Hence, he picked up such a village to unfold the story of the novel in point. The Guide is set in Malgudi (Narayan's own creation), and it started with

an introduction of its protagonist, Raju,recently released from prison, sitting on a granite slab beside an ancient temple on a bank of the river Sarayu and on the other side bank of which is situated the village Mangala. The people lived there were so simple and gullible as to be made to accept for granted even the most unbelievable things. It was Velan from this village, who first mistakes Raju for a saint. and gradually he made people believe Raju to be a saint telling them that Raju had performed to solve a crucial problem of his family. Raju, was perhaps reluctant to play the role assigned by Velan, but when Velan told Raju his problem for a solution, Raju could not help asserting his old habit of getting into other's business and inviting troubles.

Velan got an impression when he saw Raju having something of a saint in the posture. Velan met him "*sitting cross-legged*" on granite slab "*as if it were a throne, beside an ancient shrine"* (5), a river flowing beneath it. Raju's sitting cross-legged reminded one of the postures in which Lord Buddha kept sitting in meditation and in which Hindu religious gurus usually sit in meditation. Velan took it as a symbol of divinity that implies a meaning related to the figure of a holy man. The recently released jailbird Raju has become a saint overnight because of two chances working together. It was his foreseeing fortune that he was sitting cross-legged beside the ancient temple; Velan mistakes him for a swami for it and evenVelan's sister agreed to marry Raju rather some good impression has occurred in her. But Velan interpreted her thoughts and opinions to havebeen awakened by Raju and forced upon him the greatness of a saint.

Raju has played three different roleswithin the novel: his role as a tourist guide, his role as a good companion with the dancer Rosie and her husband Marco, and eventually his role as a swami at the village, Mangala. Raju was a cheat in all the phases. He told lies to Rosie in order to get close to her. Raju was employed by Marco and it was his professional responsibility to guide them properly but, contrary to what was expected of a guide, he misguided Marco and seduced his wife. He cheated Rosie both emotionally and monetarily. When he was a sage at Mangala, he was more of a hypocrite exploiting the honesty and simplicity of the innocent villagers. When Velan comes together with his sister and a basket crammed with different items of fruits and food, the hypocritical Raju, pretending to be a "perfect" saint, picks up the basket and ceremoniously places it at the feet of the image of an extended abandoned god, saying,

It is His first. Let the offering attend Him, first; and that we will eat the remnant (18).

*He even grew a beard and long hair to fall on his nape (53)*to reinforce his 'spiritual status'

Yet signs of goodness rest in Raju's heart. He told lies as a tourist guide not to fulfill his selfish end, but solely to make his tourists' excursions meaningful.

The tourists came with preconceived knowledge that these or those were worth-seeing things at Malgudi and themselves gave exaggerated descriptions of those things before Raju opened his mouth (57-58)

Raju simply could not but node only not to mar their interest. The tourists accompanied by him considered themselves lucky:

If you are lucky enough to be guided by Raju, you will know everything. He will not only show you all the worth-while places but also help you in every way (9).

Raju got close to Rosie by telling lies and gradually fulfilled all those which Marco as a husband could not. Raju was eloquent in praising her dance and wants to make her the best dancer in India. When Rosie was ignored and mentally tortured and even drags her existence miserably under Marco, Raju accommodated her and gave some meanings to her life. He came to her life as a light of hope amidst acute darkness. At the village Mangal, Raju was a feigned sage, but he always speaks to them on godliness, cleanliness and speaks on Ramayana. Despite his dubious distinction, he had sincerest concerns for the welfare of those who revered and placed him in their mind and soul as a sage. So, Raju is a pretender more for serving and accommodating others' interests than for his own.

The polarity in the character of Raju is complex and misleading. On one hand, he was hesitating to play the role given by Velan, on the other hand he was excited at the success of his playing the role perfectly, and *"no one was more impressed with the grandeur of the whole thing than Raju himself"* (47).

He was still angry with Velan for forcing on him to play the role of a saint, he acquired beard and prayer beads to heighten his spiritual status. The uncritical faith of the villagers and they're fine compliments bewilder Raju. He never made any bold effort to clear his position. Thus Raju oscillates between reluctance and eagerness. We can say that his reluctance for this role is partly due to his innocence too—as he wanted to tell Velan: *"I am not so great as you imagine. I am just ordinary* (8)—and partly due to a covert fear that the high reverence of the humble folks and their unquestioning belief in his enormous "capacity" might bring him some unavoidable trouble. Raju could anticipate some danger implied in this reverence and felt reluctant to be what Velan wanted him to be. But soon he agreed to play the role due to an inevitable necessity of his i.e the necessity of food. Once he discovered that his working, as desired by Velan, would provide him with a sure means for food, the cheat in him rose. Thus that his decision of pretending to be a saint was determined by his selfish motives is clear in the following lines:

Where could he go? He had not trained himself to make a living out of hard work. Food was coming to him unasked now. If he went away somewhere else certainly nobody was going to take the trouble to bring him food in return for just waiting for it. The only other place where it could happen was the prison. Where could he go now?(Guide, 33)

He then realized that he had no other options: he must play the role that Velan had given him. Thus, completely motivated by a selfish end, Raju decided not to leave the place where food comes to him unasked only in return for just waiting for it although at the same time fearing that someday the villagers might *come to the stage of thinking that he was too good for food and that he subsided on atoms from the air"—a foreseen comment that comes true in a different way in his life* (33).

However, Raju—a tout as he seems to be in all the phases of his life—has some uniquely good sides of his character. He is a man self-styled, self-made, a type of his own, having a massive capacity of adapting himself to all circumstances. Despite his unedifying past Raju lived the present in its every moment and accepts everything it offers. He even found the prison "not a bad place" and feels sorry when released. When he was to play the part of a saint, he so successfully adopted himself to the circumstance that not only Velan and the simple villagers but also the village school master came under his guidance.

Raju, while engaging himself as a tourist guide had to act following the expectations of the tourists. His own tastes and hobbies were not important there. And when he became a spiritual guide, he had to come up to what the role embarked upon him demands. Therefore, we can assume that Raju told lies, not for his benefit; rather the tourists wanted him to do so. And as sage, though a fake sage he was, he worked for the wellbeing of the villagers and guided them to the right path as a true sage would have done. Thus Raju is not fraud at heart but appeared so only because he failed to say 'no' to what he does not like. As he says: *"If I had inclined to say, 'I don't know what you are talking about, my life would have taken a different turn"* (55). This much of goodness of Raju's heart for sacrificing his own interests for others' gradually leads him to what can be called his martyrdom

Even in the extreme danger of the villagers, Rajus's thoughts were guided by selfish motives. He felt alarmed over the growing unrest in the village and advised the villagers: *"No one should fight"* (99). He wanted to establish order and unity among the villagers because the unrest *"might affect the isolation of the place and bring the police on the scene. He did not want anyone to come to the village"* (99). Raju got petrified of being exposed as a fake swami if the police or anybody would come to the village that he stupidly said to Velan's younger brother, one of the lesser bits of intelligence of the village, who come with news about a further probable attack between the villagers:

"Tell your brother, immediately, wherever he could also be, that unless they're good I'll never eat"
Eat what? asked the boy, rather puzzled.
Say that I'll not eat. Don't ask what. I'll not eat unless they are good. (100)

"This was frankly beyond the comprehension of the boy" and "he could not connect the fight with this man's food (87). Consequently, the message is distorted. Velan and his friends heard the message as *"The Swami, Swami does not want food anymore because . . . it does not rain"* (101 – 102).

Thus Raju's fate was sealed by a village idiot. His act of 'not taking food' was mistaken for a ritual fast. Soon the unrest was gone and the villagers started prostrating before him, saying:

"You are not a human being. You are a Mahatma. We should consider ourselves blessed indeed to be ready to touch the dust of your feat" (106).

Thus the innocent villagers again imposed a huge responsibility on Raju by conferring on him a new title 'Mahatma'. Narayan used the title 'Mahatma' for Raju to prepare him for his inspirational journey. The greatness of Mahatma Gandhi and his active role in bringing peace and unity in India are well known to the people of Mangala as well, as we find in Waiting for the Mahatma Gandhi visited Narayan's fictional town of Malgudi during India's freedom movement. Raju is a character who is completely opposite to Gandhian ideology and a man of his type would not have believed in it perhaps, but he is entrapped by the villagers' high estimation of his person:

This Mangala may be a blessed country to possess a person just like the Swami in our midst. No bad thing will come to us as long as he is with us. He is like Mahatma. When Mahatma Gandhi went without food, how many things happened in India! This is a man like that. If he fasts there will be rain. Out of his love for us he is undertaking it. This will surely bring rain and help us . . . (102)
Your penance is similar to Mahatma Gandhi's. He has left us a lover in you to save lots of us. (107)

Raju was really transformed into another phase when he realized that, while cheating the innocent villagers, he made himself *"a giant with his puny self" " and has "worked himself into an edge from which he cannot get out now"* (109). The journey of the hypocritical Raju ended there and the covert goodness of his soul found a way. Thus while under the threat of life he should have cursed the fools, he felt moved by the recollection of the big crowd of women and children touching his feet and by the thought of their gratitude. To bring about Raju's real transformation and to make it feasible, Narayan used the Indian Hindu context and culture itself. He arranged Raju to perform a ritual fast, standing in knee-deep water for fifteen days. Water and remain fasting are two holy sources of purification in Hinduism. The fasting of each day seems to dry up Raju's every sin and the water purifying his soul by washing away its dirt. Within five days of his fasting, Raju was transformed into a different man. He feels *"enraged at the persistence of food-thoughts"* (237), perhaps realizing that it was the dire necessity of food for which he had to be a fake Swami: "With a sort of vindictive resolution he told himself,

'I'll keep off all thought of food. For the primary time in his life he was making an earnest effort; for the primary time he was learning the joys of full application, outside money and love; for the primary time he was doing a thing during which he wasn't personally interested. (238)

As long as Raju's thoughts are guided by mundane affairs: love, money, food, and shelter, he had to remain a hypocrite, but the moment he shed all his hypocrisy and forgets all mundane interests, his penance is that of a real saint. From the sixth day onwards, Raju's prayer to bring down rain from heaven and save humanity was no longer a pretender's but the true supplication of a saint who, absolutely was free from the mundane and was absorbed in meditation, being in league with the Divine.

Making Raju a saint, actually it was not Raju who himself played any significant role; rather it was Velan and his villagers whose reverence forces him to be a saint. The absolute reverence and beliefs of the innocent villagers came to him as a sharp weapon at the end although Raju should not certainly be allowed to go unpunished without owning partial responsibility for his fate. However it was true that Raju could have avoided his end had he not simply agreed but Raju's failure to establish control over the situation initiated by Velan was fateful. However, if Raju was at last a saint, his transformation should not appear a miracle because such miracles were not impossible in India which had been a land of gods and goddesses and where traditional beliefs are quite a knowledge despite the invasion of the west. It also seems that the normal Hindu belief a few saint plays some role within the transformation of Raju into a saint. In Hinduism such blind acceptance and consequent reverence for a saint are public knowledge . According to Hinduism, disciples should possess two qualities: susrusa and sraddha.

Susrusais that the fervent desire to listen to , to obey, and to retain what's being heard; it implies dutifulness, reverence, and repair . Sraddha is trust and composure of mind; it demands the entire absence of each quite independent thought and criticism on the a part of the pupil; and here again there is reverence, also as strong and vehement desire" (Zimmer 1952: 48).

The presence of those qualities in Velanet al. of his village is functional. Raju was a saint not because he was a saint, but because Velan and others of his village were perfect disciples embodying all these qualities: they were never tired of hearing and taking without any consideration everything Raju narrates; not only Velan, even the teacher of the village school obeys what Raju says, and that they hear and retain everything minutely in their minds; and that they are so reverent towards Raju that they are doing never question what he tells them because they believe.

Narayan also seems to form a corrupt man a spiritual guide with the assistance of the mythic elements taken from Indian mythology. Raju's transformation corresponds to the lives of the many Indian mythical sages like NezamAoulia Peer, or Valmiki. NezamAoulia, a thief by profession, at some point comes across a pious man whom he wants to rob but the person asks NezamAoulia if his relations will share his sins. NezamAoulia leaving the person tied with a tree within the jungle goes home and asks everybody if they're going to share his sins of robbing people but none agrees. NezamAoulia feels repentant and atones by watering a dead tree until the tree blooms flowers and he's accepted as a saint by people.

Similarly Valmiki, a forest plunderer, also becomes a saint by choosing a lifetime of asceticism under a tree where he passes years until ants build a shelter above him. Finally it are often said that it's not that Raju worked to be a saint; rather he had to be a saint under a compelling pressure over which he could not establish any control. He just reluctantly accepts the greatness thrust upon him by the innocence, ignorance, superstition and deep beliefs in religion of the simple, rustic people of the village of Mangala. Chance and incidence also play a dominant role in making him a saint. And theoretically Narayan makes a use of the religious, philosophical and cultural beliefs supported the good Indian epics, legends and folk tales to rework Raju into a saint

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RESEARCH ARTICLE

Feasibility Study and Statistical Analysis to Construct a Small Airship

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ABSTRACT

This report outlines the feasibility study and statistical analysis before designing, building and flight testing of a small-scale airship for surveillance, aerial photography and advertising purposes. The airship is planned to design for indoor flight for 30 minutes with taking a payload of 0.5kg and flying at a constant altitude. Also this was planned to operate by remote control. This university research projects was planed to gain a better understanding of airship design and principles. Aim of this work was to gather the information before designing and constructing of a small airship capable of indoor flight. This statistical data will help to estimate the size of airship and provide different techniques uses for conceptual designing and building the airship. From the statistical data all the geometric parameters, different weight of airship and performance parameters were obtained.

Keywords: Airship, Blimp, LTA, Gondola, HTA

INTRODUCTION

Aircraft can be divided into two groups: lighter-than-air aircraft(LTA) and heavier-than-air air- craft(HTA) [1]. Conventional fix-wing and rotation-wing aircraft which utilize lifting surfaces like wings and blades as the source of lift belong to HTA. LTA is mainly referring to aircraft such as balloons and airships (blimps). Unlike HTA, LTA is designed to contain within their structure a sufficient volume of gas lighter than air (heated air, hydrogen, or helium) to acquire enough lift force from the buoyancy of the gas. Without consuming extra fuel to generate necessary lift for floating, airships over advantages over air cargo transportation in the past. Many different types of aircraft are designed and fabricated for diverse applications and scenarios. A survey of recent developments in aerial robotics

gives a general overview of the definition, types, categories, and topics of aerial robotics[2]. This work describes classifies and briefly introduced more than one hundred high-quality aircraft papers from more than thirty thousand that have been published in the top journals and conferences in a systematic way.

Flight Requirements

Flight Characteristics

As stated in the first objective of this project was to design the meet a set of flight characteristics for the airship. The four flight characteristics were the payload weight, cruise speed, time of flight and cruise height. The yaw and pitch of the airship needed to be controlled whereas roll control was not a part of the project requirements. Following was initial requirement of airship to build.

Standard Requirements

Following requirement need to follow for safety and standard of civil aviation authority.

- The airship must operate in way such that it is not a hazard to people or other aircraft.
- The airship can only operate in controlled airspace if approved by authority.
- The airship should operate less than of 400 ft altitude without approval from authority.
- The vehicle must not drop/discharge anything hazardous.
- The airship can only be operated at night if clearly visible

Feasibility Study

Background Information

An airship is a lighter-than-air that uses buoyancy to produce lift rather than aerodynamic lifting surfaces like heavier-than-air vehicles. The primary difference between a balloon and an airship is that an airship can be steered and propelled through the air, whereas a balloon relies on wind currents for manoeuvrability. An airship has three main sections: the envelope, gondola and propulsion system. The envelope contains the lifting gas required for buoyancy and is generally categorised into three structural classes: rigid, non-rigid and semi-rigid. The gondola carries the airship payload and also houses the propulsion system. The propulsion system provides the thrust used to control airship movement.

Airships were responsible for many of the pioneering achievements in aviation technology such as the first powered, controllable flight in 1852. In the early part of the 20th century military leaders recognised that airships could be particularly useful as bombing craft and also as naval surveillance vehicles. The First World War demonstrated that airships could be used in these roles, however, their size and lack of speed meant that they were extremely vulnerable to enemy attack. Following the war, large airships were used as passenger transport vehicles. The German built Graf Zeppelin made 143 crossings of the Atlantic Ocean from 1928 to 1936 with a perfect safety record. The success of the Graf led to the design and construction of an even larger airship, the Hindenburg. In 1937, the Hindenburg crashed spectacularly while trying to land at Lakehurst in the United States. This incident undermined public confidence in airship safety and they were no longer used for intercontinental passenger transport.

In the last 50 years airships have been used for certain niche applications such as advertising, surveillance and aerial photography. The most well known advertising craft is the Goodyear blimp which has been prominent at major sporting events. Smaller craft have been used for advertising and photography in large indoor arenas such as basketball and ice hockey stadiums. The United States Coast Guard has also experimented with using airships for high altitude surveillance of its borders and coastline. Some earlier scientific and technical notes and documents about airship design can be found as technical reports from NASA. There are two famous reports by Tuckerman [3] [4], emphasizing two most critical issues of airship design - the determination of forces on an airship hull and inertia factors.

Regarding airship, [5] introduced the recent researches and conceptual designs of airships and classifies the airships according to its body. In paper [5], a state-of-the-art literature review on airship dynamics modeling is presented, aerodynamics and flight dynamics modeling method are described. This also provides the structural flexibility, incorporation of atmospheric turbulence as well. Based on six degrees of freedom, an attractive dynamic model is presented in ref. [6]. In ref.[7], an blimp-based robot and its navigation system are introduced. The blimp is a commercial kit which can be used as platform directly. Ref.[8] introduces a design methodology and fabrication of an easily deployable finless airship for indoor surveillance and advertisement. The detailed and step-wise procedure for designing and fabricating indoor remotely controlled airships are discussed in [9].

A comparison between the airship using design methodology introduced in this work with some other commercially available airships are also exhibited. Paper [10] introduces an airship that mimics fish-like movement in the air, propelling an airship by undulating its hull and a caudal fin. A work on DEA predicted that DEA strip actuators could reach 90% maximal efficiency in optimal conditions. However, an actual peak efficiency of 18% was measured in the experiment due to the high energy loss of such a voltage transform [11]. The propulsion efficiency analysis of fish-like robot is exhibited in [12], the relationship of speed and energy efficiency are analyzed. Ref.[13] does a research on the efficiency of fish propulsion. As a commonly used propulsion unit for indoor airships, small-diameter propellers performance data including energy performance are tested and a reliable database of performance data of many propellers has been created in [14]. Recent years, several fish-like indoor airship projects appeared due to high efficiency of fish propulsion. [15] [16] The propulsion efficiency of both propeller and fish movement is studied. The efficiency of fish movement and propeller is studied in [17] and [18] respectively.

Analysis of Similar Projects

A comprehensive review of other airships was undertaken to gain a better understanding of airship design principles. The review focussed on small-scale, university level projects. The design of the envelope, gondola and propulsion system were of particular interest as was the performance capabilities of each craft.

Envelope and Gondola Design

Envelope design for other projects was based principally on mathematical shape modelling, drag estimations and aesthetics. As a starting point, the necessary lifting force is converted to an approximate volume using the buoyancy equation. Basic shapes are then used to form a computer model, from which the total surface area can also be calculated. A project at the National University of Singapore (NUS) made an approximate envelope using two ellipsoids, as shown in Figure 21.. The volume and surface area were then analysed.

A number of material options exist for envelope manufacture. Previous airship design projects have based the material choice on factors such as cost, durability and permeation of helium. Projects with larger budgets have used polyurethane. The NUS craft and another design at Rowan University each used polyurethane as the envelope material. Polyurethane retains helium well and has aesthetic appeal, but is not seen in home projects because of its cost and difficulties in manufacturing. The small zeppelin “Simon”, designed and built by students at the Realgymnasium Rämibühl in Zürich, utilized biaxial-oriented polyethylene terephthalate (BOPET) for the envelope. Metallised BOPET, also known by the trade name Mylar, is inexpensive but looks unprofessional and is prone to helium leakage at the welded seams. Many different types of gondola are used for small airships. Standard plastic gondolas are available for purchase from retailers, but these are used with a specific envelope that comes part of the same kit. A custom designed gondola offers more flexibility in terms of weight, size, storage space and structure. The airship “Simon” had a gondola made from plaster, wax and fibreglass, shown below in Figure 22. Balsa wood is another material which could be used for gondola construction as it is lightweight but still has enough strength to carry a reasonable payload.

Propulsion System

All of the small airships that were investigated used batteries to power the propulsion system. Lithium Polymer batteries are lightweight, small and efficient and hence are ideal for use in an airship. An internal combustion engine could also be used, but is generally more suitable in high thrust vehicles such as remote control planes and helicopters. All of the airships reviewed used propellers or ducted fans to provide forward thrust. Ducted fans are safer and less noisy than open propellers and also output a more direct flow of air. Yaw movement of the University Bombay airship is controlled by altering the levels of thrust from the side fans, shown below. A rudder cannot be used for yaw movement, as the airspeed is too low to impart a significant turning force. For propulsion system the common choice is applying three dc motors to the airship [7]. All three dc motors are used to drive propellers, a vertical motor allows altitude to be regulated and the other two motors deployed on left and right side of gondola symmetrically control speed along x-axis and yaw rotation. In general, to achieve point to point movement in 6 DoF flight coordinate system, 3 actuation units are needed. However, as [19] mentioned, if unwanted movements are discarded in a specific scene, the number of required actuation units can decrease. A project involving building a model tank used a pulley and servo to rotate a shaft for the swivel of a gun turret as seen in Figure 24. A similar set-up could be used to rotate ducted fans so that they could direct thrust in any plane about the lateral axis. This can be achieved by attaching a pulley to a servo-motor, a pulley to the axel and then connecting the pulleys with a belt.

Performance Characteristics

The flight requirements of an airship determine its performance characteristics. It is hard to directly compare blimps and their performance characteristics, because different designs may be trying to achieve different objectives. For example, airships that are used for indoor photography may not need a high cruise speed but will need to be able to hover steadily for large periods of time. The airship “Simon” was able to achieve a maximum speed of 6 ms-1 with a total thrust output of 6.6N from two propellers. In contrast, the NUS design had a maximum speed of 1.5 ms-1 and a total thrust output of 0.14 N for a craft approximately half the length of “Simon”. The yaw rate, or rate of turn, of the University of Washington craft was approximately 28° per second while the NUS design had a yaw rate of 15° per second.

Special Systems

Depending on the application for an airship, a number of special systems may have been introduced. Most of the academic projects that were researched incorporated a level of automatic control in addition to the use of a standard hand-held radio controller. In an automatic configuration, sensors provide information about the surroundings of the blimp, while a processor interprets this data and controls the thrust output of the propulsion system. An automatic system could be extremely useful in controlling parameters such as cruise speed and ceiling height, but may be difficult to implement. The NUS project attempted to design a complex control system, using GPS, to make a fully autonomous airship. Automatic control was used in the University of Berkeley to enable an airship to have a collision avoidance system. Ultrasonic sensors installed in the gondola, measured the distance to a surface and if the airship was going to collide, a turning manoeuvre would be carried out by an onboard processor. The University of Berkeley design also used ultrasonic sensors to maintain a constant cruise altitude.

Many of the researched projects had the ability to take video footage from the gondola of an airship. Generally, the footage would be wirelessly transmitted to a ground station where the signal would be recorded. The University of Bombay design used a very small and inexpensive camera to transmit footage to a computer. The image quality from the onboard camera varied and often suffered from interference. Commercial airships, specifically designed for photography, use a sophisticated motorised camera system that allows the camera to pan and tilt. This system is used by the company Airship Solutions in Melbourne but is expensive and heavy.Advertising is a common feature of many airships. The large surface area of an airship is an ideal space for advertising to draw the attention of crowds. Banners can be attached to the airship itself or trailed behind. It is also possible to print directly onto the envelope although this may be prohibitively expensive for this project.

Statistical Analysis

The feasibility study also included a statistical analysis of airship designs. As part of this investigation, data was collected in regard to specifications of the different airships. These specifications included geometric dimensions, weight and performance values. This data was tabulated and used to perform calculations to obtain specific ratios and graphs. Three main ratios were graphed and analysed. These were the empty weight to take-off weight ratio, the length to width ratio and the thrust to weight ratio. These ratios were chosen for specific analysis as they provide information useful in the initial design of the airship.

Length to Width Ratio

The length to width ratio is useful in providing a basic understanding of the geometry of the airship envelope. A larger length to width ratio (e.g. 10) means the airship has a long thin shape like the Zeppelin designs. An airship with a smaller length to width ratio (e.g. 4) usually is a result of a tapered design which has a larger frontal area and hence larger maximum diameter. The two different shapes each have their own advantages and disadvantages. To give an overview of all data collected an initial graph of all length/width ratios was made. The graph was put in chronological order to help give a perspective of the changes in airship design throughout the approximate period 1900-2019.

The graph shows that initially, in the early 1900s, the length to width ratio was around 6. Then in the 1910s with the long, elliptical Zeppelin designs, the length to width ratio increased to between 8 and 10. By the late 1930s most airships were designed with a length to width ratio of between 4 and 5. Recent airships have been designed with low length to width ratios of 3-4. The addition of a trend line to the graph clearly demonstrates the decline in the length to width ratio throughout the last century. The airships used to create the previous graph vary in size from a weight of about 100kgto as much as 100 tonne. As the airship being designed in this project is designed to have a weight less than 5kg, a second graph was created showing the length to width ratio for smaller airships. A size of less than 1 tonne in weight was used as it gave a sufficient sample size as well as reducing the average weight of airships being analysed. The results of this graph are similar Figure 27, showing that small airships have a length to width ratio around 3. A more accurate average value for the small airships was calculated to be 3.7. Using the analysis of the more modern airships and the smaller airships, a figure of 3.5 was established as a guideline value to help design the shape of the airship.

Thrust to Weight Ratio

The thrust to weight ratio is used as a design guide to help determine the thrust needed for the airship. From the thrust to weight ratio and the weight of the airship, an approximate thrust value can be established. The thrust value also helps to select the components of the propulsion system including motors, ducted fans and batteries. A graph off the thrust to weight ratio for all the airship data collected was produced displaying the results in chronological order. The graph shows that there is significant variation between thrust to weight ratio (0.1 – 0.7), however this is independent of the time of production. The average thrust to weight ratio over the whole period was 0.25. As there appeared to be no relationship between the age of the airship and its thrust to weight ratio, a graph comparing the thrust to weight ratio and weight was created (Figure 210). This showed a large grouping of airships with a thrust to weight ratio of 0.2 and a weight less than 200,000N. It also showed for airships larger than 200,000N that the thrust to weight ratio was around 0.1. A significant number of airships less than 100,000 N in weight had a thrust to weight ratio of more than 0.3.

Another graph was produced which only considered designs with a weight close to the desired weight of this project. The graph shows the distribution of thrust to weight ratios to be quite large (between 0.1 and 0.7). The average thrust to weight ratio was 0.3. The average thrust to weight ratio for all airships was about 0.25 while for smaller airships it was about 0.3. The large variation in the data means it is difficult to draw any significant conclusions. The main reason for this variation is that the thrust to weight ratio is dependent on the purpose of the

individual airship. If the airship is designed to move quickly through the air it has a larger thrust to weight ratio than if it was designed to hover. As the desired speed of this airship is to be small, a low thrust to weight ratio would be likely. Using a conservative estimate of 0.4 for the thrust to weight ratio and a weight of 5kg, the approximate thrust required would be 20N. This estimate is likely to be much greater than the thrust needed by this airship. This is primarily because most of the airships being analysed were designed to meet higher performance standards.

Empty Weight to Takeoff Weight Ratio

The empty weight (W_e) to take-off weight (W_0) ratio is the most important of the three ratios analysed. The airship take-off weight is the empty weight plus the payload weight. Using the W_e / W_0 ratio and a known payload weight it is possible to then determine the overall weight of the airship. An initial graph of the empty weight to take-off weight was created showing the airships in chronological order. Figure 211 shows a slight trend of decreasing empty weight to take-off weight ratio. However, this trend is only about 0.1 over 100 years and hence is not that significant. The graph also shows that the ratio stays relatively constant at an average value of 0.6. As there was little correlation between the age of the airships and the empty wieigt tp take of weight ratio, a second graph (Figure 212) was produced showing the dependence on takeoff weight. Only small airships, less than one tonne, were considered. This graph showed again that the W_e / W_0 ratio was around 0.6. As with the previous graph, Figure showed that the empty weight to takeoff weight ratio has an average value of around 0.6.Using the graph and a payload weight of 0.5kg, the take-off weight was calculated to be 2.2kg. This seemed much lower than expected as initial estimates for the weight of the airship were about 3-4kg. The difference is due to the fact that most of the airships analysed used combustion engines and hence the weight of the fuel is not accounted for in the empty weight. Batteries are intended to be used in this project and their weight would be included in the empty weight. Conservative estimates of 3.2kg for the take-off weight and 2.7kg for the empty weight were the final results of the statistical analysis.

CONCLUSIONS

The goal of study was to select the size and power requirement for a small airship with a pay load of 0.5 kg by investigating previously statistical data. The study was used to arrive the baseline configuration of an airship to be designed to meet the specification. Following important design ratios are estimated by making the statistical analysis of various airships. These estimates are a helpful guide to establish the actual parameters of the design.

- Length to width ratio – 3.5
- Thrust to weight ratio – 0.4
- Empty weight to takeoff weight ratio – 0.6

The ratios were then converted to actual performance values.

- Thrust - 20N
- Takeoff weight – 3.2Kg
- Empty weight – 2.7Kg

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Table 1.Airship Characteristics

Category	Value
Payload weight	0.5 kg
Cruise Speed	1 m/s
Time of Flight	60 mins
Cruise height	8 m

Table 2 : Manoeuvrability Requirements

Manoeuvre	Control
Yaw	Controlled manually
Pitch	Controlled automatically

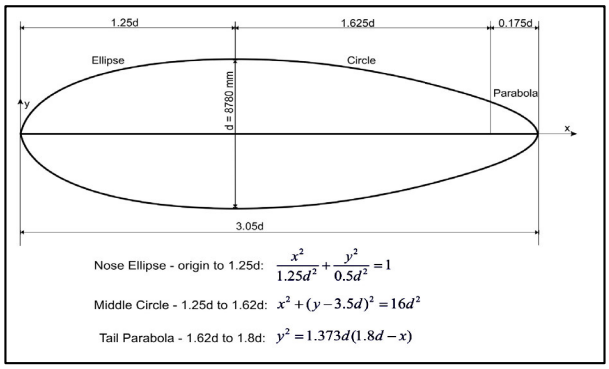

Figure. 1 - Envelope shape analysis (C.S. Jin, 2003)

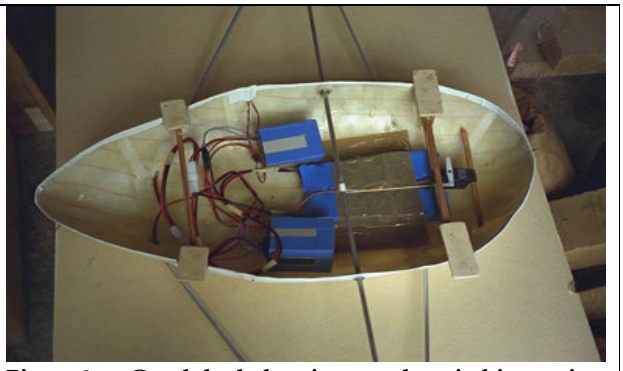

Figure.2 - Gondola belonging to the airship project "Simon" (Lutz, 1998)

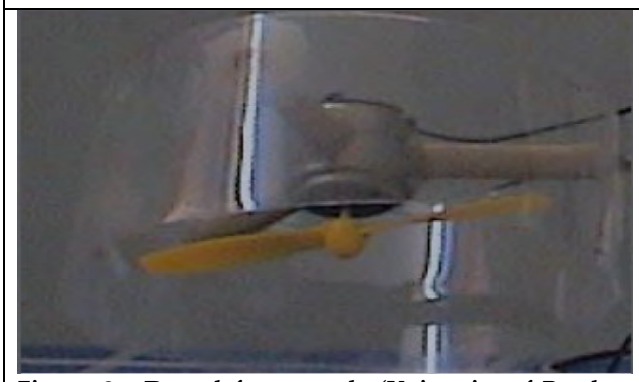

Figure. 3 - Ducted fan example (University of Bombay, 2004)

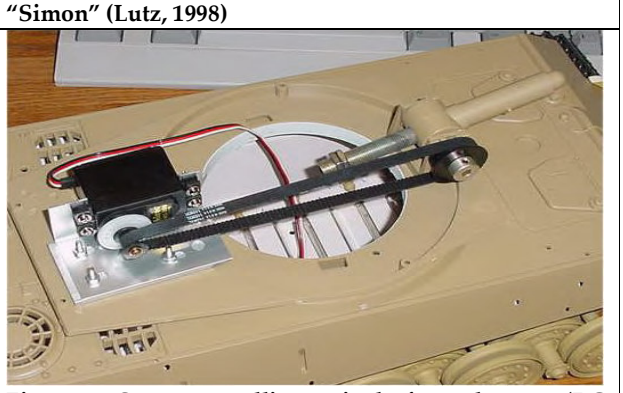

Figure.4 - Servo controlling swivel of a tank turret (RC tankcombat.com, 2007)

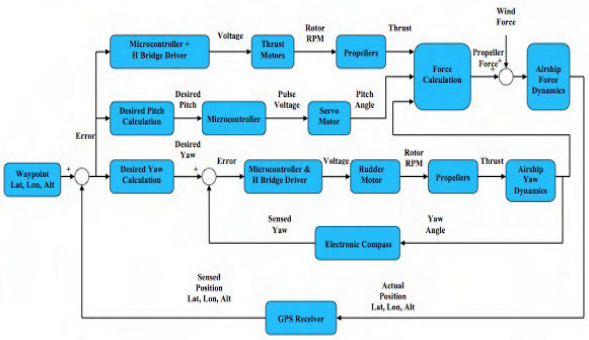

Figure. 5 - Automatic Control system (C.S. Jin, 2003)

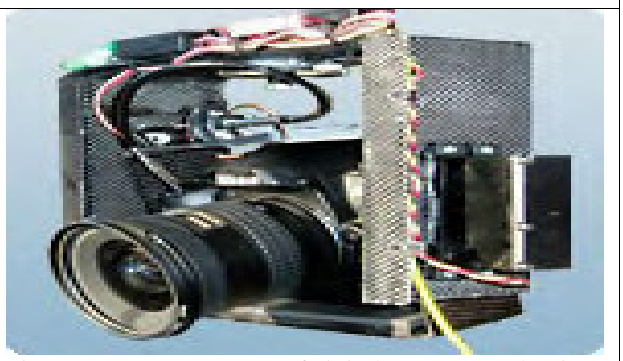

Figure. 6 - Heavy Duty SLR/Digital Camera Mechanism (Airships Solutions, 2007)

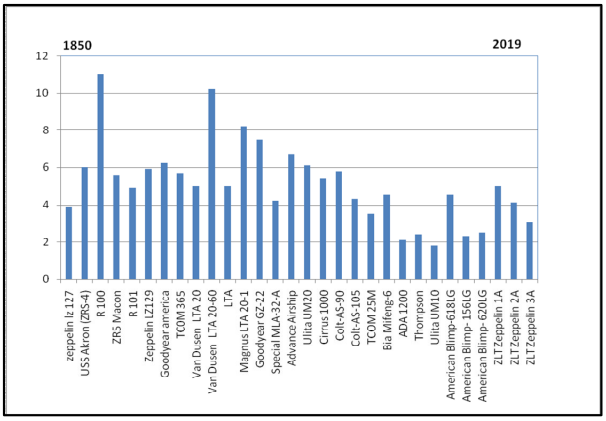

Figure. 7 - Length / Width Graph All Airships

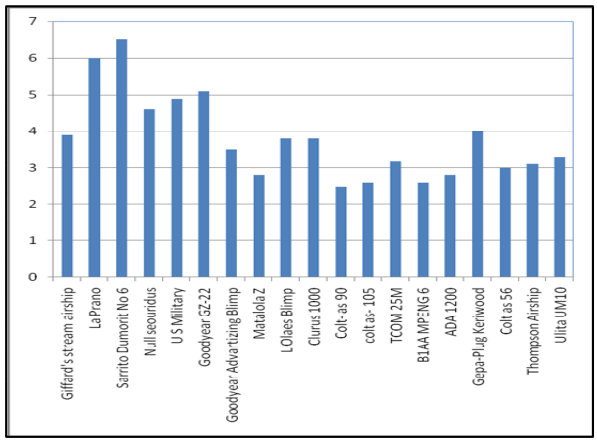

Figure.8 - Length / Width Graph, Airships (W0 < 1 tonne)

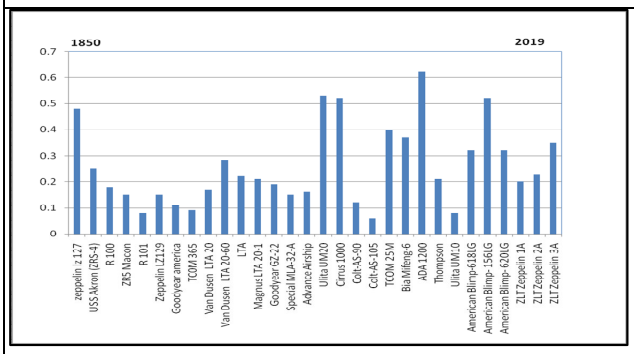

Figure. 9 - Thrust to Weight ratio graph

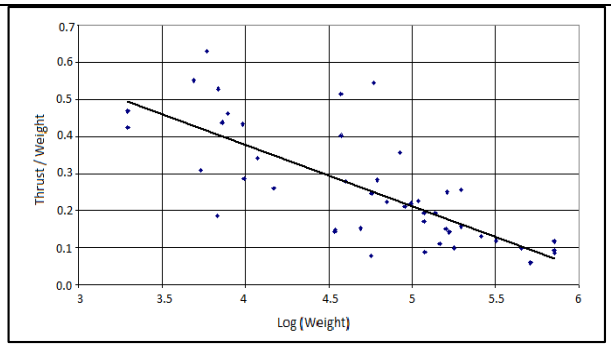

Figure.10 - Thrust/Weight vs Weight graph

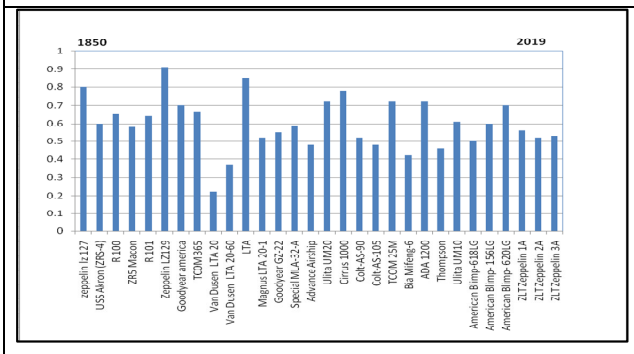

Figure. 11 - Empty weight to takeoff weight ratio graph

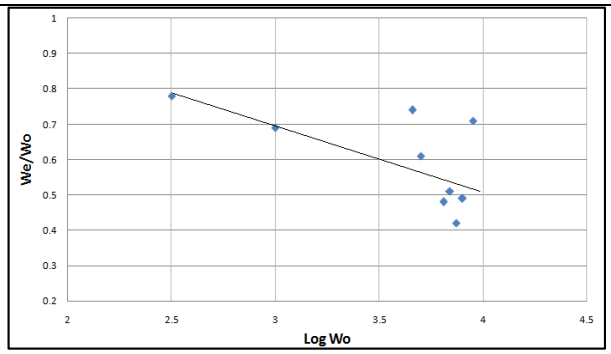

Figure. 12 - We / Wo ratio vs Takeoff weight graph – (Wo < 1 Tonne)

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RESEARCH ARTICLE

Load Balancing by Feeder Reconfiguration in Distribution Network

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ABSTRACT

In most of the technical papers existing descriptions for distribution network reconfiguration assume that the distribution system is (three-phase) balanced and a single-phase equivalent is used. In contrast, distribution feeders and transformers are usually unbalanced due to a large number of single-phase loads, unsymmetrical conductor spacing, and three phase line topology. In this paper described, load balancing of over loaded feeders and transformers can be achieved by shifting excess loads to adjacent transformer or feeder which is lightly loaded. An excellent method can include defining an objective function as a sum of squares of the load deviation of transformers or feeders. The minimization of this objective function determines the optimal operating states (open or closed) of sectionalizing switches. This redistribution of loads among transformers and feeders makes the system more balanced and risk of overloading is reduced and thereby increasing the reliability of the system. The next steps will be implementation of this algorithm in practical to assess the performance of this method.

Keywords: Load Balancing, feeder reconfiguration, load deviation.

INTRODUCTION

The advanced metering infrastructure (AMI) and smart monitoring/control mechanisms widely incorporated into modern distributed networks enable individual nodes such as buses and switches with the mastery to communicate with one another and perform local computations [1]. We grasp on optimization of objective function formulated as a function of the Network Load Index (NLI) and Load Index and obtaining load balance by transferring load to align the load indices of a transformer and/or feeder with the NLI.Load Balancing by feeder reconfiguration in utility distribution systems has been an important aspect of distribution automation. The feeder reconfiguration is used to refrain from overloading of transformers and feeders resulting from load variations. In a distribution feeder, the load may differ from its rated value with time and overshoot its rated thermal capacity during some heavy load period.

The load variation also depends on the kind of load such as lighting in residential load, commercial or industrial load. In case of an overload, in order to keep the system reliable, a part of the load from the overloaded feeder should be transferred to an adjacent feeder that is relatively lightly loaded. Similarly, main transformer overloading can be addressed by identifying the appropriate feeder causing the overload and transferring a part of load from that feeder load to an adjacent transformer which is lightly loaded. This redistribution of load among feeders and transformers makes the system more balanced and the risk of overloading is reduced thereby increasing the reliability of a system.

Tie-switches exist in distribution networks that can be utilized to reconfigure the physical distribution networks topology to restore load balancing in distribution across the system [2]. However, as the optimal distribution network topology reconfiguration problem is a combinatorial mixed-integer program consisting of nonlinear and non-convex constraints, finding an exact solution is generally not possible. Hence, this method is not applied in real-time to mitigate unexpected system congestions/stress caused by dynamically changing end nodes residing in the distribution network. In order to avoid these difficulties, we leverage on the objective function approach of the modern grid to propose a decentralized and adaptive distribution network topology reconfiguration algorithm [3]. State-of-the-art in the area of distribution network topology reconfiguration can be generally divided into three categories. Publications belonging to the first category apply meta-heuristic techniques such as genetic algorithms [4], [5], ant colony optimization [6] and hybrid particle swarm optimization [7]. These approaches can be applied directly to the non-convex topology reconfiguration problem. However, these approaches also involve extensive amount of computation time and highly detailed parameter tuning with no guarantees on convergence speed and optimality. The second category of published work applies convex relaxations for controllable computation. Methods of relaxation employed include MISOCP (Mixed Integer Second-Order Cone Programming) [8], [9], [11], MILP (Mixed Integer Linear Programming) [12], QCP (Quadratically Constrained Programming) [9], MISDP (Mixed Integer Semi-Definite Programming) [13] and linearization of current flow [14]. These algorithms are implemented in a centralized manner by the electric power utility (EPU) that manages the distributed network. The EPU needs to process large volumes of datasets generated in the distributed network over short intervals and this is not practical for real-time coordination. Moreover, these relaxations tend to neglect important physical attributes of the distributed network (e.g. treating the system as a balanced single-phase system, ignoring reactive power, load balancing, etc.). The third and last class of existing literature handles graph-theoretic methods to use structural properties of the distributed network to solve the topology reconfiguration problem. Hierarchical distributed network decomposition [15], branch exchange algorithm [16], best-first tree searching method [17] and open shortest path first (OSPF) [18] are examples of these publications which set down part of the computational and communication tasks to several individual nodes that can act in parallel. These require highly specific parameter tuning for taking care of in-built heuristics which does not allow for generalization. Involving nodes also need to be perpetually updated with conditions across the system for local decision-making and this is not scalable for real-time coordination.

Here, in this paper, we took advantage on the radial structure of the distribution network and the inherent relationship between loads and bus voltages to propose a novel distributed network topology reconfiguration algorithm. Our contributions are defining objective function formulated as a function of the Network Load Index (NLI) and Load Index and obtaining load balance by transferring load to align the load indices of a transformer and/or feeder with the NLI. The remainder of this paper is organized as follows. In sec.II, the problem is defined and system model is presented. The proposed algorithm is presented in Sec. III along with theoretical analysis. Practical lab experimentation and comparisons with existing work are presented in Sec. IV. The result and analysis are presented in Sec V. The paper is concluded in Sec. VI.Problem description for load balancing In this section, we present the feeder reconfiguration problem as detailed overview of the system settings, assumptions, and notations utilized to represent objective function defined minimization problem. We, then, present the distribution network topology reconfiguration problem and highlight the difficulties associated with solving it.

System Settings and Assumptions

A distribution network is defined as a radial network for system settings, mainly composed of feeders (i.e. edges) that transfer power from the transformer/feeder (connecting to the bulk power grid) to loads (i.e. vertices/nodes) where residential houses and mini industrial systems attach to. The distribution network considered in this paper is composed of Three radial feeders and two distributed generators, fifteen nodes that are each equipped with monitoring, computational and communication capabilities as shown in Figure 1. These node modules can actuate local switches located in directly connected feeders to activate or deactivate these as necessary. Next, we consider the distribution network to be a low-voltage multiphase system which is a more general system model than existing state-of-the-art that treats the distribution network as a single-phase balanced system [2]. Finally, due to recent advances in phase balancing algorithms [19], [20] and analyses from references such as [21], transience resulting from the activation/deactivation of lines in the distribution network is not considered to introduce adverse effects to the system. From the preceding system settings, advances in smart grid technologies and current state-of-the-art, we make the following assumptions about the distribution network:

Each node is equipped with a tie-line switch,

The tie-line switches can be switch off/on remotely,

Each distribution feeder is equipped with a meter showing how much load it carries.

For assumption 1, we adopt an understanding for the operator to operate the switch very conveniently without any delay. However, the operator is authorized to operate the switch. With assumption 2, operator could operate the switch without going near to feeder being in the substation switch yard. Assumption 3 allows the operator to decide which feeder should be loaded and which feeder should be off-loaded seeing the load values each feeder carries.

Power Flow Relations and Notations

Next, we introduce the multiphase power flow relation assumed from reference [10] and notations utilized in this paper to model similarities of physical states such as voltage, power flow and current flow in the low-voltage distribution network. Variables are denoted by capital fonts, and system parameters are denoted by small fonts. All nodes in the distribution network form the set S. Currently active distribution network lines form the set D where (s, d)$\in$D denotes an active line connecting bus to node D. Node D is closer to the feeder than nodes in terms of the length of the path between the bus and the feeder. The maximum number of phases any distribution network node/feeder can have is three and these are labelled as a; b and c. The phases associated with nodes$\in$S and feeder (s,d) $\in$Dare represented by the sets ϕs and ϕsd respectively.

Topology Reconfiguration Problem Formulation

The distribution network topology reconfiguration problem presented next aims to improve the load balancing profile of a low-voltage multiphase distribution network in the presence of highly fluctuating power components while accounting for physical substation constraints. A distribution network with every transformer and feeder loaded to the load at a balanced condition is called a network with balanced transformer and feeder loads. A load balancing problem is formulated by proposing various load indices of a network as well as the equipment of a distribution network, transformers and feeders. The balance condition of the system can be determined using Network Load Index (NLI). The NLI of a distribution network represents the load margin still available to take up at that point of time without violating the capacity constraints of the equipment.

Network Loading Index (NLI) = Actual Load/Loading Capacity (1)

Actual Load = Total Loading at that point;
Loading Capacity = Maximum Load Carrying Capacity.

LTj=load indices of the transformer j, (j=1, nT) = Actual load in Transformer Tj
LFi=load indices of the feeder i, (i=1, nf) = Actual load in feeder Fi

MTj=Capacity of Transformer Tj
MFi=Capacity of Feeder Fi

A basic philosophy used for system balancing is to avoid the overloading of any equipment (Transformer, Feeder) based on the load indices so that equipments are loaded uniformly. Balance condition is when any part/equipment in the system is loaded to the same extent as the consolidated/average load in the system. As described above, the balance condition of the system can be determined or indexed using NLI and for feeder/equipment through load indices. In balanced conditions the load indices and the NLI will be nearly of the same value. As the network is likely to have different sections of unequal or different capacities, it is desirable to normalize the loading condition for every section to effectively approach balanced system condition.The normalized value of loads of the feeders/transformers is the load indices of the feeders/transformers. As one can readily see, in balanced condition, the normalized load value will be nearly same as the system load index. In other words, each transformer and feeder in a balanced operating distribution system is loaded to its normalized load which is same as NLI. Load deviation of transformer/feeder

(ΔL Tj , ΔL Fi)=Load at balanced condition=(NLI)×(Margin of transformer or feeder) (2)

It is to be noted that the load deviation value is a normalized value. The balance is achieved by adjusting the load deviations in the feeder/transformer starting with the equipment having the highest load deviation value. The distribution system comprises transformers as a source to a single or group of feeders with substation breakers and tie- switches. The tie-switches are simple isolating devices capable of load break and load pick-up. Opening and closing of these tie-switches is controlled by a control system. It is to be noted that only that case is considered where the feeder configuration does not have any feeder loops and all feeder sections are radially energized. To make the transformer/feeder be in balanced state, load deviation can be minimized. For the system, therefore, the objective for balance is to have load deviations in all the sections (feeders, transformer and branches) minimized. The objective function for optimization is defined as:

$$J = \sum_{k=1}^{nt} \Delta L_{Tk}^2 + \sum_{i=1}^{nf} \Delta L_{Fi}^2$$

The load deviation term is squared to make the expression invariant to polarity. The load balance is then obtained using a min-max optimization of the objective function. Aim here is to identify appropriate switching operations (open/close) in order to obtain the objective of load balancing of transformers and feeders subject to the constraints of their capacities.We will be solving the optimization problem by conjugate gradient method. The steepest descent method is appropriate, but it becomes very slow in converging to optimal solution. The Newton method is very fast in converging, but error remains very high. So conjugate gradient method is more applicable, it executes relatively fast compared to steepest descent method and less error compared to Newton method. The optimization solution identifies an appropriate set of switches that should be closed or opened such that loads on heavily loaded transformers/feeders can be transferred to relatively less heavily loaded transformers/feeders, in order to balance the load on all the transformers/feeders. During the operation of a distribution network when any transformer or feeder gets overloaded, the overload condition is identified with values of load deviation as an event in the system. The Supervisory Control and Data Acquisition (SCADA) system is configured to sense this event and trigger the Distribution Management System (DMS) application of Load Balancing by feeder reconfiguration.

The algorithm for load balancing

All The algorithm of load balancing by feeder reconfiguration is illustrated in Fig. 2.The event handler waits till the event has occurred. Once an event is sensed, the DMS application (e.g., a control system and/or software module) is triggered.The topology, the switch states (open/close) and feeder section loads are received along with the actual system load of the system as measured values in the system. The capacity limits of transformers and feeders are also obtained from the Distribution Management System database. Computation of System Loading Index, margin of

transformers and feeders (MTj; MFi), normalized load of transformers and feeders is carried out (e.g., in a computer having attendant memory and I/O). In addition, the load deviation of transformers and feeders are also calculated.

From the load deviation values, the source feeder for load transfer is determined. The source feeder is the one with largest value of load deviation (ΔLTj or ΔLFi). The load transfer on the transformer or feeder with the greatest value of load deviation is given the highest priority. If the equipment (transformer/feeder) with greatest load deviation happens to be a feeder then it is marked as a source feeder from where the load transfer is to take place. Otherwise if the equipment with the greatest load deviation is a transformer (Tj), then based on the load deviation value of that transformer (ΔLTj), the source feeder is identified. If ΔTj<0, the feeder with smallest load deviation (ΔLFi) among the feeders supplied power from the overloaded transformer is designated as the source feeder for load transfer and if ΔLTj>0, then the feeder with greatest load deviation (ΔLFi) is designated as the source feeder for load transfer1.

The Algorithm for Load Balancing

The sample system as a case study considered here is demonstrated in Fig. 3. This is atest system in power distribution system fraternity. The radial system consists of three feeders with twelve nodes, two distribution generators etc. Normally the distribution feeders have meshed and they are equipped with sectionalise switches and on-load/off-load taps to control the node voltage. In the normal operation case network losses can be minimized selecting optimal separation points. In case of element failures some portion of the system may be out of service and can be resupplied by changing the separation points. Dispersed generators may feed energy into the distribution system. The HV/MV-transformers usually have voltage control with possibly active compounding. The MV/LV-transformers have no voltage control, but their taps can be changed by hand mostly.

As could be seen in the Figure 3the bus name is Bhubaneswar and the feeder is L16 is rated 100 Ampere of current and is going to Rasulgarh. That feeder is loaded up to 43.7 A, it is evident that the feeder is loaded by 43.7% of full load. The voltage at Rasulgarh is 20.2 kV, is over voltage by 101.1%. By taking out that feeder current flowing through it drops down to zero, as can be seen in Figure 4. Rasulgarh voltage drops down to100.9% reflecting that feeder is out.

EXPERIMENTAL RESULT AND ANALYSIS

The experiment has been conducted in the laboratory to verify these events of line-in and line-out. The result of the experiment has been tabulated in Table 1. In the experiment we have three phase voltage of 415-volt line-line, and variable loads for three phase independently 1200 watt, 2400 watt and 4800 watt. From these we have calculated the impedances to be 685 Ω, 800 Ω, 960 Ω and1600 Ω.

CONCLUSIONS

The load balancing by feeder reconfiguration is achieved by defining an objective function formulated as function of the Network Load Index (NLI) and Load Index and obtaining load balance by transferring load to align the load indices of a transformer and/or feeder with the NLI. Experimentally it is proved to some extent. It can't be exactly balanced as uniform load is not expected to be experienced. So, as far as it has to be balanced with some tolerance. In further to prove this algorithm is valid or not it has to be experimented on real distribution feeder system.

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Table 1: Load Balancing By Feeder Reconfiguration

	Loads in Ohms			Current in phase (A)		
	LR	**LY**	**LB**	**IR**	**IB**	**IC**
Balancing	685	685	685	0.35	0.35	0.35
Unbalancing	685	1600	800	0.35	0.15	0.05
Switching	1600	1600	960	0.142	0.142	0.25
Unbalancing	685	1600	800	0.35	0.148	0.05
Switching-2	1600	1600	960	0.142	0.142	0.25

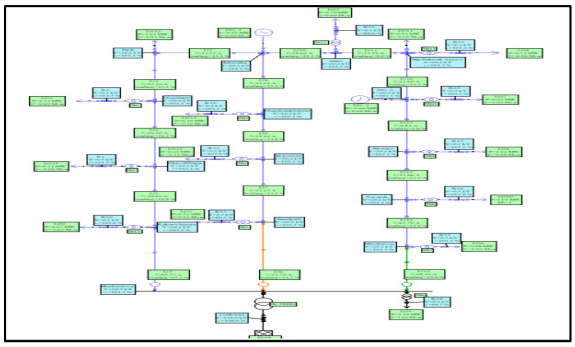

Figure 1: Sample System for Load Balancing by Feeder Reconfiguration.

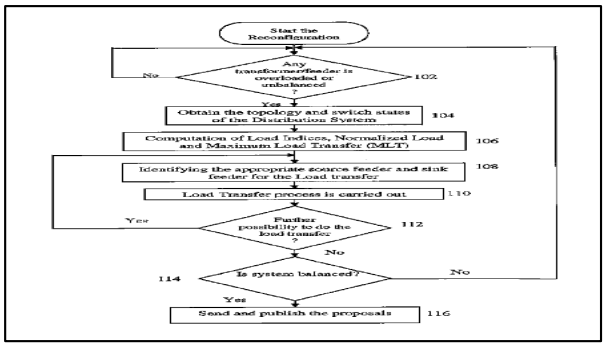

Figure 2: Flowchart of Sequences of Load Balancing by Feeder Reconfiguration

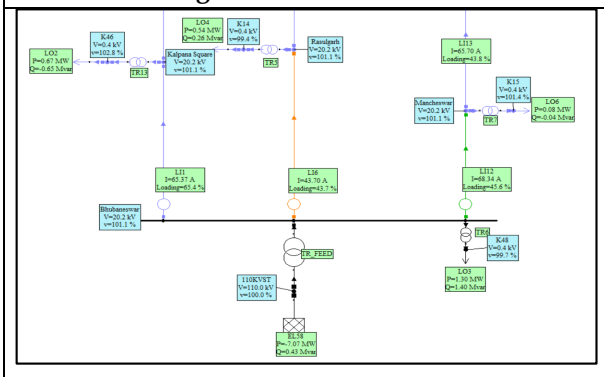

Figure 3: Test feeder in normal operation.

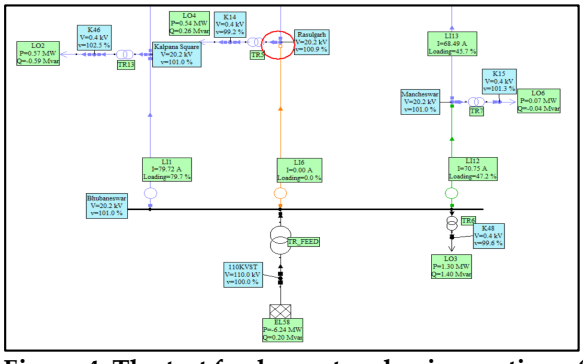

Figure 4: The test feeder system having section of the feeder is out.

Figure 5: Picture of Experimental Setup

Figure 6: Balancing the circuit by switching.

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REVIEW ARTICLE

Comprehensive Review on Various Motion Control Strategies of Autonomous Underwater Vehicles

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ABSTRACT

This paper presents a comprehensive review on various motion control strategies of Autonomous Underwater Vehicles (AUVs). The autonomous underwater vehicle (AUV) may be a representative marine technology which has been contributing continuously to many ocean-related fields. An extensive literature review of some existing AUVs characterizing their operation endurance and different methodologies used to enable long range AUVs has also been described in this paper. The techniques like path optimization, path re- planning in connection to dynamic environments and cooperative path planning of multiple AUVs are now in recent trend in connection to research related to autonomous underwater vehicle (AUV). This paper has been written with the objective to represent an extensive survey of the optimization techniques used for path planning of AUVs depending upon its properties. This paper highlights challenges faced while planning the path for AUVs that requires to be addressed for developing advanced optimization techniques for AUVs so that it is capable of operating in extended mission durations.

Keywords: Autonomous underwater vehicle (AUV), Cooperative path planning, Fuzzy logic controller, Backstepping controller

INTRODUCTION

Oceans cover two thirds of the Earth and have a huge impact on our ecosystem. Traditionally they act as the source of food, provide warmth and natural resources, and sustain the ocean ecosystem by maintaining biodiversity. With the development of ocean science, their ecological, economic and social importance are now better understood. On the other hand, ocean activities are closely related to some deadly natural phenomenon's such as tsunami,

earthquake and hurricane. Hence the constant monitoring of the ocean state becomes an urgent necessity and will definitely benefit mankind in terms of minimizing the loss due to natural disasters, maximizing the harvest from the oceans, and more [2].The word autonomous refer to the ability of an object to move without any help of human guidance. Control of AUV generally implies the movement of the body underwater without the need of any input from the operator. But the autonomous movement and control of an AUV underwater environment is a difficult task due to the complexity in its structure, nonlinearity and uncertainty. Underwater vehicles present advanced tools that enable the ocean monitoring to go far beneath the ocean surface, collect diverse first-hand data and see how the oceans behave. Underwater vehicles can be manned or unmanned. With the advancement in technologies, path planning for AUVs has become important for many application like security, acoustic surveillance, collection of ocean data at specific locations, for ocean prediction and monitoring. A path planner should be abletoreact rapidly to fast changing environments and find a path that safely allows the AUV to reach from its initial position to its final position using either a chosen minimal energy or time related cost criterion. Since the 3D environment consumes more memory and may slow down the planning process , hence most conventional path planning approaches project the 3D environment to 2D space [3]. However, the drawback with 2D space is that it cannot completely embody all the 3D information, like currents, bathymetry and obstacles of the ocean environment. Evolutionary algorithms have been proven to be an efficient and effective way of dealing with non-deterministic polynomial-time (NP) hard problems [2]. The review report is presented in different sections of this paper, which are organized in the following manner. In Section II, a brief review on AUV structure are presented. In Section III path planning problem are discussed. In Section IV, some of the optimization techniques are explained. Conclusions are mentioned in Section VI.

AUV Structure

Most of the applications of AUV require that it should follow a desired path like pipeline or scanning or surveillance of a desired region, these requirements lead to address a common objective for most of the applications is navigation.

Navigation System

Navigation system is meant for obtaining the position and orientation of the vehicle using INS, GPS, or other acoustic sensors. But the navigation of an AUV is difficult because the unavailability of the sensors for giving accurate position and orientation measurements [1]. But with the development of DVL, Ultra Short Baseline(USBL) and many other position measurement sensors, which can be integrated to the INS for getting accurate data. In the navigation system, usually the sensor data get corrupted by external noises. So signal processing has a major role in navigation system. If a state is unavailable then an estimator can be employed to generate the missing or unmeasured state [4].

Guidance System

The guidance system deals with the desired path generation from AUVs current position to the desired position. The major challenge in the guidance control is to generate an optimum path for the AUV considering the obstacles between the paths. Hence in order to follow the optimum path successfully, the path feasibility for the particular AUV should be determined. This path feasibility different AUVs vary depending on whether it is a fully-actuated or an underactuated system.

Control Structure

Control structure helps in determining the required control forces required for steering the AUV along the desired path.The different objectives which can be obtained from the control structure are trajectory tracking, path following and way point tracking [1]. While developing a control law, it is necessary to check the stability of the AUV states, and also the generated control forces should reside within its maximum limit. Design of control law for a fully-actuated system is simpler than an underactuated system but the control allocation map is to be given major attention. In an underactuated system, it is challenging to develop a control law together with ensuring the system stability. For both the cases it is necessary to show the robustness and adaptation of the control structure for the

external disturbances [4]. Besides path following, other motion control strategies of interest are trajectory tracking and way point tracking, which are described as follows.

Trajectory Tracking Problem: It refers to the control problem where the AUV isrequired to follow a time-parameterized path. Here the controller development is highly dependent onwhether the system is fully-actuated or under-actuated. A fully-actuated system is generally not preferred muchdueto its cost, weight and efficiency consideration. Path Following Problem:In this type of control problemthe entire path considered for tracking doesn't involve any time-parameterized constraint. Path-following is well suited for underactuated system because less number of constraints involved. For path-following problem the path is represented with its geometrical description and the AUV needs to follow the geometrical property of the path and eventually converges to the path [17].Way Point Tracking Problem:This method is different as compared to trajectory tracking and path following problems. Here, a desired region is specified within a visible range. The control force should be designed in such a way that it will drive the AUV towards the region confirming the stability criteria. This is done by placing a series of way-points between the AUV actual position and desired position [13].

Optimization techniques for path planning

Completeness and optimality are the two important aspects of the path planning algorithm. Completeness includes two forms i.e. probabilistic completeness and resolution completeness. If an algorithm guarantee to find an existing solution in finite time as long as the resolution of an underlying grid is fine enough then it is known as Resolution completeness. Most resolution complete planners are graph search methods such as Dijkstra,A*and Field D*.On the other hand , an algorithm is considered probabilistically complete if the probability of finding a path approaches100%.

Graph search schemes

Graph-based methods come under classical path planning approach that belongs to the category of discrete optimal planning.The first graph method used to search a minimum cost paths is Dijkstra's algorithm ,it computes every possible path from a starting point to a specified destination point. The most recent algorithm used for AUV path planning includes FM algorithm. The FM algorithm can be improved by using wave front expansion to calculate shortest time paths and also determines the departure time of the vehicle from the starting point.

Artificial Potential Field (APF)

An artificial potential field for global path planning based on a linear energy cost-function was originally proposed in [21]. Potential fields have also been used for underwater path planning in [8] with a cost function measuring the total drag experienced by the vehicle,total travel time and any obstacles in the field. After generating a feasible set of tracks, an optimization is performed on these tracks. This algorithm has the advantage of being inexpensive, thus allowing for easy real-time computations to adapt the vehicle path. However, it has the drawback of producing locally optimal solutions. Another problem with potential field methods is their adaptation to dynamic ocean currents. It is very inefficient to re-compute the potential field for the whole map for each time instant.

Rapidly-exploring Random Trees (RRT)

Rapidly-exploring Random Trees (RRT) is another method used to solve the path planning problem. In this method a tree is allowed to grow incrementally to explore the space until the branch of the tree reaches the goal location [35]. A number of extensions like the Dynamic RRT [19] and Multi-particle RRT [36], have been made to facilitate robot navigation in dynamic and uncertain environments. RRT has been applied to both AUVs [23] and gliders [24] path planning in dynamic flow-fields. The RRT algorithm is very fast and effective to produce collision free paths to problems with high-dimensional configuration spaces, but it does not assure optimality and the paths found often requires further refinement.

Evolutionary algorithms

Evolutionary algorithms are another technique used for path planning. The two well-known forms of evolutionary algorithms includes genetic algorithm (GA) [37,25] and the particle swarm optimization (PSO) [38,39]. GA and PSO algorithms are similar in the sense that they are population-based search scheme and that they all depend on information sharing among their population members to enhance their search processes using a combination of deterministic and probabilistic rules. However, PSO differs from GA in the sense that PSO is a stochastic evolutionary algorithm which does not incorporate survival of the fittest, and there is no conventional evolutionary operators such as crossover and mutation. For PSO, all particles are retained through the course of the run and each particle adjusts its searching in the space in terms of its own searching experience and its companions' searching experience. A detailed comparison between PSO and GA can be found in [40]. Quantum-behaved particle swarm optimization (QPSO) is recognized as an improved version of the original PSO. It differs in that QPSO assumes that every particle in the swarm has quantum behaviour instead of using the conventional position and velocity update rules employed in PSO.

Control of AUV

The application of AUV requires an accurate motion control strategy. In order to achieve the path following control of an AUV, the error between the path parameters and AUV position and orientation need to be reduced to zero. the complete dynamics of AUV is generally a nonlinear 6DOF equation of motion coupled with nonlinear terms like added mass, hydrodynamic damping and also external disturbances. Hence it becomes difficult to achieve an accurate path for the AUVs by using linear controllers.However some investigations have considered the approximated 2nd order linear equation of AUV for designing path following controllers. In [26] 2nd order AUV model is approximated to 3rd order equation with the inclusion of an extra degree and its parameters are identified by using Markov parameter. Various nonlinear controllers from [28, 29, 30] can be usedto develope path following controller considering certain nonlinear dynamics. A number of nonlinear controllers includes backstepping controller, sliding mode control, soft computing approach are used for path trajectory of AUVs. Numerous control strategies have been adopted for controlling the depth and steering control. It is possible to classify the algorithms into two main groups: Linear and Nonlinear [2]. The tracking control of AUVs mainly includes path following and trajectory tracking. The main difference between path following and trajectory tracking is that the reference trajectory of path following is independent of time and that of trajectory tracking is dependent on time. Path following can be regarded as a special case of trajectory tracking; therefore, the trajectory tracking problem is more widely applicable. In comparison with mobile ground robots, the major factors that cause difficulties in controlling AUVs are listed as follows:

The hydrodynamic performance of AUVs is highly nonlinear and time varying.

The center of gravity and buoyancy changes with a change in the load.

The additional mass and inertia

Fuzzy Logic controllers and sliding mode controllers

Fuzzy Logic controllers and sliding mode controllers have been implemented for AUV path following [31, 32, 33]. In [31], the error between desired path and AUV position is represented using a sliding surface and using this error in to consideration a fuzzy controller has been implemented for generating the control input i.e. rudder orientation. In [32], a sliding mode controller is designed for marine vessel using 3DOF equations of motion.The marine vessel which is considered in [32] is considered to be fully actuated vehicle and the stability analysis was made using the Lyapunov method.

Backstepping controller

Another nonlinear controller which is mostly used for the autonomous vehicles is Backstepping controller, a Lyapunov based controller. An initial work on path tracking of mobile robots using the backstepping control is reported in [34]. Usually a mobile robot can be accurately controlled with the kinematics only but in the case of AUV only kinematics control is not sufficient because of nonlinearity and presence of coupling terms in the dynamics

equation. In case of AUV, both the parameters of kinematics and dynamics need to be controlled. The backstepping control has been applied to AUV considering the complete dynamics equation in [2, 35, 36, 1] . Referring [2], presents a path following control of an AUV by assuming a virtual vehicle that follows the desired path and the error between its position and orientation has been considered with backstepping controller. The boundedness and stability properties of the error backstepping is also presented in [2]. A similar approach has been applied for the path following problem of AUV [35, 36] with an exception that a Serret-Frenet frame is considered in place of virtual vehicle. But in the development of the pathfollowing controllers in [35, 36] the information for jerk parameter is required for effective path following but in practical cases the measurement of jerk parameter is difficult to measure. As this data is not available using any sensor so the controller heavily relies on mathematical model, but if parameter uncertainty mathematical model is considered then the jerk data will be an erroneous data. In [25], the S-F frame has been considered and problem of requests jerk information has been resolved.

Leader-Follower Control

In this approach, the vehicle is positioned with respect to the neighbor vehicle in order to form an geometrical structure. In [37, 38, 39] a leader-follower strategy is used in which there are global local leader. This control structure is proposed for multiple mobile robots in which it has been shown the transition from one formation structure to another formation structure with the help of graph theory. The same concept of the leader-follower approach is also applied to underwater vehicles [40] whereNeural Network function approximation has been used to show the dependence of follower AUV on leader which provide the approximate states of leader to the follower. A similar approach has also been adopted in [41] where an estimator is used in the follower vehicle to estimate the velocity of the leader vehicle. Sliding mode controller and fuzzy controller has been implemented in [40,42] for developing a leader follower strategy among the vehicles.

Virtual Structure Based Control

Theonly difference between this approach and the leader-follower strategy is in the physical presence of the leader vehicle. In virtual structure-based approach, a virtual leader is considered, so the approach remains same for analysis. In this approach the information regarding the position and velocities of vehicles are to be regularly transferred in the similar way as done in leader-follower approach. Thus, usually centralized method is adopted for implementation of virtual structure-based strategy. This strategy is first introduced by [21]the principle behind this approach is that the vehicles will move in such a way that the structure will move smoothly along the path. [41,42] have also shown the application of virtual structure approach in mobile robots.

Adaptive Control

Adaptive control automatically adapts itself to the change in the characteristics of an object and disturbances through timely correction of controlled object's performance; there by enabling the entire control system to operate efficiently and stably. Adaptive control research is aimed at uncertain objects whose dynamic model is difficult to determine. Adaptive control, a complex feedback control method, has little dependence on mathematical models and requires only a small amount of prior knowledge. There are four types of adaptive control-feedforward, feedback, model reference, and self-tuning. Here, the model reference adaptive control is used as an example to introduce adaptive control.[28]

The system comprises four parts-the controlled object with unknown para- meters (AUV), the reference model (which describes the desired output of the control system), the feedback control law with self-correcting parameters, and the adaptive mechanism of the correction parameters. Here, a is a control parameter of the adaptive law. The model reference adaptive controller is designed through the following three steps:
Selection of control law including the change in parameters.
Selecting the adaptive law which is employed to correct these parameters.
Analyze the convergence characteristics of the existing system.

Neural Network Control

Neural network control entails utilizing a neural network as a controller or an identifier in the control structure. This control method mainly aims at solving the control problem of a complex, nonlinear, uncertain, unknown system in an uncertain environment. A neural network can approximate any nonlinear function with arbitrary precision. Neural network control has adaption and self-learning abilities for handling complex problems involving uncertainty and can resolve problems involving large-scale, real-time calculation by using a parallel processing mechanism.

As neural network does not require an accurate dynamic model hence the nonlinear performance of AUVs can be fitted by neural networks. presented a bioinspired neurodynamics model used to design a kinematic controller, which can smooth the speed value of AUVs and avoid thrust overrun. used neural network predictive control for the depth control of an ROV, achieving a fast system response . designed an adaptive neural network controller by combining a single-hidden- layer neural network and sliding mode control for underwater vehicles to trace the desired trajectory with estimated global pose information. studied the integration of two neural networks (a critic neural network and an action neural network) and adaptive control for the trajectory tracking problem in the horizontal plane.

CONCLUSION

Due to the wide range application of AUV, its research has gained salient progress. However, it has some limitations and problems which are yet to be further explored. In this review paper, several AUV tracking control methods has been discussed briefly. Each of them has its own advantages and limitations. The most efficient control method should be chosen by identifying the characteristics of the specific objects that are controlled and requirements of the control performance. The structure, feasibility, and cost of the control method should also be taken into considered. A combination of two or more methods can be adopted if for better control strategy.

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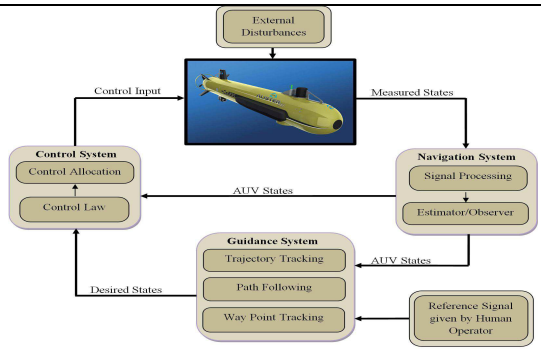

Fig. 1 Structure of AUV

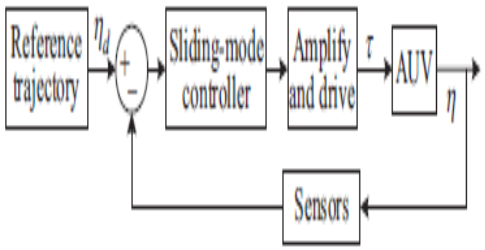

Fig. 2 Block diagram of fuzzy logic controller and sliding mode controller

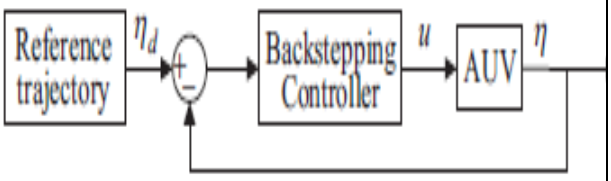

Fig 3. Block diagram of backstepping controller

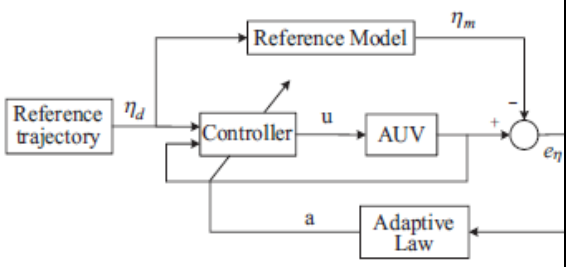

Fig. 4 Block diagram of adaptivecontroller

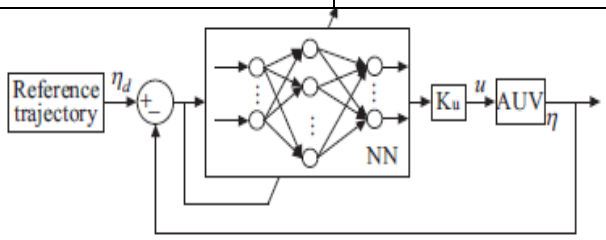

Fig. 5 Block diagram of neural network

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RESEARCH ARTICLE

Improvement of Power System Stability by using FLC based PID Controller

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ABSTRACT

The objective of this paper is to improve the stability of power system by using fuzzy based PID controller. It will be capable in providing the proper damping to generator oscillation, which will reduce the effect of instability. Here the application of the fuzzy PID controller how much effective to stabilize the power system in comparison to fuzzy logic -based power system stabilizer has been discussed. Here Speed deviation (ds) and acceleration (da) of the rotor synchronous generator has been taken as inputs of the proposed model. The excitation control of fuzzy PID based power system has been done by the tuning process, i.e. by tuning the acceleration and speed of the rotor synchronous generator. A good damping characteristic over a wide range has been obtained by the system inputs i.e. speed deviation and acceleration of synchronous machine to stabilizer. Now the power systems are interconnected which results low frequency oscillations. The disturbances or the low frequency (LFO) can be mitigated by providing a supplementary damping signal which is produced from the system membership function, which is typically depending on the acceleration and speed of the rotor synchronous generator. How the proposed fuzzy-PID controller-based power system stabilizer is superior to fuzzy logic-based stabilizer, has been discussed and shown in the simulation results

Keywords: PID, PI, FLC, LFO, PSS, AVRs

INTRODUCTION

To maintain the state of equilibrium ,the power system stability has the tendency of the power system to develop restoring forces which can be equal to or greater than the disturbing forces[1]. In the power system the generation of electricity has been completely relied on the synchronous machines, all the machines on power system has to satisfy a necessary condition I.e. all the synchronous machine has to remain in synchronism. The dynamic relationship between the generator roto angles and power angles has the key aspects to maintain the stability. Hence as it shows

the dynamic behavior, so it is a dynamic system. Today the electric power system has no longer operated as isolated system, it has been operated as interconnected systems which includes millions of electrical elements and also spreads over large geographical regions in worldwide [2-3]. The main work of the thesis is to make the power system stable with as much less time as we can. The power system should be reliable and economical for generation, transmission and distribution. To prepare a better system than the exciting one the survey of the previous work is important. From where one can gate enormous idea to enhance the work.

Problem Identification

For better result or for the cause of reliability of power supply power systems are interred connected. Which results a low frequencies oscillation in the poser system. This is due to the frequent variation of the load demand. In the power system the goal for maximum power transfer and power system security can be obtained those low frequency oscillation (LFOs)which has been also related to the small singnal stability of a power system. The stability problem will be disregarded when it has been found the satisfactory solution of using damper windings on the generator rotors and the turbines can control those oscillations. A major cause of system instability is weak synchronizing torque among the generators which is obtained when power systems began to operate closer to their stability limits. The steady-state stability of the power systems has been improved by the help of automatic voltage regulators (AVR). To develop a large interconnected power system, a major concern is to transfer the large amounts of power with less losses in the long transmission lines[4-5]. To reduce the inhibiting effects of LFOs a supplementary controller has been introduced in the control loop such as the conventional power system stabilizers (CPSSs)to the AVRs on the generators .It has been observed that the CPSSs work quit perfectly at the particular network configuration and also in the steady state conditions for which they has been meant to design .CPSSs satisfies its purpose of work for this system. Once conditions change the performance starts to degrades. The CPPSSs which includes lead-lag, proportional integral (PI) power system stabilizer, proportional integral derivative (PID), are operated at a certain point of power system stabilizer[6-7-8]. The main drawback of those type stabilizer that they are unable to operate under different disturbance. To overcome from this disadvantage a PSS design based on Fuzzy logic technique has been developed. But it is found that by the use of Fuzzy-PID (Proportional-Integral-Derivative) controller logic we can gate better result.So, there need of design a better system using the Fuzzy-PID Controller

PROPOESED METHODOLOGY

Numerous techniques has been developed in the literature to overcome the drawbacks on fuzzy logic based power system stabilizer. In this Paper, the effectiveness of the fuzzy logic-based Power System Stabilizer (FLPSS) on the system damping has then compared with a fuzzy-PID controller based PSS while it is applied to a single machine infinite bus (SMIB) power system. By comparing the results of both it has been found that PID controller based fuzzy logic systems give better performance than the only fuzzy logic-based power system stabilizer. So, the need for designing the Fuzzy-PID Controller for the power system is justified[11-12]. Radman and Smaili have proposed the PID based power system stabi-lizer and Wu and Hsu have proposed the self tuning PID power system stabilizer for a multi machine power system[9-10-15]. Here PID controller has been connected with the existing Fuzzy logic model and the simulation has been carried out. Result is verified. In this model in order to keep a simple structure, gains are adjusted by outside. The FLPSS has been compared with two reference stabilizer for its validation.

FUZZY PID MODEL

The Following is the Model Of the Fuzzy –PID Controller

FUZZY-PID Membership Functions

Fuzzy logic is nothing ,it is the derivative from the classical Boolean logic and it is implemented in soft linguistic variables on the basis of continuous range of truth values which is to be defined between conventional binary i.e. [0, 1]. It has been considered as a subset of conventional set theory. Here the velocity and acceleration of the synchronous generator has been viewed in the Fuzzy-PID controller. And the waveform is diagnosed.Here it is worked to improve the stability of power system by using of the fuzzy based PID controller. It will capable in providing the proper damping to generator oscillation, which decrease the effect of instability[13]. Here a comparison has been studied between fuzzy PID controller and only fuzzy controller for power system stability. Speed deviation (ds) and acceleration (da) of the rotor synchronous generator has been taken as input parameters for this system[16]. In fuzzy PID based power system the excitation control is done by tuning the input parameters i.e speed and acceleration. of the synchronous generator. In this proposed model both inputs of synchronous machine gives good damping characteristics over a wide range to stabilize the power system.

FUZZY-PID Controller Rules

The output of the fuzzy-PID controller model is given below. One can see the at the time of the Kd, Ki is small and the Kp is small the value of the acceleration and the velocity is small and when the value of Kd, Kp is small and the Ki is medium the value of acceleration is medium and the velocity is small[14]. Similarly, all the result is verified.

SIMULATION RESULTS

It has been seen that the power system can damp the oscillation with in some few second by using the Fuzzy-PID controller with the power system. But previously we are getting or can stable the system in 2 seconds. Hence it is found that Fuzzy-PID controller is more effective when using in the power system. The simulink result is as follows. Here, it is shown the simulation results using MATLAB / SIMULINK for both types of power system stabilizers (Fuzzy based AND Fuzzy-Pid)

CONCLUSION

The objective of this paper is to develop the effective damping of oscillations for stabilizing the power system using a controller based on fuzzy-PID logic. The purposed controller provides more robust control in stabilizing the power system over a large disturbance points when it is applied on single machine to infinite bus system, where optimal controller and lead lag stabilizer most of the previous control methods either are not working sufficiently under whole range of operating condition or they need complicated calculation as they require the exact model methodology to site the proposed controller, which doesn't depend on the Eigen analysis approach model From Fig.1.6 to Fig.1.8 it is shown that the settling time of angular position and angular speed for Fuzzy- PID PSS is as much faster than Fuzzy PSS. In the shown result i.e from Fig 1.6 to Fig 1.8 the settling time angular position for Fuzzy- PID PSS takes less than 1 sec to reach its final steady state value and the settling time angular speed takes 0.6 sec to reach its final steady state value. Therefore, it can be inferred that fuzzy-PID controller does not require any complex mathematical support and the response is much impressed than Fuzzy PSS. In the future works the Fuzzy-PID based (FPIDPSS) can be extended to multi machine interconnected system having nonlinear loads. It can be carried out for more complex network mode

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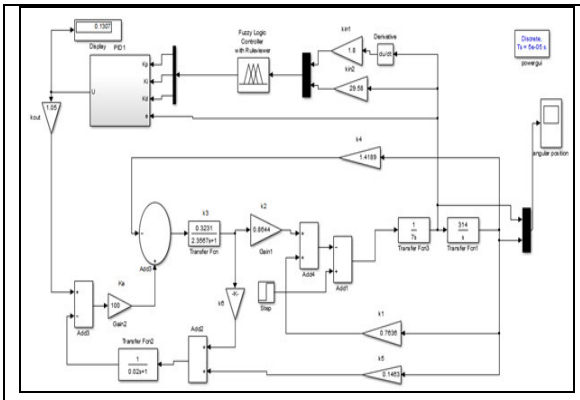

Figure 1: Fuzzy-PID controller

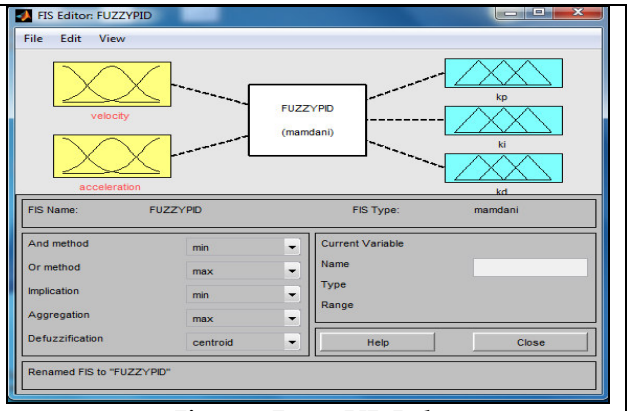

Figure 2: Fuzzy-PID Rule

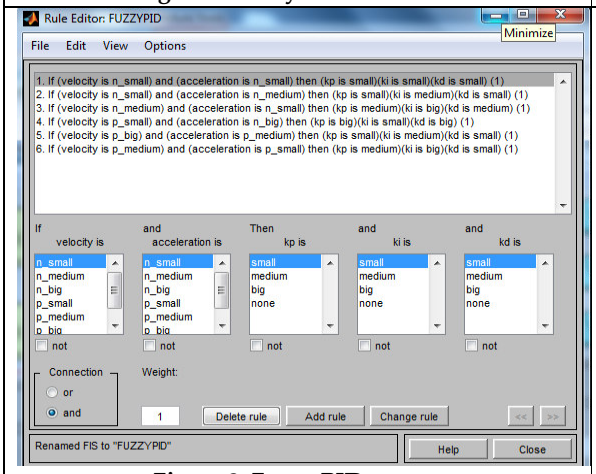

Figure 3: Fuzzy PID output

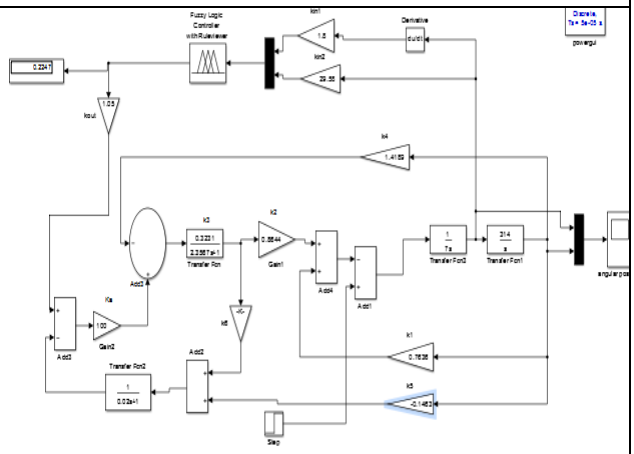

Figure 5 Performance of FLPSS (-K5)

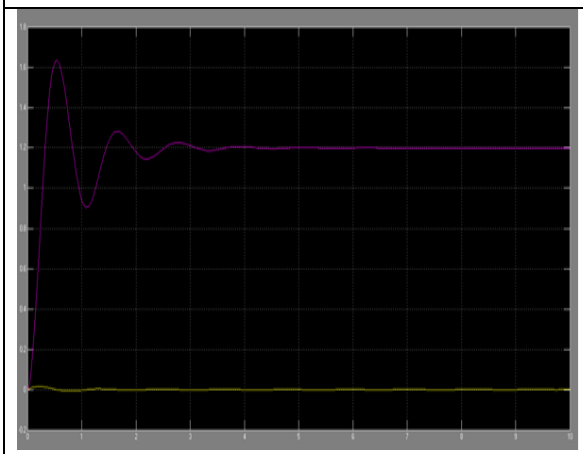

Fig.6 Waveform of FLPSS (K5)

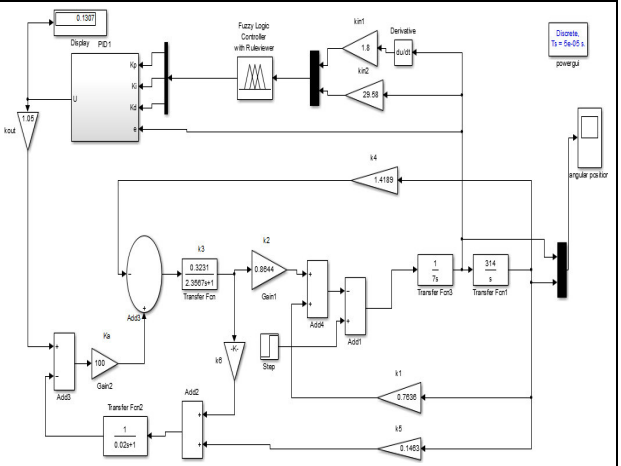

Figure 7 Performance of Fuzzy-PID PSS

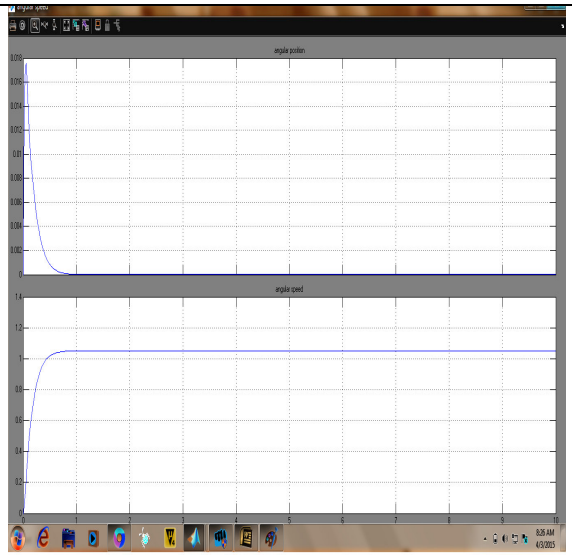

Figure.8 Waveform of Fuzzy-PID PSS

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RESEARCH ARTICLE

Revisionary Study on the Lichens Diversity of Khandagiri and Udayagiri

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ABSTRACT

The revisionary study reports the diversity, distribution and colonization of lichen thallus growing on historical monuments and caves of Khandagiri and Udayagiri hills. The result of study revealed the occurrence of 16 lichen species belonging to 8 genera and 6 families. The members of the lichen family Caliciaceae, Teloschistaceae, Thelotremataceae, Lacanoraceae, Stereocaulaceae and Peltulaceae. Caliciaceaeconsider the dominate family among other family. Crustose exhibits their luxuriant growth among different growth forms, with respect to squamulose and foliose species. Substrate preference for lichen assembly is apparent by occurrence of maximum diversity of lichen represented by 16 species on caves, rocks and monuments respectively.

Keywords: Lichen, Khandagiri, Udayagiri, Bhubaneswar, Odisha

INTRODUCTION

Lichens are successful symbiotic organism in nature, which consist of fungus (mycobiont), and a green (phycobiont) algae, or blue green algae (cyanobiont) (Galloway, 1992). These are autonomous organismsi.e. autotrophic in nature and maintain a self-micro environment with ecosystem for itself (Farrar, 1976; Seawad, 1988). They have various type of growth form, which accelerate them with ecological support to adopt according to environmental and artificial stress (Ahti, 1959; Sheard, 1968; Ahti et al, 1973; Rai et al, 2012). The growth of the lichen thallus takes place where the no survival of either alga or fungi alone can be possible. That is why the colony of lichens are grow in various types of substratum i.e. trees(epiphytic), the ground (terricolous), stone (epilithic) etc. In succession, the introduction or invasion of lichen depends upon the pH of the corresponding substratum. On neutral and alkaline substrates most commonly and on acid substrate silicicolous species are found. The various appearance of thallus on the surface of

stone are of different kind, like Crustose(crust like), Foliose(thread like encouraged), fruticose(three-dimensional thallus), endolithic(Found in calcareous stone) (Awasthi, 2000).

Out of the different plant groups, which are grow on monuments and architecture the effect of bio deterioration by lichens is poorly studied in India and these are one of the major factor for weathering of rocks due to their biogeophysical and biogeochemical agents, which are unique to the lichens (Ahmadjian and Hale, 1973). The crustose lichen have close adherence or contact with lithic substrate, however the foliose have attached loosely. The phenomenon of bio-adherence and biodeterioration was explained and were made in the 1920s on ancient stained glass window (Mellor1921, 1922, 1923, 1924; Fry, 1992, 1924). The purpose of defining the interaction between lichens and rocky surface. The experiment work was hold on 1960s to 10 year on word, with a specific report (Syers and Iskander, 1973).Lichen reproduction occurs by germination of spore or multiplication of Soredia and Isidia. The fungal partner only take part in reproduction by forming fruiting body. the disposal of reproductive structure dispersed by birds and insect fall on any substratum with moisture content new growth takes place (Garty, 1988). It is shown that the calculation of lichen species deteriorate collectively from the peripheral zone to the center of urbanised areas, with a decrease in the amount of species and of the surface area colonization. These are behave as a detectable biosensor of atmospheric pollution because of its only weak point that it establish a symbiotic association between algae and fungi. High pollution, particularly by sulfur dioxide, damages the lichen thallus, first leading to retarded growth and then to death (Seaward, 1976).

Savoye and Lallemant (1980) demonstrate that, lichens stabilize on a substrate then it has been partly transform the substances in the air and then by other microbes generally bacteria. This hypothesis seems verified by the fact that lichens grow more readily on archaeological broken monuments (ruins) on which mould facilitates bacterial growth and the role of biofilm on stone surfaces that leads to become porous. In the state of Orissa, a number of collections were carried out for exploration of lichens in different part of the state, but two of the studies mostly done on the epilithic lichen distribution. Nayak et al. (2017) reported total 15 species belongs to 14 genera and 11 families growing on the sun temple of Konark, which is located in the Puri district of Odisha. The study revealed more than 500 various types of spots are found on sun temple as well as small statue situated inside the temple landsite and surface and most of them are Squamulose lichens. Apart from this Nayak et al. (2018) also reported the luxuriant growth of crustose lichen, which are responsible for the bio-physical and bio-chemicals weathering of the statues and other stone at the excavation site of Ratnagiri and Udayagiri. Most of the statues which are continuously receiving less sunlight and remain in the shade for longer period of time are mostly affected by lichen patches.

MATERIALS AND METHODOLOGY

Khandagiri hill situated in between 20.2561′73 N latitude and 85.7801′09 E longitude and Udayagiri hill situated in between 20.26311′52 N and 85.7857′25 E in Khordha district of Odisha state. The two hills are known as Kumari Parvata in the inscription of the Hathigumpha, which implies its historic background. These two hills which is located 6 km far from the centre of the capital Bhubaneswar, which contains partially manmade and partially natural caves which have archaeological, religious and historical recognition. These places are famous for Budhist statue, Jain script, jain statue and ancient elephant cave respectively. It is shrubby greenery area obtain about more than hundred hectors and count as pilgrimage place situated on a small hilly area. The slope of this region varies from gentle to very step. Geologically theabove area occupied by few undulations which bear some perennialplants and ancient rocks which are found rich with lichen thallus with gregarious form of growth. The present study reveals more than 300 different patches, which are spotted from the rock surface of the statue and cave region of Khandagiri and Udayagiri during the winter i.e. between December 2019 to January 2020. Being a protected monument, it was not possible to collect the samples, hence high-resolution camera used to take snaps of the lichen patches.

RESULTS AND DISCUSSION

From the preliminary observation, it was observed that monuments and sculpture of Khandagiri and Udayagiri are more disposed to both bio-physical and bio-chemical weathering. Their sum total of 16 species of lichen belongs to 8 genera.Among them some are crustose, foliose and squamulose respectively these are mostly found in surface of stone and monuments also called lithicolous(epilithic) or calicolous lichen according to their substratum category, but according to their family and thallus growth form these are levelled in following table ie. Table1 and table2. From the above data (Table 1), it is clearly seen that most of the species are mostly crustose type and mostly belongs to caliciaceae and lecanoraceae family. The *Lecanora* sp. and *Pyxine*sp. are mostly occurring species in the rocks of Khandagiri hills.

From the data (Table 2), it is clearly seen that like Khandagiri most of the species of Udayagiri are mostly crustose type. The species are mostly belongs to caliciaceae and teloschistaceae family. These is a sum total of 11 types of species found in the stone surface of Udayagiri. From above thepie chart it is observed that caliciaceae, the dominated family which is encircle 40% of area, thelotremataceae, lacanoraceae, stereocaulaceae and teloschistaceae moderately distributed and peltulaceae have quite least distributed family. From the above discussion most of lichen found are belongs to*Pyxine* species which show profound growth at the surveyed sites of Khandagiri and Udayagiri caves. These are widely spread distribution in Khandagiri and Udayagiri. Rather than*Pyxine* their also other lichens which are found in thesearea are belongs to families Caliciaceae, Lacanoraceae, Thelotremataceae, Stereocaulaceae, Peltulaceae, Teloschistaceae. Among the different foliose lichens the specices of lichen genera *Pyxine* are most dominant in the area, and crustose lichen like *Diploschistes*, *Lacanora* are common dominant species found in caves and monuments.

CONCLUSION

From above preliminary performance, we conclude that stone species composition, distribution and diversity play an important role in shapinglithicolous communities in the Khandagiri and Udayagiri, with the main drivers being substratum traits e.g. stone and monuments. In addition, our revisionary study shows that distribution of different epilithic lichen diversity in Khandagiri and Udayagiri hills or caves.

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Table 1: Total no of species, family and thallus form of Lichens of Khandagiri

Serial Number	Name of lichen	Family	Growth form
1.	*Diploschistes* sp.	Thelotremataceae	Crustose
2.	*Lecidella enteroleucella*	Lacanoraceae	Crustose
3.	*Lecidella* sp1	Lacanoraceae	Crustose
4.	*Lepraria* sp2	Stereocaulaceae	Crustose
5.	*Pyxine cocoes*(Nyl.)	Caliciaceae	Foliose
6.	*Pyxine* sp1	Caliciaceae	Foliose

Table 2: Total no of species, family and thallus form of lichen Udayagiri

Serial Number	Name of Lichen	Family	Growth form
1.	*Amendinea* sp.	Caliciaceae	Crustose
2.	*Buellia* sp.	Caliciaceae	Crustose
3.	*Buellia* sp2	Caliciaceae	Crustose
4.	*Caloplaca* sp.	Teloschistaceae	Crustose
5.	*Diploschistes* sp1	Thelotremataceae	Crustose

6.	*Diploschistes*sp2	Thelotremataceae	Crustose
7.	*Leprarialobificans*	Stereocaulaceae	Crustose
8.	*Peltula*sp.	Peltulaceae	Squamulose
9.	*Pyxinecocoes*(Nyl)	Caliciaceae	Foliose
10.	*Pyxine*sp1	Caliciaceae	Foliose
11.	*Pyxine*sp2	Caliciaceae	Foliose

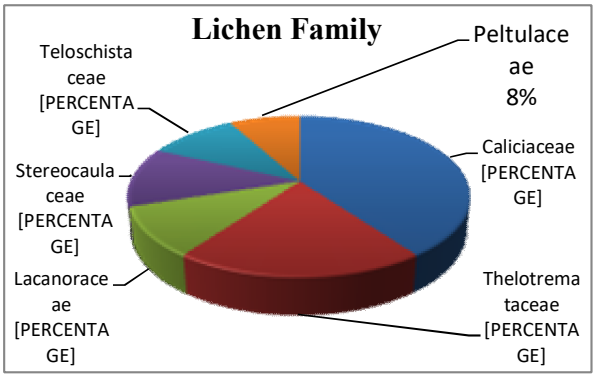

Figure 1: Species abundance per family (Family existence for that particular area)

PLATE - 1

***Pyxine cocoes*(Sw.) Nyl.**

***Pyxine* sp1**

Lecidella enteroleucella

***Lepraria* sp2**

***Diploschistes* sp.**

***Lepraria* sp2**

PLATE - 2

***Pyxine cocoes* (Sw.) Nyl**

***Pyxine* sp2**

***Pyxine* sp1**

***Peltula* sp.**

***Diploschistes* sp.**

***Diploschistes* sp2**

PLATE - 3

***Buellia* sp1**

***Buellia* sp2**

***Caloplaca* sp.**

Lepraria lobificans

***Amendinea* sp**

Note: Photo plate-1: Lichen flora of Khandagiri, Photo plate-2, 3: Lichen flora of Udaygiri

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RESEARCH ARTICLE

Diversity and Medicinal Properties of Fabaceous Herbs by Tribes of Karanjia and Its Adjoining Area of Mayurbhanj District, Odisha, India

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ABSTRACT

The present study was done in Karanjia and its adjoining areas, to collect the information of the diversity of edible herbaceous plant and documentation of indigenous knowledge of medicinal use of herbs belonging to Fabaceae family used by different tribes in various forest pockets of Mayurbhanj districts. During the survey 16 fabaceous herbs have been collected, critically studied, identified and incorporated in the Herbarium. Out of these, 11 edible fabaceous herbs collected are found to be pulses, which are excellent sources of protein.Through this work, it is concluded that the diversity of pulse based edible fabaceous herbs is more than other fabaceous species in the study area.

Keywords: Fabaceous herbs, Indigenous Knowledge, Medicinal use, Mayurbhanj.

INTRODUCTION

The Fabaceae or Leguminoseae, with approximately 741 genera and 20,200 species (Mabberely, 2017), is among the third largest family of flowering plants next to Orchidaceae and Asteraceae, on the basis of species richness with cosmopolitan distribution (Judd *et al.*, 2002). The family ranges from giant perennial trees, shrubs to small annual herbs with, majority being perennial herbs (Rahman and Parvin, 2004). It includes a number of agricultural and food plants like pea, bean, pulse or legume which are excellent source of fibre, protein, complex carbohydrates and micronutrients and have no cholesterol (Clark *et al.*, 2018). The herbs are used to cure many ailments such as cough, asthma, leucoderma (Kaur *et al.*, 2012), diabetes (Lin *et al.*, 2018), snake bite (Upasani*et al.*,2017), peptic ulcers, respiratory infections, tremor and gastritis (Bahmani*et al.* 2014 and Zargaran*et al.*, 2013).

Fabaceae plants distributed mostly in tropical, subtrobical and temperate regions. In India, they occupy third position in the list of dominant species. It is second most abundantspecies in Odisha (Haines, 1922 and Mooney, 1950). In Odisha about 147 species and 7 subspecies or varieties belonging to 59 genera have been documented (Bairiganjan *et al*., 1985). The state of Odisha is rich in natural plant resources and its utililation as medicinal plant resources is one of the oldest cultural traditions (Rout *et al.* 2009).Mayurbhanj being the largest district in Odisha, occupies a unique position retaining 38% of its area under forest cover (Routray *et al.*, 2017). It possess great diversity of culture, tradition and especially medicinal plant resources. It is a tribal dominated district, occupying a large number of population constituting of about 52% of tribes. Out of 62 types of tribals in Orissa, Mayurbhanj alone houses 53 communities both aboriginal and migrated, are found in the district (Naik, 1988). The major tribes among them are Santal, Kolha, Munda, Bhomij, Bathudi, Kharia, Mankidia, Gond, Mankdias, Ho, Bhuyan, Paudi and Bhuyan live in the forests of Mayurbhanj district(Rout *et al*., 2009).

In Odisha, the diversity and medicinal use of fabaceous plants have been studied in several areas which include Mayurbhanj (Singh *et al*., 2010), Sunabeda (Kandi *et al*., 2011), Dhenkanal (Kumar, 2015), Koraput (Padhan and Panda, 2015), Sambalpur (Mendali and Behera, 2018). Although a number of reports are available on diversity of medicinal plants,indigenous knowledge about fabaceous herbs used among the tribes of this region has not yet beengiven any significant attention. The present study was conducted to explore and collect data on the diversity of edible herbaceous plant and documentation of indigenous knowledge of medicinal use of herbs belonging to Fabaceae family used by local people. These indigenous knowledge are gathered from nearby areas of Karanjia in Mayurbhanj district of Odisha, for the evaluation of traditional knowledge and for their scientific documentation before the loss of traditional knowledge and practices.

MATERIALS AND METHODS

Study Area

The study was undertaken among the tribes residing in Karanjia of Mayurbhanj district of Odisha, India, Figure 1. The district lies between 21°17' and 22°34' North latitude and 85°40' and 87°11' East longitudes. The vegetation comprises of tropicalsemi-evergreen forest, tropical dry deciduous and tropical moist deciduous forests. The climate is mostly tropical with annualrainfall ranges from 1200mm to 2000mm and temperature ranges from 2°C to 48°C in this region.

Questionnaire and Data Collection

Various tribal rich forest pockets of the area under study were identified and field trips were conducted. Interviews were performed in the study area with the local peoples, farmers and local healers (Kabiraj), who have knowledge about the healing properties of the collected plants, to obtain the information about the cultivation patterns and the ethnobotanical data. Vernacular namesin the different tribal languages and Odia were documented along with plant parts that is edible and that usedas medicinal plant part were obtained in details.The supportive plant specimens of folklore claims were collected, processed, critically studied, identified and preserved in the Herbarium.

Collection of Herbal Samples, Herbarium Preparation and Identification

As different species come to flowering and fruiting at different seasons, field surveys were executed in such a way as to accommodate a relevant information in different stages of their life history. The healthy flowering twigs or whole plants with roots were collected with extreme care using required instruments and their herbarium was prepared as per the standard protocol as described by Manden (2004) and Seshagirirao *et al.*, (2016). Photographs of whole plants or twigs with the flowers were taken in their natural habitat for future documentation. The collected plant specimen thus pressed, mounted and properly numbered were identified with the references of the flora book of Haines (1921-1924), Mooney (1950), Saxena & Brahmam (1994-1996), and other important publications in relation to floristic have been given throughout the work.

RESULTS AND DISCUSSION

As a result of intensive and extensive field explorations and interactions with farmers, tribal healers 'Kaviraj' and senior women folks who practice native phytotherapy in Karanjia in Mayurbhanj district, it became possible to generate enormous amount of data. After identifying the plant specimens in the Herbarium and scrutinizing the data, it was found that the information is quite interesting. From several observations, there are some herbs grown naturally or cultivated in the agricultural fields along with their medicinal properties are as follows in Table 1.

During the survey, 16 fabaceous herbs have been collected, critically studied, identified and incorporated in the Herbarium. Out of these, 11 edible Fabaceous herbs collected are found to be pulses, which are excellent sources of protein. The table is prepared based on number of collected genera of edible Fabaceous herbs of the study area. Some species are commonly cultivated. However, several species are found naturally in the studied area. Even after the use of modern methods and instruments, still traditional methods are being used in this area due to less advancement. Therefore, there is the need of more advanced and modern techniques of cultivation and irrigation for the qualitative and quantitative improvement of the edible herbs of Fabaceae including proteinaceous pulses in the particular area, as the efficiency of these fabaceous herbs is important for nitrogen fixation and enhancement of soil quality.

CONCLUSION

This study reveals that all of the collected 16 fabaceous herbs are used by the local people either as food or for various disease treatments. Although this study lacks experimental data that supports the usefulness of those herbs as described by local people, these plants need further pharmacological and phytochemical investigations for better research work. The work provides only oral information about the usefulness of edible fabaceous herbs including pulses. They are essential for nitrogen fixation and soil fertilization followed by balanced biological cycling. The edible parts of the plants are illustrated, as they are essential food plants and most of them are proteinaceous pulses. Through this work, it is concluded that the diversity of pulse based edible fabaceous herbs is more than other fabaceous species in the study area. The survey provides useful information for further research to verify the healing effect of these plants and for the possibility of commercializing them.

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Table 1: Fabaceous herbs of Karanjia in Mayurbhanj district of Odisha.

Sl. no.	Scientific name of the plants	Local names	Properties and uses
1.	*Arachis hypogea* L.	Chinabadam	Peanuts are used in cooking and as edible oil. Scorched seeds may serve as coffee substitute. Used in peanut milk.Nut used to increase good cholesterol,prevent coronary artery diseases & stroke risk.
2.	*Abrus precatorius* L.	Gunja (Odia) Kaweth (Santali)	Seeds: purgative, emetic, tonic, aphrodisiac and used in nervous disorders. Root: tonic, diuretic, emetic, alexeteric; used in preparation of drugs against jaundice.Leaves used as substitute for liquorices in catarrhal affections and cough.

3.	*Cajanus cajan* (L) Millsp.	Harada	Seeds are cooked and eaten as dhal. Leaves are useful in oral ulcer, diabetes, intoxication, laxative, stimulant, analgesic and to induce lactation.
4.	*Cicer arientinum* L.	Chana (Odia) Chola (Santali)	Seeds are eaten fresh as green vegetables or fried, roasted and boiled for snack food. Flour from seeds can be used as soup, dhal and for bread. Roasted seeds or roots can be used as coffee substitute.An acid exudation from the seed pods is astringent which is used in the treatment of dyspepsia, constipation and snakebites.
5.	*Clitoria ternatea*L.	Aparajita	The roots are bitter, refrigerant, ophthalmic, laxative, intellect promoting, alexeteric, aphrodisiac and tonic and useful in opthalmopathy, tubercular glands, burning sensation, strangury, helminthiasis, leprosy, leucoderma, elephantiasis, inflammation, vitiated conditions of 'Pitta', bronchitis, asthma, ulcers and fevers. The leaves are useful in otalgia, hepatopathy and eruptions. The seeds are cathartic and are useful in visceralgia.
6.	*Desmodium gangeticum*(L.)DC.	Salaparni	The roots are bitter, sweet, thermogenic, nervine, tonic, aphrodisiac, carminative, constipating, diuretic, cardiotonic, anti-inflammatory, expectorant and tonic, and are useful in vitiated conditions of 'Vata', anorexia, dyspepsia, dysentery, fever, gout, inflammations, cough, asthma, bronchitis, cardiopathy and debility.
7.	*Lathyrus sativus* L.	Khasari	Immatured seeds can be eaten like green peas. The leaves and stem are cooked and eaten as chana saga.
8.	*Macrotyloma uniflorum* Lam.	Kolatha	Seeds are cooked and eaten as dhal.The bean is used to cure stomach pain or disease of stomach & for the cure of flaturation, sore throat, stones & pain of dry piles.
9.	*Mucuna prurient* (L.) DC.	Baidanka	The roots are bitter, sweet, thermogenic, emollient, stimulant, purgative, diuretic and tonic. They are useful in vitiated conditions of 'Vatta' and 'Pitta', constipation, nephropathy, strangury, neuropathy, consumptions, ulcers, fever and delirium. The leaves are aphrodisiac, anthelmintic and tonic and are useful in ulcers, inflammation, cephalagia and general debility. The seeds are astringent, laxative, ahthelmintic, alexipharmic and tonic. They are useful in gonorrhoea, consumption and sterility. The hairs and flowers are vermifuge.
10.	*Pisum sativum* L.	Matar	Dried, roasted and steeped as coffee substitute, roaster drink. Mature seeds can be dried and ground into a powder, then used as flour in bread etc.Seeds used as poultice for skin complaints like acne. The oil from seeds used to prevent pregnancy.
11.	*Pueraria tuberose* DC.	Bhuin-kakharu	The roots are said to be used in medicine as a demulcent and refrigerant in fevers as cataplasm for swelling of joints and as glactagogue. Tubers used for treatment of dysuria, cough, rheumatism, erysipelas and malaria fever.

12.	*Trigonella foenum graecum* L.	Methi	Seeds are cooked and eaten raw. Seeds are powdered and used in curries, pickles and bread etc. as a flavour. Leaves are eaten raw or cooked.Seeds help for body weight gain and inhibit cancerous cells of the liver. Powdered seeds can be applied to treat abscesses, boils, ulcers and burns.
13.	*Vigna mungo* L.	Biri	Black green seeds are eaten as pulse, direct or in various preparations.Beans are used cure constipation,piles & colic.
14.	*Vigna radiata*L.	Munga	Beans are eaten whole or split (dhal). Seeds or flour may be used in variety of dishes like soups, porridge, snacks, bread, noodles and ice-cream. Mung bean is used for starch noodles, mungbeanprotein.Seeds used in paralysis,cough,fevers & liver ailments.
15.	*Vign aunguiculata cylindrical* L.	Jhurango	Young seed pods are used as food in various preparations. Seeds are used in soups.Seeds used to strengthen the stomach & destroy worms. Crushed leaves used to heal & bond broken bones.
16.	*Vigna unguiculata unguiculata* L.	Jhurango	Pods are cooked as vegetable food and dry seeds are good alternative to coffee.The seeds & leaves applied to skin infection as poultice. Leaves are chewed to cure toothache & seeds for insect string. Roots used as antidotes to snakebites.

Figure 1: Map showing the location of Karanjia of Mayurbhanj district, Odisha, India.

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RESEARCH ARTICLE

Diversity and Distribution of Fructicose Lichen in Puri District of Odisha, India

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ABSTRACT

Puri, a district of the Odisha biodiversity region has been recognized for its lichen diversity, based on the own collection, identification, field observations. Puri is situated on the Bay of Bengal. According to the study approximately 30% of Puri is covered with lichen *Roccella montagnei*. Rocella is a lichenized genus of fungi in the family of Roccellaceae and has some antimicrobial and anticancer properties. Sakhigopal is the most dominated place of lichen with more no. of patches on trees per square meter. Mangalpur, Teisipur, Sakhigopal, Biragobindapur, Narua region shows 11, 14, 16, 9, 7, no of patches per square kilometer. Palm trees contain more no. of patches as compared to coconut and Betel nut. Several regions of Puri yet to be exploration will enhance the chances of endemic species and new species in this region.

Keywords: Odisha, Puri, *Roccella montagnei*, Bay of Bengal.

INTRODUCTION

Lichens are the most fascinating and non-vascular cryptogams resulted from the symbiotic association of algae and fungi. Survivability of two organisms growing together depends upon each other. Lichens are the excellent example of mutualistic relationship and dominated 8% of the total ecosystem. Currently lichens range from 13,500 to 20,000 all over the world. (Hawksworth et al. 1995). Approximately 6% of earth's land surfaces habituated by lichen species like Cladonia, Rocella are found worldwide. Especially tropic regions are not easy to invade and still under exploration (Aptroot and Sipman, 1997).India statistics of lichen flora is only about 10% to the world statistics. India has recorded 2585 lichen taxa. (2040 species, 64 variety, 8 subspecies) circulated in between 322 genera and 72 families (Awasthi, 2000). Lichen biodiversity of India is inhabited by fructose, foliose and fruticose lichen forms.Both

tropical and temperate environments of India support the growth of lichen, which is the biggest advantage of the country. Graphidaceae family is found most abundantly in India (Singh and Sinha, 2010). However, global warming and climate change has a tremendous impact on composition change of lichens in India and observed minutely in Pindaric Glacier valley within a period of three decades (Joshi et al. 2008). Now a day's many countries adapting the study of environmental quality by the proper use of living organisms. In Odisha, Jharsuguda, Ganjam and Mayurbhanj has the largest diversity of odisha. Mayurbhanja is one of the ecologically balanced environments and Similipal Biosphere Reserve contains highest lichen species richness (141) (Singh and Kumar, 2012). In near future there is a chance of identification of new species due to vigorous exploration of unexplored districts. Lichens are generally considered as the most effective biomonitors in the study of atmospheric pollution (Nimis et al. 2002). Ecofriendly and inexpensive nature of lichens make them the most sensitive indicator of biological effect of air pollutants (Sloof 1995, Bari et al. 2001). Lichens play a major role in detecting the deposition of heavy metals. Lichens have proven to be an interesting source of biologically active secondary metabolites comprises of more than 20,000 species all over the world. Lichen synthesized secondary metabolites have antiviral, antifungal, antioxidant and antibacterial properties which describes their importance in human's life (Halama and Van Haluwin, 2004; Huneck, 1999; Rankovic et al. 2007).

India is an ecologically balanced country and has recorded a total 2585 lichen taxa (2513 species, 64 varieties, 8 subspecies) and 23% of the taxa are indigenous to India. Lichen biodiversity of India is inhabited by crustose lichen (1665 taxa), foliose (706) and fruticose (211) forms. Three hotspots of lichen diversity in India contain massive species richness. Western Ghats, Western Himalaya and Eastern Himalaya regions show species richness with a no of 550 to 880 species. Odisha posses a ecologically balanced environment which supports the massive growth of lichens 252 species have been identified in Odisha, comes under 81 genera and 35 families. Graphidaceae is widespread and most abundantly found with 49 species it is highest in no. some other families also followed by graphidacea like Arthoniacea (21), Prypetheliaceae (19), Parmeliaceae (18), Trypetheliacea (17), Physciaceae (15), Teloscitaceae (14), Lecanoraceae (13), etc. Out of 30 districts 17 districts has no sign of lichen species. Mayurbhanj, Jharsuguda, Ganjam are the hotspot of lichen diversity in Odisha. 12 species were recognized from the reseve forest in Dhenkanal district. (Nayak et al. 2015) Some species are also identified from the Puri, Khordha and Sambalpur district.

MATERIALAS AND METHODS

Study Area

Puri is a city and a municipality in the state of odisha in eatstern India. Puri district is located on the Bay of Bengal, 60km away the state capital Bhubaneswar and also known as Jagannatha Dhama and Sri Kshetra. Puri is demarcated by the Bay of Bengal on the southeast, the Mauza Sipaurubilla on thewest, Mauza Gopinathpur in the north and Mauza Balukhand in the east. Puri is in the coastal delta of the Mahanadi River on the shores of Bay of Bengal. The holy land was drained by a tributary of the Bhargavi River, a branch of Mahanadi River. According to the climate Puri is classified as tropical climate. The city has moderate and tropical climate humidity is very high throughout the year. The coldest month in Puri is January with an average high temperature of 26.8°C (80.2°F) and average low temperature of 17.7°C (63.9°F). May is the warmest month, with an average temperature of 32.5°C (90.5F) and an average low temperature of 27°C (80.6°F). The month with the most rainfall in Puri is August and throughout the year, there are 60 rainfall days and 1337mm (52.6") of precipitation is accumulated. Puri district lies between north latitudes 19°28′ and 20°10′ and longitude 85°09′ and 86°25′ falling in survey of India toposheet nos 74E, 73H, 74J, 73L. The coastal sand dunes occur as a linear strip, running parallel to the shore line. Although trees like betel nut, palm, and coconut are found in Puri district, coconuts are found most abundantly along the coast line.

Field Survey, Collection and Preservation

Field survey is one of the important aspects for the diversity study of lichens. For the proper collection of samples first environmental condition, climate, demography, location of the site has studied. Then we went to the site of survey with all our necessary equipments required for the collection and preservation of the sample. A long sharp, flat edged chisel (1 to 2 inch) and a hammer (1 to 2kg weight) are the most common equipment used in collecting the samples along with their substratum. Collection was done in between 5 meters from the soil and climbing trees were not included in our survey. Lichens are loosely attached to the trees were scared out and collected. GPS used for the latitude and longitude determination. Then the collected lichen samples were transferred to the polythene pockets and labeled according to their location history. Then all such packets were transferred to the larger collection bags. Lichen specimen cannot be kept for long duration because it increases the chance of specimen spoilage due to the fungal attack. Lichen samples are then thoroughly dried and preserved in the herbarium packets.

RESULT AND DISCUSSION

Puri is quite rich in its lichen diversity. Approximately 30% of the trees in Puri are covered with lichen *Roccella montagnei*. Roccella is a lichenized genus of fungi in the family of Roccellaceae and has some antimicrobial as well as anticancer properties. It can be used as biomonitoring tools also. *Roccella montagnei* is diversified in the villages of Puri district. Shakhigopal is the most dominated place of lichen with more no. patches on trees per square meter. Several other villages also show the presence of lichen species includes Netapur, Narua, Khalakata, and Kantapada. Palm trees are habituated with more no. of patches because human interference is minimal in those trees. Coconut trees are also most abundant in this region and show adequate number of patches of lichen. Several regions of Puri, yet to explore with the lichen diversity. More exploration will enhance the chances of identification of endemic species and new species in this region.

From the above analysis, we conclude that in Mangalpur area. Number of patches per trees varies from 5 to 12. Betel nut trees show the lowest number of patches and palm with maximum no. of patches. From the above analysis, we conclude that in Teisipur area number of patches per trees varies from 7 to 13 betel nut trees shows the lowest number of patches and palm trees with maximum number of patches. From the above analysis, we conclude that Narua shows lowest number of patches per trees, lichen diversity is loss as compared to other areas of Puri. Betel nut shows lowest number of patches and palm tree with maximum number of patches. From the above analysis, we conclude that Sakhigopal shows highest number of patches per tree. Palm tree with number 15 patches per trees is maximum and betel nut tree with lowest number of patches. In Biragobindapur, according to the above analysis we conclude that betel nut trees patches are lowest and palm tree patches are highest in number. From the pie chart and above table analysis we conclude that palm trees dominant over the coconut and betel nut in number of patches per trees because human interference is minimal in palm as compared to coconut and betel nut.

CONCLUSION

The current study of lichens from Puri will be very much beneficial for further studies in the state. Lichens are termed as the sensitive organism and can be helpful in biomonitoring. They also produce some secondary metabolites and can be used for different purposes. The present lichen study reveals some interesting fact of the area, which encourage researchers to carryout future study. The physiological responses and adaptability of lichens in the coastal area is another interesting aspect.

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Table 1: Collection site and number of trees per square meter in these areas

PLACE	NO. OF TREES PER SQUARE METER
Mangalapur	11
Teisipur	14
Sakhigopal	16
Biragobindapur	9
Naura	7

Table 2: Number of lichen patches per tree in Mangalpur

AREA	TREE (T)	NUMBER OF LICHEN PATCHES PER TREE					
		T_1	T_2	T_3	T_4	T_5	AVERAGE
MANGALPUR	BETEL NUT	5	8	9	7	6	7
	COCONUT	6	9	7	10	11	8.6
	PALM	9	11	13	10	12	11

Table 3: Number of lichen patches per tree in Teisipur

AREA	TREE (T)	NUMBER OF LICHEN PATCHES PER TREE					
		T1	T_2	T_3	T_4	T_5	AVERAGE
TEISIPUR	BETEL NUT	7	9	10	8	7	8.2
	COCONUT	9	11	12	11	10	10.6
	PALM	11	13	10	10	12	11.2

Table 4: Number of lichen patches per tree in Narua

AREA	TREE (T)	NUMBER OF LICHEN PATCHES PER TREE					
		T_1	T_2	T_3	T_4	T_5	AVERAGE
NARUA	BETEL NUT	5	6	6	7	6	6
	COCONUT	7	8	7	9	10	8.2
	PALM	12	10	9	9	11	10.2

Table 5: Number of lichen patches per tree in Sakhigopal

AREA	TREE (T)	NUMBER OF LICHEN PATCHES PER TREE					
		T_1	T_2	T_3	T_4	T_5	AVERAGE
SAKHIGOPAL	BETEL NUT	8	9	8	7	9	8.2
	COCONUT	11	13	10	12	10	11.2
	PALM	14	12	11	15	11	12.6

Table 6: Number of lichen patches per tree in Biragobindapur

AREA	TREE (T)	NUMBER OF LICHEN PATCHES PER TREE					
		T_1	T_2	T_3	T_4	T_5	AVERAGE
BIRAGOBINDAPUR	BETEL NUT	8	7	7	6	5	6.6
	COCONUT	9	11	12	10	11	10.6
	PALM	12	13	10	11	13	11.6

Table 7: Average number of patches in different collection site

SERIAL NUMBER	BETEL NUT	PALM	COCONUT
1	7	11	8.6
2	8.2	11.2	10.6
3	6	10.2	8.2
4	8.2	12.6	11.2
5	6.6	11.6	10.6
AVERAGE	7.2	11.32	9.76

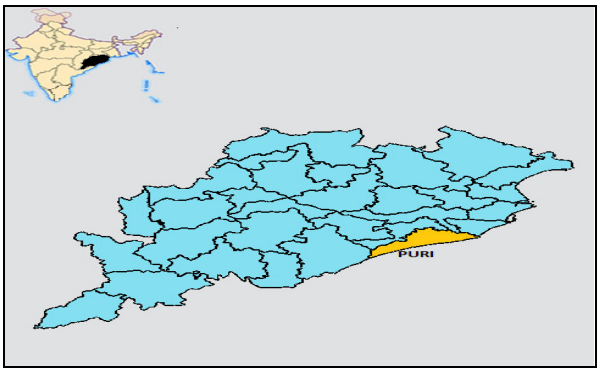

Figure 1. Study Area

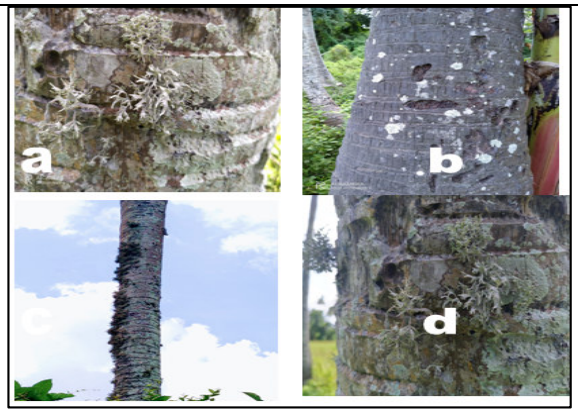

Figure 2: a,b,c,d representing the growth of *Roccella montagnei* in different tree substratum.

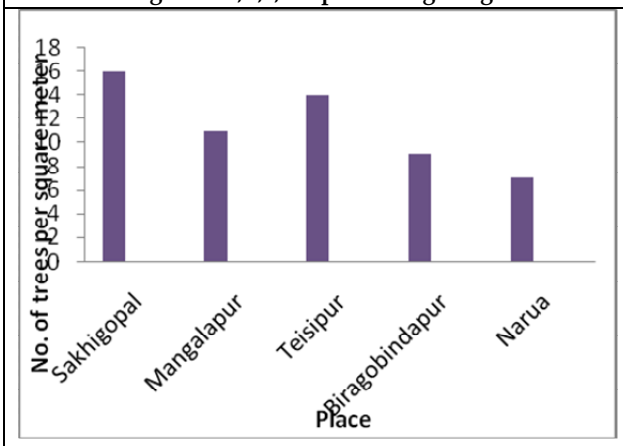

Figure 3: Collection site and number of trees per square meter in these areas

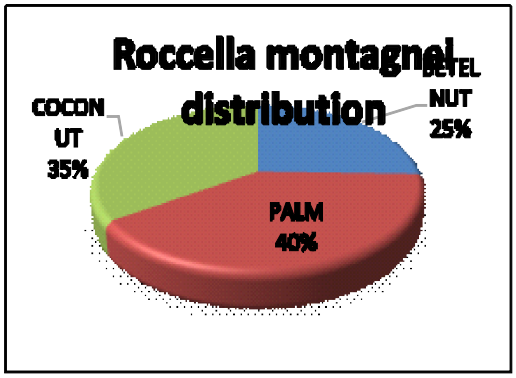

Figure 4: Distribution of *Roccella montagnei* in different tree species

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RESEARCH ARTICLE

Exploring Quantum Dot Cellular Automata Nanotechnology for Efficient Realization of Digital Combinational Circuits

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ABSTRACT

Quantum dot cellular automata (QCA) technology being transistorless, offers unique benefits over the boundaries of existing silicon transistor based CMOS technology like faster, reduced size and less power requirement in designing digital circuits. This paper explores the survey of techniques and efficient utilization of QCA in realizing digital combinational circuits like logic gates and several arithmetic circuits using QCA nanotechnology.

Keywords: QCA, Nanotechnology, CMOS, Combinational circuits, Adder, QCA cell, Majority voter.

INTRODUCTION

The necessity of enhanced speed, power efficiency and size restrictions of CMOS devices forced the scientific community to explore substitute emerging technology [1]. In compared to carbon nano-tube field effect transistors, single-electron transistors QCA is a favourable technology being its transistor-less property that work with high speed, high densities and less power consumption which are required for next generation circuits [2]. QCA offers an innovative nano-scale structure that substitutes traditional CMOS technology. In the upcoming era of beyond CMOS will reach the necessary limit. QCA is the transistor-less computation model possible for beyond CMOS technology. The CMOS technology has high complexity. The effective circuit design tries to reduce the optimization parameters like complexity i.e. number majority gates used, speed, area and power consumption [3]. QCA offers another mode of computing to define logic states 0 & 1 by the position of electrons. Nanotechnology takes more attractive because current transistor technology faces challenges like high power consumption, size reduction [4]. For the entire problem QCA is the challenging solutions to increase the performance of logic system. Implementing logic circuit using QCA reduces the size and complexity, power dissipation because no current flows between adjacent cells whereas in CMOS technology current flow takes place between transistors that requires power [5]. This paper describes the QCA background and reported the review of possible simulation and synthesis tools used for realizing efficient digital functions and combinational circuits.

Quantum Dot Cellular Automata

The promising QCA nanotechnology provides efficient computational platform. It embodies the digital information by polarization of electrons [6]. The fundamental unit in QCA is a cell which allows calculation and propagation of data. The building blocks are determined by the basic logic functions. It formulates the digital information in accordance with quantum dots located at the corners of the square. The cell consists of two mobile electrons that can tunnel between the dots [7]. Electron tunneling out of the cell is not possible due to the potential barriers between cells. Two free electrons reside at the corners of the cells, always diagonally due to Coulombic repulsion [8]. As a result, two stable polarization states denoted as -1 or +1 are attained to symbolize as binary 0 and 1 respectively. Cell polarization P = +1 is encoded as binary 1 i.e. logic 1 for electrons located as shown in Figure 1(a) and P = -1 as binary 0 i.e. logic 0 as shown in Figure 1(b) [9].

The topology and interactions between cells determines the interconnection requirements. A sequence of cells positioned in consecutive manner can propagate the cell interactions to act as a conductor [10]. Input and output cell structures are presented in Fig. 2 and diverse types of QCA cells like crossover, normal and vertical cell structures are presented in Figure 3. The fundamental configurations in QCA are majority voter, invertor and wire. In the majority voter gate, there are cells on left, top and bottom to work as inputs and the middle cell as output as shown in Figure 4. As the Coulomb forces of the electrons of all input cells sum up, the middle cell adjusts to the majority of the input cells based on the equation Y=A.B+B.C+C.A [9].

Realization of Digital Circuits using QCA

The QCA technology has been increasingly used in designing and realizing digital circuits. Different logic operations like MV, NOT, AOI, NNI etc have been realized in recent years. Different logic functions can be synthesized by MV and NNI gates by eliminating inverter [5]. It enables to realize an efficient designing adder circuit, 2-inputs and 2-outputs AND-NAND and OR-NOR cells. Thus an expression for the minimum number of gates required to an arbitrary number of input variables, causing synthesis of adder circuits has been achieved [11]. An attempt has been made to actualize QCA based XOR and XNOR with improved circuit parameters. Combinational circuits like Inverter and Buffer have been executed utilizing for the QCA based XOR and XNOR gates [12]. A Code-Converter circuit has been implemented utilizing the QCA XOR entryway. N-bit Binary-to-Gray code converter and 4-bit Excess-3 code converter circuits have also been designed using QCA.

Realization of Logic Functions in QCA

The realization of logic gates such as QCA OR, AND, NOT, NAND, NOR, QCA XOR and QCA XNOR gate have been reported [13]. The inverter or NOT gate can be realised by placing two QCA cells at 45 degrees to interact inversely. AND gate can be realised by configuring one of the inputs to zero i.e. set polarization to -1 in majority gate and setting one of the inputs to one i.e. set polarization to +1 for OR gate. The structure for realization of basic gate design using QCA is presented in Figure 5.NAND logic is realised by cascading inverter at output of AND gate, and similarly NOR gate can be constructed by connecting the inverter at output of OR gate as shown in Figure 6. Using this basic QCA structures XOR operation can be realised and similarly placing inverter at the output end of XOR, XNOR can be realized as presented in Figure 7.

Simulation of Combinational Circuits in QCA

A combinational logic circuit which is a combination of logic gates, accepts signals from the inputs and produce the outputs based on combination of the inputs that depend on logic function. Various types of combinational circuits like adder, subtractor, encoder, comparator etc. have been reported with designing in QCA. The adders design like half and full adder circuit synthesis is important in the field of VLSI and nanotechnology design and logic synthesis. A number of synthesis techniques for adder design have been reported [14-15]. Half adder circuit is realised by XOR, AND gates and full adder has been implemented by digital logic gates with three binary inputs.

Heumpil Cho and Earl E. Swartzlander [16] utilized the QCA structures to design a fast and efficient carry flow adder that provides improved performance. It also explores the design of serial parallel multipliers and simulated with several different operand sizes. Ismo Hanninen and Jarmo Takala [17] described the design of low-power multipliers on QCA nanotechnology using a single homogeneous layer of the basic cells without the noise problems and provides dense circuits and high operating frequencies. A common circuit can be used to perform both addition as well as subtraction for efficient hardware utilization. A majority logic based adder-subtractor architecture has been realized by Marshal Raj et al [18] using QCA and validated using the coherence vector simulation engine in "QCADesigner" tool with simulation results showing fewer cell count, area and latency. New circuits for XOR and XNOR and concurrent XOR-XNOR purposes are realized by Venkata Yashwanth Goduguluri et. al [19]. The incorporation of clocks plays an significant role in the efficient design of QCA circuits. A study using QCA describes a new method of implementing the logical function with power depletion analysis. The proposal is excellent in the realization of nano-scale computing with minimal power utilization. The results are compared with the existing approaches and improvements of 6% in the area required and 7% in the number of cells are achieved [20]. Ayan Chaudhuri et al [21] have developed a "Hamming code Generator-Checker" architecture design using 4-dot-2-electron QCA cells.

Mahdi Khakpour et. al [22] proposed a structure for digital code converter circuits in QCA technology. The basic structure of most of these circuits is the XOR gate, which is widely used in digital design. The realization of logic combinational circuits for generating parity bit, binary to gray, gray to binary and BCD to gray code converter have been reported with better complexity. The final circuit as a digital code converter has improved by 37% in terms of cell consumption and 25% in speed. M. Gholami [23] has proposed "Phase-locked loops" and "delay-locked loops" that are commonly used in telecommunication applications. Besides this, an Arithmetic Logic Unit (ALU) design is the key component of CPU. The 8-bit QCA-based reconfigurable ALU has been proposed by K.Pandiammal and D.Meganathan [24] using clock zone based crossover. The MGs used in XOR operation are reused for logical AND & OR operations and reduces two MGs in 1-bit ALU design. which reduces energy dissipation by 54.5% and minimizes the QCA cells utilization by 43.5%. QCA based ALU is an important part of the processor in order to develop a full capability processor [25]. A design constructing 4-bit ALU based on the QCA has been simulated by Nilesh Patidar et. al [26] using the "QCADesigner" tool that performs the basic operations like addition, subtraction, increment and decrement in the designed circuit.

CONCLUSIONS

QCA is an emerging nano-scale technology that is suitable for the design of highly scalable logic circuits. This paper provides the comprehensive and systematic survey of the techniques and mechanisms in the field of QCA-based digital combinational circuit realisation. QCA based circuit designs have been explored in realizing digital logic functions and combinational circuits. As logic gates are rudimental for most of digital circuits, having high speed, less complex and reduced area designs are significantly important. An ample of circuit layouts have been reported in the recent years for the design of QCA cell based majority voter, invertor, logic gates and other combinational circuits with lesser number of QCA cells, minimal size specification, high speed and simulation accuracy. Thus QCA has potential applications in future computers.

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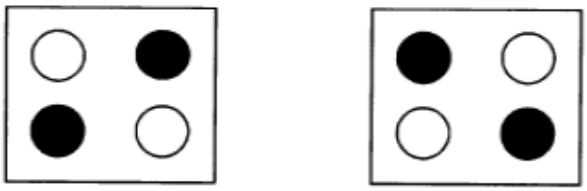


a) Binary 1 **(b) Binary 0**

Figure 1: QCA cells with four quantum dots. (a) P= +1 (Binary 1), (b) P= -1 (Binary 0)

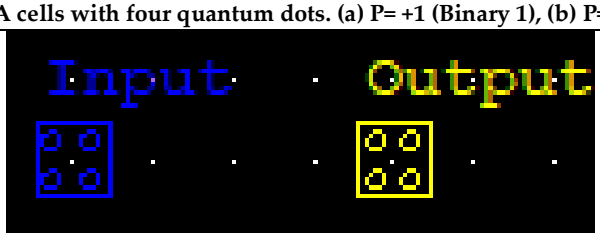


Figure 2: Input and Output cell

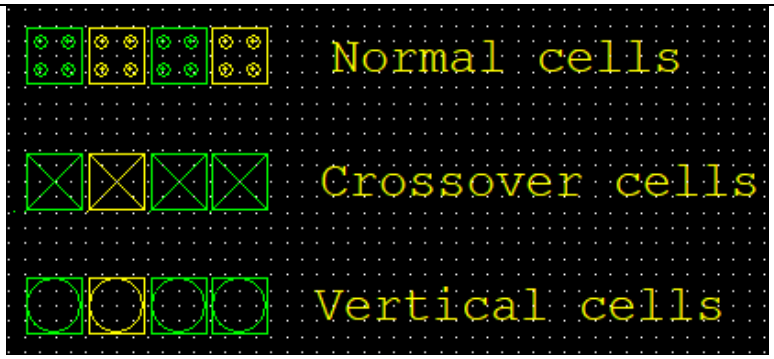


Figure 3: Types of QCA cell –Normal, Crossover and vertical cell.

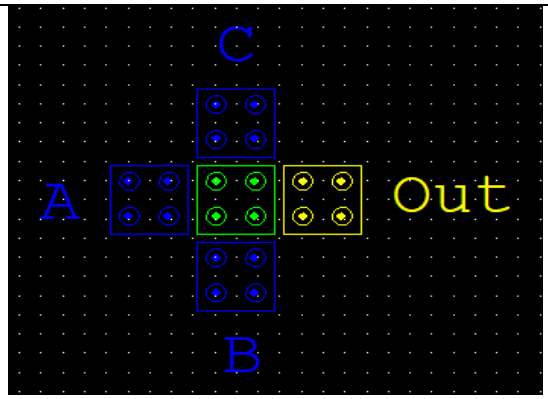
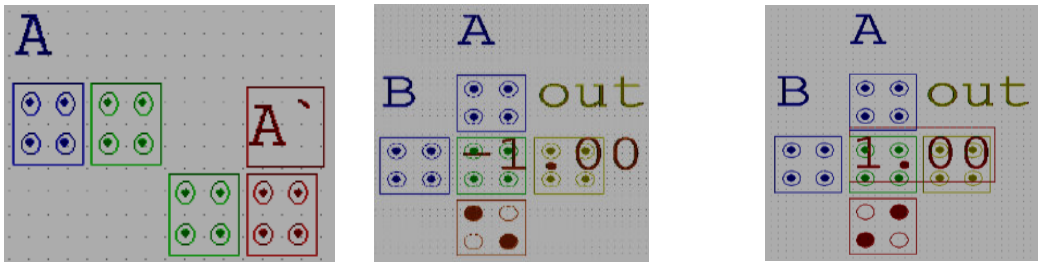
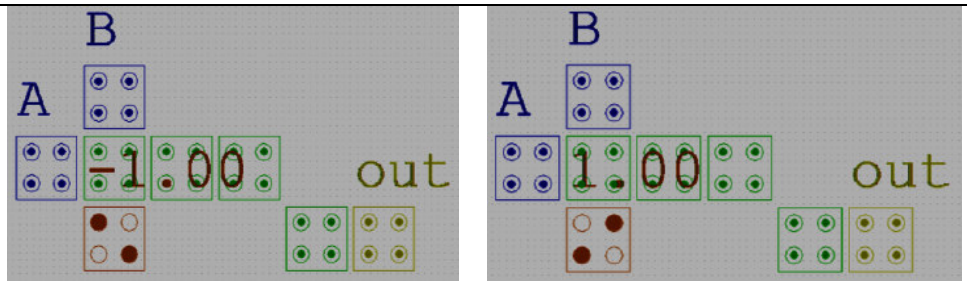


Figure 4: Majority voter



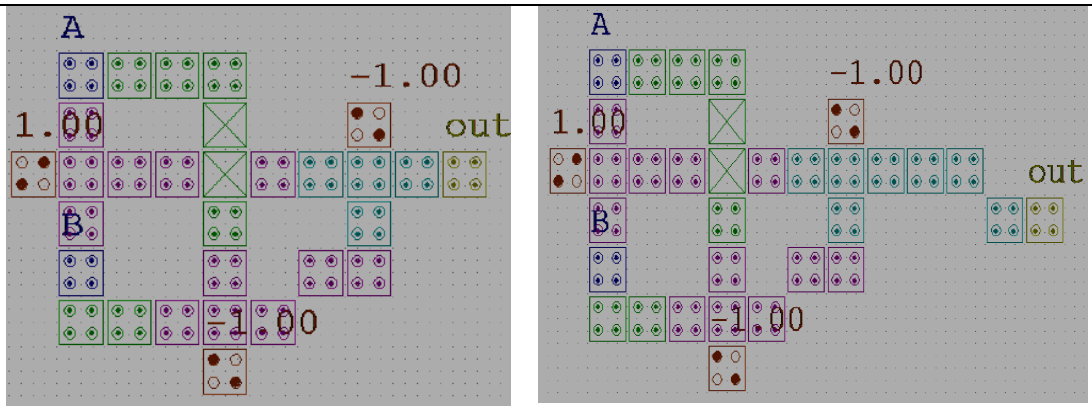
a)NOT gate (b) AND gate (c) OR gate

Figure 5 Realization of NOT gate, AND gate and OR gate using QCA



(a) NAND gate (b) NOR gate

Fig. 6 Realization of NAND gate and NOR gate using QCA



(a) XOR gate **(b) XNOR gate**

Fig. 7 Realization of XOR gate and XNOR gate using QCA

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REVIEW ARTICLE

A Review on Advances of Fluid Dynamics

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ABSTRACT

In this literature review paper of advances of fluid dynamics, the works were done by different researchers during 2006 up to 2019 is studied. During review process, the different parameters used in governing equations of flow field and their effects were discussed. Different numerical methods adopted by different authors are studied. Also, different applications of fluid dynamics are acknowledged.

Keywords: Viscous , Bouncy force, Multiphase

INTRODUCTION

Anything that can flow is termed as fluid. It can be visualized everywhere of the surroundings as well as in our body also. So the study of fluid dynamics has an important role in our daily life. The research work in the area of fluid dynamics begins during 250 B.C with the Archimedis's bouncy force. Then it progressed slowly up to seventeenth century. During seventeenth centuries the contributation Pascal and Newton accelerated the progress. In eighteenth century, Daniel Bernoulli and Leonhard Euler had given new dimension in research of fluid mechanics. During nineteenth centuries, many conferences, workshops were conducted and many authors like P.G. Saffman's and G.K Batchelor started writing books about dynamics of fluid flow. The formulation of Navier stock equations had given clear picture about research of fluid dynamics. Mean time the advancement of numerical method has added a wing in the progress of research work. In beginning of twentieth century prandtl (1904) had showed his work for fluid with small Viscous and since then the work progressed in the exponential order. The study from a single-phase fluid reaches to multiphase with inclusion of different outer forces has given a great momentum to fluid dynamics research. Overview of fluid dynamics T Hayat and A.H Kara [41] have studied about the analytic solution of time dependent fluidflow. This fluid would be incompressible and third grade under the impact of magnetic field. For solving the governing equation group theoretic method have used.They have found solutions to the exhibiting of athird-gradeCouette flow problem with variable magnetic field. The field hascertain initial and boundary conditions.

Jan Halama, FayssalBenkhaldoun and Jaroslav Fort [17] have studied on the modelling of two-phase transonic flow. The purpose of the study was for developing the formula for the transonic flow of wet steam modelling in presence of evaporation phase change. The governing equations were solved by finite volume method based on Lax-Wendorff scheme. They got that the numerical outcomes of 2D two-phase flow are shown in this method is capable to modelling an evaporation and they are fully explicitly. Naeem Faraz and Yasir Khan [28] conducted a study about the solution of electrically directed rotating flow. They gave emphasis on the steady two-dimensional MHD rotating flow of a second-grade fluid which was on a shrinking surface. The governing partial differential equations initially transformed to ordinary differential equations and finally solved by homotropy perturbation method. The flow characteristics of a MHD second-grade fluid have been investigated. The variation of velocity with suction/injection parameter λ, the Hartman number M, the second grade fluid parameter α and shrinking parameter s has been discussed. Dulal Pal and Babulal Talukdar [6] have conducted a study about interface of convection and thermal radiation In this paper. They discussed on fluid embedded with porous media with heat absorption and first order chemical reaction. In the present study the governing equation have been solved by using Runge-kutta Fehlberg method followed by shooting technique. Problems onunsteady, incompressible MHD boundary layer flow has been discussed.

In this article, Arati Nanda Pati, Kehinde Laelipo and David Panigua[2] have analyzed about the application of distributed langrage multiplier method for the moving leaflets simulation. The mathematical model consists of Navier-Stokes equation with Euler-Newton equations havebeen solved by these methods. In this study, for reviewing about the pulsatile flow they have used a distributed Lagrange multiplier procedure. Simulation of the valve dynamics during the systolic phase have been investigated. A numerical study about heat and mass transfer characteristics of two-dimensional laminar boundary layer flow over a stretching sheet have been analyzed by M. Ferdows and Qasem M. Al. Madallal[27]. The governing equations then solved by numerically using shooting method followed by Runge-kutta six order scheme.It is observed that the flow activities increases with the rise of order of reaction and reduce with the increase of Schmidt number parameter.

There was a study on impacts of deformation on MHD viscoelastic fluid flow by F.M Hady, R.A Mohamed and HillalM.Elshehabey [9]. The aim of the study was to show effects of thermal heat transfer emissions, heat source and work done by heat transfer of a viscoelastic fluid which is over a nonlinear stretching sheet. The effects of heat radiation and work done by deformation on flow have been examined.Salina Aktar, Mahamuda Binet, Mostafa Ruma and M.D Abdul Alim [34] proposed a study about the consequence of heat and mass transmit by natural convection. The aimed flow was along the isothermal sphere with loss of heat due to radiation. They used to solve the governing equations by finite difference technique with Keller-Box scheme. Conjugate effect of heat and mass transfer through radiation heat loss has been studied numerically. P.V Satya Narayan, B. Venkateswarulu and S. Venkataramana[32] analyzed a study about the consequence of hall current and current absorption. The finding was the effect of MHD micro polar fluid in a rotating system. That study gave emphasis on geophysical, cosmically fluid, biology and medicine. All those activities depend on a strong magnetic field in presence of low density.

Swati Mukhopadhya [39] has studied about the laminar boundary layer flow of a fluid. The given fluid was viscous and incompressible. Further the study deals with the heat transfer of the cylindrical stretching sheet with the presence of uniform magnetic field. Shooting method has been used to obtain the analytic solution of some special cases.From her study, it is concluded that the curvature of the stretching cylinder plays an important role of influence for both the flow and temperature field.The rate of transport is considerably decreased with raising the values of curvature. A.P Vouros et. al [4] have studied on Influence of an exit boundary wall on the flow parameters through a circular Jet. The effect of boundary wall of a circular disk has been examined by numerically as well as experimentally. At last the effects of boundary wall on velocity distribution were investigated.

Igor V. Mingalev et. al [16] have studied on a computational work on the transformation of global gas flows in the atmosphere of earth. In this paper they have evaluated the dynamics of gas equation numerically. Aziz Rahman, Al Amin, AlamgiriHossian and Brain Fleck [3] conducted a study on two phase nozzle flow. The main aim of the study was the better understanding of the outcome of nozzle geometry on the two-phase atomization performance in effervescentnozzle. They got that the turbulence became the main source in determining bubble size and the greater turbulent flow, the smaller the bubble size. K.V.S Raju et. al. [22] worked on viscous, steady MHD flow over a fixed horizontal channel. The leading equations are closed and the exact solution was found for velocity as well as temperature distribution. They have found that the flow formed by horizontal pressure gradient is parallel with the fixed floor. The momentum equation of Darcy's law has been analyzed.

P.T Manjunatha, B.J Gireeshet. al [31] conducted a study about the consequence of radiation on flow and heat transfer of MHD dusty fluid. The authors proposed a stretching cylinder model in a porous medium. The flow is adoptedas the dusty gas model. The governing equations are computed by Runge-kutta Fourth-Fifth order method.skin-friction and heat transfer coefficients are computed for differentvalues of the Prandtl number, radiation parameterand arrived to the conclusion that dusty fluid is better to clean fluids for heat transfer. Hadi Taheri et. Al[13] have studied Numericallythe effects of heat conductivity of fluid during charging.process of a stratified thermal storage tank. The impact of the turbulent mixing and the advection effects are studied. T.N.Samantara, S.K.Mishraand T.C.Panda [43] have considered a problem of Laminar mixing of a two-dimensional plane wall jet of particulate suspension in an incompressible carrier fluid.The basic equations are of the boundary layer type and include the diffusion equation for sub micron particles to investigate the flow field.The drag force due to slip, finite volume fraction ,heat due to conduction and viscous dissipation in the particlephase energy equation have been introduced to study their effect on skin friction & heat transfer The governing equations are solved by taking perturbations on Schlirchting's model.The effects of Prandtlenumber ,Eckrt number, Nusselt number, size of the particles ,Material density of the particles and diffusion parameters on the velocity and temperature field for both phases have been studied.It is observed that Nusselt number always increases with the Michale Kopp, Anatoly Tur and Vladimir Yanovsky [24] have studied on the large scale of instability in rotating fluid with small force. They had found a significant instability in rotating flow forced turbulence. A new scale of instability in rotating fluid has been established.

Jiangyong Hou, Wenjing Yan and Jiechen [19] have studied on velocity projection with upwind scheme constructed on the discontinuous Galerkin methods. For solving of two-phase flow problem, they obtained a new algorithm to gain more effective and stable approximation of coefficient under the deliberation of upwind scheme.The velocity reconstruction from the projection has beenanalyzed and found better forpreserve the local mass conservation property than the others Yanna Zheng, et.al.[45] have proposed an article named as comprehensive energy-saving sail by CFD method. In this paper they have studied a computational fluid dynamics code by a case of arc wind sail. They got the result that CFD code can frequently be used for numerical analyzation of sail aerodynamics. In this paper HarounaNaroua [15] has studied about the hydrodynamic free flow of an infinite porous plate which is in a rotating fluid. The governing equations based on velocity and temperature field has been discussed and solved by Nakamura finite differencemethod. A simulation was carried out on the hydro magnetic free convective flow in a rotating fluid and the conclusion is there is a rise in the transient secondary velocity profile (v) due to an increase in rotation parameter (Er)and radiation parameter (R).

Takashi Yoshida et.al [40] have studied on numerical simulation ofTwo-dimensional incompressible flow over an open cavity. In this paper,two-dimensionalN-S equation are evaluatedby the using finite difference method. The relation betweencavity shear layeroscillation modes and recirculating vortices in the cavityhas been investigated.
FarjanaAkter et. al [8] have analyzed on chemical reaction and thermal diffusion effects on mass transfer flow through an inclined plate. A boundary layer mass transfer flow by an inclined plate have been studied. The momentum, energy and concentration balance equation have been solved by explicit finite difference method. It has been concludedthat two physicalphenomena, chemical reaction and thermal diffusion can greatly effect on the

boundary layer fluidflows through an inclined plate. Gopal Chandra Hazarika and Jadav Konch[11]have analyzed on the properties of variable viscosity and thermal conductivity on MHD dusty fluid. The fluid flow was along a vertical porous plate with generation of heat. Governing partial differential equations were solved by numerically by shooting method after transforming to ordinary differential equation with boundary value problem. They got the outcomes that the temperature and velocity of fluid is higher than the dust phase. When viscous dissipation, thermal conductivityare increased then rate of heat transfer also increase and it decrease when velocity and magnetic field are increase.

K.L Krupalaxmi et.al.[21] have analyzedthe two-phase boundary layer flow of a dusty liquid. That liquid was passed over a stretching sheet with thermal radiation. In his study they determined the solution of the two phase MHD boundary layer flow, heat and mass transfer problem.It is concluded that, the momentum, thermal and solute boundary layer thickness of fluid as well as dust phase are decreased for higher values of mass concentration of suspended dust particles. T.N. Samantara, S.K.Mishra&T.C.Panda[44] have considered a problem of dusty fluid passing through plane wall jet. They have considered that the fluid is not electrified by outer source rather the dust particles are electrified due to collision among themselves as well as with the wall of the jet. The governing system of nonlinear partial differential equations are solved by using finite difference method of non-uniform grid. It is observed from this paper that the electrification of particles reduces the velocity and temperature gradient, leading to reduction of skin friction and heat transfer.

Haider Ali et. al [14]have proposed a study about the effect of contraction ratio in a two-phase flow injection nozzle. The effectiveness of contraction of two-phase flow mixing with mass transfer has been investigated by the use of Euler- Euler numerical method.Euler- Euler two fluid method has been used to solve the equations. In this study they observed on effects of contraction ratio on gas-liquid flow in the nozzle. Basant k Jha, Babatunde Aina and Sani Isa [5] did a paper which deals with the theoretical concept of MHD convection flow of fluid in the presence of radial magnetic field. The discussed fluid was also incompressible as well as electrically conducting. Exact solutions have been derived for energy and momentum equation with appropriate boundary condition. Exact solution has been generated for the viscous, incompressible fluid under certain circumference of magnetic field. Hartmann number (M) and fluid wall interaction parameter increase as the decrease of fluid velocity and radius ratio respectively. Andrey Tolmachev [1] have deliberated on algebraic calculation scheme of one-dimensional steady compressible gas flow. An algebraic method of solving one-dimensional steady compressible flow is applied in this paper which is high tolerance to coarse discretization of the calculation than the finite difference method. An algebraic method for solving one-dimensional fluid flow has been generated by the alternative of finite difference method.

Philip LyiolaFarayola [29] have analyzed on steady flow of a reactive viscous fluid in a porous cylindrical pipe. A dimensionless variable was used to obtain the leading equations. A regular perturbation procedure was used to obtain an approximate outcome of the resulting dimensionless non-linear equations.It has been determined that, the viscous heating parameter and presence of pores on the geometry of the problem have a consequence on temperature and velocity profile of the flow. Md. MoniruzzamanBhuyan et. al [23] studied on simulation of heat transfer inside a tubular U-Loop pipe. They used different twisted tape inserted. The leading equations are solved by using finite element method. A study of heat transfer phenomena of fluid flow has been concluded. In this paper by Michalis Xenos [25] a study of thermal radiation effect on MHD turbulent compressible boundary layer flow, in combination of pressure gradient, heat transfer and local suction. The governing Reynolds averaged boundary layer equation with boundary condition has solved by using of Keller box method and Falkner Skan transformation method.The ffect of magnetic field and thermal radiation of boundary layer flow has been concluded. JavedKonch and G.C Hazarika [18] have analyzed on unsteady hydromagnetic flow of dusty fluid over a stretching cylinder. On the presence of variable viscosity and variable thermal conductivity the by similarity transformation method, the equations are resolved by fourth order Runge-kutta method with shooting method after converting the governing equation from partial differential equation to ordinary differential equation. Unsteady flow of a conductive dusty

fluid has been studied. After study it has been found that velocity of fluid and dust particles increases when increasing Prandtl number and the temperature of fluid and dust particles decreases when velocity and Prandtl number increase.

In this paper Rowsanara Akhter, Mohammad Mokaddes [33] have examined that the effect of thermal radiation on the fluid of low Prandtl number. They have discussed about fluid which is also incompressible and electrically conducting. The governing equations as non-linear partial differential equation have solved numerically by finite different method. It was found that by the effect of thermal radiation parameter, fluid velocity, temperature and skin friction were increase. Ganewara Reddy, Machireddy and Sandeep Naramgari [10] conducted a study about heat and mass transfer in radioactive MHD. The setting was to investigate the heat and mass transfer in carreau fluid across a stretching sheet. The study gave importance to in metallurgical process with gamma flow, blood flow etc.The heat and mass transfer rate boosted by the power law index. Heat and mass transfer rate of Carreau fluid is high in blowing situation. SenanThabet and Thabit H. Thabit [36] have analyzed computational fluid dynamics simulation of the air flow around a car model. In this paper they have studied about the flow simulation.At last they found aerodynamic coefficients from the computational fluid dynamics simulation and compared them with the available experimental data.

M.A.Haque [26] studied on Magneto-Hydrodynamics flow of Newtonian fluid on a rapidly enhanced flat plate. In existence of transverse magnetic field, the laminar flow of Newtonian conducting fluid designed by a moving plate have studied. Laplace transformation was used to solve the governing equation. He concluded that whenvelocity of the fluid decreases then magnetic field increases and decreasing of velocity remain zero when it attains a sufficient large distance from the plate. G. K. Mahato et al [12] carried out a research study on "Melting Heat Transfer on Magnetohydrodynamic (MHD) Flow of a Heat Radiating and Chemically Reacting Nano-Fluid past a Stretchable Surface". They found that "heat transfer coefficient is an increasing function of velocity ratio parameter, magnetic field, Brownian motion and thermophoresis diffusion, while it is a decreasing function of thermal diffusion, thermal radiation, melting of the sheet and chemical reaction".

T Li, Y C Wang et. al [42] have studied on numerical study on extracting energy efficiency by autorotation of elliptic cylinder from low velocity flow. Ainnovative idea of power generator by using autorotation of elliptic cylinder to extract energy from fluid is studied. The application of computational fluid dynamics and rigid body dynamics has been introduced. D.Srinivasacharya and G. MadhavaRao [7] made a study on pulsatile flow of couple stress fluid. The present paper is about the pulsatile blood flow through a bifurcated artery. The governing equations are solved by finite difference method. The influence of velocity, shear stress, flow rate etc. are studied graphically. Simson Ingelsten et.al [37] has proposed about simulation of transient viscoelastic fluid flow. The coupling of constitutiveequations and fluid momentum equation have been studied and estimated by using interpolation withradial basis function. The system of governing equations has been computed by finite volume-based flow solver method.

P.K. Tripathy& Mishra [30] have investigated the two-phase thermal boundary layer flow over a flat plate by employing momentum integral method. They found that, heat flows from the plate towards fluid as Nusselt number (Nu) is positive and inclusion of Buoyancy force stabilizes the boundary layer growth. J.M Lopez et.al [20] have conducted a study about viscoelastic two-dimensional two-phase flow using volume-of-fluid technique.Particularly they used time-split scheme for splashing of weakly viscoelastic drops. Santiago Lopez Castano, Bernarel J. Geurts and Vincenzo Armenio [35] have studied on the boundary layers designed in a fixed air-water couette-Poiseulle flow system. They have given important on the changes in the statistics in between air or water sub-domain. They also analyzed on the dynamic flow structure which is forming near air-water interface. Sujata Panda et.al.[38] analysed the effect of viscous dissipation, thermal conductivity and thermal radiation of a natural convective boundary layer flow of a Newtonian dusty fluid past a stretching sheet and solved by using similarity transformation and Runge-Kutta fourth order method along with shooting technique. The magnitude of shear stress decrease with the increase

of the Prandtl number. The rate of wall heat transfer significantly increases with the increase of diffusion parameter, Grashof number and Prandtl number.

CONCLUSION

Reviewing above mentioned papers, it is concluded that the research on fluid dynamics is a multidirectional task .It also can be extended in multidirection, considering different aspects of physical problem as well as adaptation of different methods of solution. It has huge applications at every corner world

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RESEARCH ARTICLE

Adiabatic Compressibility, Intermolecular Free Length and Surface Tension of Power Transformer Oils at Different Temperatures through Ultrasonic Method

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ABSTRACT

The main objective of this work is to measure the thermo-acoustic parameters such as density, viscosity, ultrasonic velocity of Power transformers oil. Using the measured values of thermo-acoustic parameters we calculate the acoustic parameters such as adiabatic compressibility and intermolecular free length. Velocity is the ultrasonic parameter most used because of its reliable results. The value of ultrasonic velocity decreases as temperature increases. The temperature dependence of velocity of ultrasonic velocity can be used to monitor the oil quality. In the present study, velocity of ultrasound was measured in three different oils at 4 MHz frequency using ultrasonic multi- frequency interferometer at 30 ^{0}C, 40 ^{0}C,50 ^{0}C and 60 ^{0}C.The present study throws light in understanding these oils with regard to their purity and data presented will be highly useful to identify the ages of the oils. The study demonstrated that using ultrasonic properties, we obtain reliable results to monitor and control quality.From the experimental data acoustic and thermo dynamical parameters have been calculated. In this present work the parameter adiabatic compressibility (β), intermolecular free length (L_f) and surface tension(S) have been calculated using the standard formulas.

Keywords: Power transformer, ultrasonic multi- frequency interferometer, transformer oil adiabatic compressibility (β), intermolecular free length (L_f) and surface tension(S).

INTRODUCTION

During the service time of transformer, transformer oils are exposed to electrical, mechanical and chemical stresses. Due to the jointed or distinct action of these stresses, aging phenomenon of transformer oil initiated which leads to

slow and permanent changes in their properties. As effect of the aging process transformer oil loses its strength slowly and start decomposed and oxidized and ultimately starts to create mud. And this referred to the degradation phenomenon of the transformer oil. The key aspects that increases transformer oil aging and degradation phenomenon are moisture, oxygen and other contaminants. And the presence of corrosive Sulphur in transformer oil also disturb the insulating characteristic of the oil-paper insulation [1-2].

In recent years, Ultrasonic waves have acquired the status of an important probe for the study of structure and properties of matter, acoustical studies in liquids and in solids have been the focus of study. Ultrasonics is the method widely acknowledged for researching thephysico-chemical properties of the liquids, liquid mixtures, electrolyte solutions and polymeric solutions. In view of power transformer a very good detection techniques to analyze the aged transformer oil which have been used by many researchers and obtained influential results. In this work ultrasonic method is used for condition assessment of transformer oil [3-5].

The propagation of ultrasonic waves in oils depends on its visco-elastic behavior and density which significantly affected with change in temperature and frequency .Therefore the application of low intensity ultrasound acting as a high frequency dynamic mechanical deformation applied to oils, can monitor the changes in acoustic and thermodynamic properties associated with it [6]. In this thesis the bulk properties like density, viscosity and ultrasonic velocity are measured at four different temperatures like 303 K, 313 K, 323 K, and 333 K at frequency 4MHz.These experimental data has been used to calculate the acoustic and thermo dynamical parameter such as "Adiabatic compressibility(β) , intermolecular free length (L_f) and surface tension(S)".The variation of ultrasonic velocity and acoustical and thermo dynamical parameter with different temperature leads to the analysis of intermolecular interaction between the solutions.

MATERIALS

In order to investigate and compare different characteristics property of pure and used mineral insulating oil, oil samples were collected from Gramtarang transformers laboratory, Centurion University of Technology and Management, Odisha. First oil sample was collected after filtration. The filtration of the oil was carried out at a temperature about 333K and this process removes dissolved moisture unwanted dust particles, sludge and dissolved gases from the oil. Second sample was collected from transformer which in service for one year. Third sample was collected from transformer which in service for 2 year.

EXPERIMENTAL DETAILS

Speed

The speed of the ultrasonic wave in the solution has been measured utilizing an ultrasonic interferometer, working at 11 various frequency supplied by M/s Mittal Enterprises, New Delhi (Model M-84). The measuring cell of the interferometer is a specially structured twofold walled vessel with an arrangement for temperature constancy. . An electronically worked advanced steady temperature shower provided by M/s Mittal Enterprises, New Delhi, (Model SSI-03spl) working in the temperature range -10 ^{0}C to 85 ^{0}C with an precision of ± 0.1K has been utilized to circulate water through the external jacket of the twofold walled estimating cell containing the test fluid.

The expression used to determine the ultrasonic velocity is

U =2d/T (m/s)

Or. U= 2d×v

Or, $U= \lambda \times v$

(Here-2d=λ)

Where, v is the frequency of the generator which is used to excite the crystal; (In the present investigation, the frequency 4MHz interferometer was taken) d- Separation between the reflector and crystal; T. Travel time of the ultrasonic wave [7].

Density (ρ)

The ϱ of the solution were estimated using a 10 ml Pycnometer bottle. The Pycnometer bottle with the transformer oil was submerged in a temperature-controlled water shower at 303 K, 313K, 323K and 333 K .The ρ was estimated using the equation

$$\rho_2 = (w_1/w_2)\rho_1$$

Where, w_1 = weight of distilled water, w_2 = Weight of investigational solution, ρ_1 = Density of water, ρ_2 = Density of transformer oil.

Viscosity (η)

The viscosities of the solution were estimated using Ostwald's viscometer standardized with distilled water. The Ostwald's viscometer with the transformer oil was submerged in a temperature-controlled water showerat 303 K, 313K, 323K and 333 K.The time of flow was measured using an advanced stopwatch with a precision of 0.01 s. The η was calculated using the equation,

$$\eta_2 = \eta_1(t_2/t_1)(\rho_2/\rho_1)$$

Where, η_1 = Viscosity of distilled water, η_2 = Viscosity of solution, ρ_1 = Density of distilled water, ρ_2 = Density of transformer oil. t_1 = Time of flow of water, t_2 = Time of flow of transformer oil.

THEORETICAL ASPECT

The information of ultrasonic speed, ϱ, and η lead to the determination of different thermo-acoustical parameters, using standard equation.

Adiabatic compressibility $\beta = \frac{1}{\rho u^2}$

Intermolecular free length $L_f = \frac{K_T}{u\rho^{1/2}}$

Surface tension $S = 6.3 \times 10^{-4} . (\varrho . U^{3/2})$

RESULTS AND DISCUSSIONS

The density, viscosity, and velocity of oil samples are given in table 1, table-2 and table-3 respectively.The adiabatic compressibility, intermolecular free length and surface tension of oil samples is given in table-4, table-5 and table-6 respectively.The variation of oil samples adiabatic compressibility intermolecular free length and surface tensionwith temperature and oil samples are represented in fig.1,fig.2, fig.3,fig.4,fig.5 and fig.6 respectively. With increase in temperature, density and viscosity decrease (as table-2 and table-3) which indicates that due to rise in thermal energy of the system their intermolecular forces decrease. As the inter molecular distance among molecules increases so that volume of the oil samples increases which leads to decrease in density and viscosity with rise in temperature.

The variation of adiabatic compressibility (β) is increases with increase in temperature of transformer oils. The increase in adiabatic compressibility indicates enhancement of degree of dissociation among the oil molecules. The increase in adiabatic compressibility contributes to a lower packing of the molecules resulting in a reduction of intermolecular free length [8]. L_f increases with rise in temperature,this results in a less ordered structure and a greater spacing between the molecules due to an increase in the systems thermal energy, which increases in volume expansion and therefore increasestheL$_f$.Decrease insurface tension with increase in temperature indicates weaker

molecular interaction among adjacent molecules [9]. It is observed that, adiabatic compressibility and Inter molecular free lengthincreases (fig.1 and fisg.3) for filtered oil and then decreases with aging of transformer oil at a particular temperature. This is due to the structural changes occurring in the oil. So it is concluded that molecules of pure oil has more intermolecular force of attraction among them, which is an indication of strong molecular association [10]. But when the oils age increases the cohesive forces among them decreases, this indicates existence of molecular association, which leads to decrease in adiabatic compressibility and Inter molecular free lengthwith aging and the trend is reverse in case of surface tension.

It is observed that, surface tension decreases (fig.5) for filtered oil and then increases with aging of transformer oil at a particular temperature. This is due to the structural changes occurring in the oil. So it is concluded that molecules of pure oil has intermolecular force of attraction among them, which is an indication of weak molecular association. But when the oils age increases the cohesive forces among them increases, this indicates existence of molecular association, which leads to increase in surface tension with aging.

CONCLUSION

Ultrasonic wave propagation through oils of power transformer was analyzed in this paper.It is observed that, the aging of the oil is related to the interaction of the molecules through thermo acoustic parameters like density, viscosity, velocity, adiabatic compressibility , intermolecular free length , and surface tension. A comparison of the samples like fresh transformer oils and used oils confirms the well-known fact that, as transformeroperating timeincreases, the fraction of aromatic hydrocarbons in transformer oil increases suggesting degree of oil degradation.

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Table-1: Values of density of oil samples in kg/m$^{3.}$

Temperature(K)	pure oil	used oil (1year)	used oil (2 year)
303 K	828.76	831.43	833.67
313 K	822.73	825.12	828.03
323 K	817.53	819.78	821.62
333 K	814.03	815.77	818.37

Table-2: Values of viscosity of oil samples in N.s.m^{-2}

Temperature(K)	Pure oil	Used oil (1 year)	used oil (2 year)
303 K	15.510	14.677	14.293
313 K	12.466	11.814	11.513
323 K	10.999	10.408	9.789
333 K	9.521	8.837	8.356

Table-3: Values of ultrasonic velocity of oil samples in m s^{-1}

Temperature(K)	velocity (m s^{-1})		
	Pure oil	Used oil (1 year)	used oil (2 year)
303 K	1378.00	1355.00	1361.6
313 K	1353.00	1338.40	1345.2
323 K	1330.00	1314.67	1320.4
333 K	1305.00	1284.13	1296.4

Table 4 Values of β oil samples at different temperature.

Temperature(K)	β (10^{-10} m^2/N)		
	Pure oil	Used oil (1 year)	used oil (2 year)
303 K	6.366	6.572	6.487
313 K	6.651	6.785	6.697
323 K	6.924	7.077	6.997
333 K	7.228	7.450	7.294

Table 5 Values of $L_f$oil samples at different temperature.

Temperature(K)	L_f (10^{-10} m)		
	Pure oil	Used oil (1 year)	used oil (2 year)
303 K	5.006	5.086	5.054
313 K	5.206	5.258	5.224
323 K	5.402	5.462	5.431
333 K	5.613	5.698	5.638

Table 6 Values of 'S' oil samples at different temperature.

Temperature(K)	S (N/ m)		
	Pure oil	Used oil (1 year)	used oil (2 year)
303 K	26708.11	26126.14	26388.16
313 K	25795.54	25452.86	25737.53
323 K	24981.68	24618.49	24835.32
333 K	24176.68	23649.58	24065.72

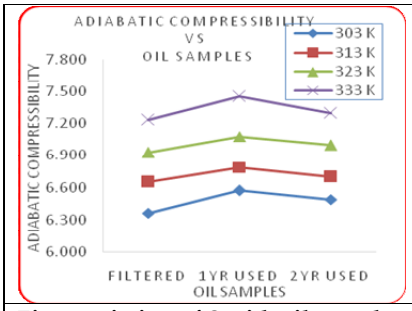

Fig-1 variation of β with oil samples

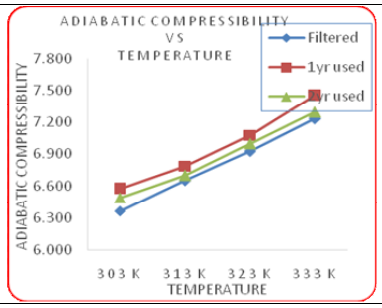

Fig-2 variation of β with temperature

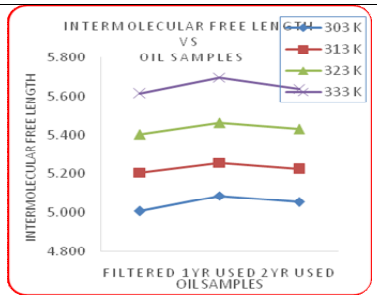

Fig-3 variation of Lf with oil samples

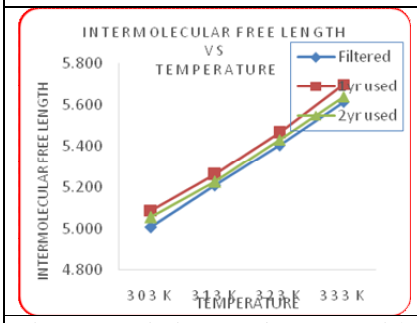

Fig-4 Variation of Lf with temperature

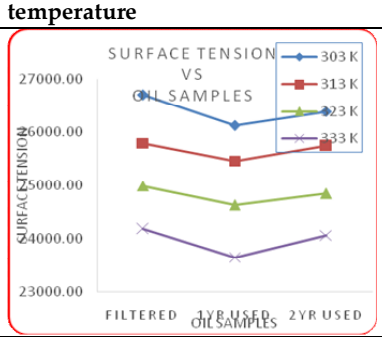

Fig-5 Variation of S with oil samples

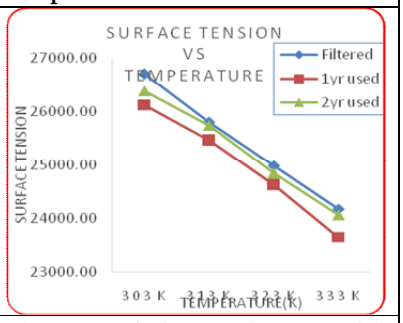

Fig-6 Variation of S with temperature

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RESEARCH ARTICLE

Productivity of Human Resources in Indian Mining Industry

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ABSTRACT

The article is about the maximum utilization of human resources for more production in Indian mineral industry which plays a major role in economic development [6]. India is the country which is rich in mineral deposits. Most of mining company in India issued manpower as key resource for mining operations. Productivity is expressed as the measure of quality or quantity output to the inputs in any type forms. Productivity of manpower depends on working methods, working environment, nature of work, attitude of workers, technology, control, organization, competency to work etc. Now a day the labor productivity of Indian mining industry is declining according to India ratings and research.

Keywords- attitude, competency, working environment, technology.

INTRODUCTION

In India the total number of mines is 3100 and out of which 1531 mines are in operation. These mines are produced 95 minerals – 4 fuel minerals, 10 metallic mineral, 23 non-metallic minerals, 3 atomic minerals and 55 minor minerals. These mines are mostly required manpower for its smooth operation. The Indian mining industry is creating job opportunity for nearly about 700000 individuals. The mining industry has a contribution to gross domestic product is nearly about 2-2.5% whereas in consideration of the total industrial sector the mining sector has contribution to GDP nearly 10-11%. According to India ratings and research labor productivity is lagging behind. So it should be enhanced for better economic growth in India. Now labor productivity in mining sector is about 4.8% whereas china has maintained a labor productivity of 6.5% [1].

FACTORS AFFECTING THE PRODUCTIVITY

In India we are adopting two types method for extracting minerals from the earth crust these are open cast method which is done above the surface and open to sky and underground method in which the minerals are extracted below the surface level. There are numbers of risks and hazards associated with mining operations i.e. emission of noxious gases, water inundation, occupational health hazards, dust generation, ground vibration etc. Occupational

health hazards are generally generated due to the working environment. In mining sector these hazards are named as silicosis, pneumoconiosis etc.

For focusing the labor productivity in Indian mining industry these factors should be taken into consideration i.e. physical factors, performance factors and management factors [3]. Physical factors are mostly related to working environment and operation cycles. Physical factors include the physical environment such as lighting, ventilation, noise, and the equipment's available in the workplace. So always pay attention to know the impact of physical environment on the manpower resources. Therefore, the working environment is the major player in labor productivity in mining industry. Performance factors depend on working attitude and work performance. Without better working attitude of mining official and managers better working performance cannot be possible. Favorable attitudes are commonly thought to result in a high level of work performance. So job performance depend on these factors the number of workers, competency level, skill, motivation, abilities of workers, interest, wages, incentives, working method, working time etc. Management affects the labor productivity through the decisions and methods such as planning, organizing, controlling, communicating, directing, and motivating to the workforce. Motivating to work force means inspiring or insisting the workforce to do their job[2, 3].

ATTITUDE AND PERFOMANCE OF WORK FORCE

When an employee comes to work in an organization his attitude towards the work matters a lot. It has an impact on others working with him. In general it has been studied that the worker with positive attitude gives good performance and worker with negative attitude perform less than the counterpart. In Indian mining context the manager is the person who is responsible for checking and improving the performance level of the employees [4]. Attitude consists of a set of mindsets which is based on feelings, thoughts and conditions of workplace. An attitude based on many factors which bring to workplace by the employee. A deep-rooted attitude of an employee makes it hard to change. The impact of the employee's attitude is playing a major role in productivity of the employee as well as other employees associated with him. Therefore, attitude of an employee affects the perception to the job and the value of the organization. So, in mining industry we perform team work, that attitude will destroy the working environment.

Attitudes are the pattern of thin kings which affects the worker's view of his job and also changing the social relationships with others in the work place. There is generalized sign of attitude like no thinking, come to conclusion, personalization and blame etc, are the sign of negative attitude. In Indian mining industry manager has authorized to manage the manpower in a mine. So, if manager always think negative then the whole team is working under him affected by him. Therefore, manager always focus on the attitude of himself as well as the employees to be positive. Manager can estimate the job performance of the employee whether it is poor or good. Then he has to check the reason of the performance whether it is an attitude problem or other factors like physical factors, job satisfaction, inability to handle the work, needs of training, personal problem. After proper checking manager find the problem which affects the job performance. So these factors as well as the employee's insights are the cause of the poor job performance.

Manager always promotes and identifies the positive attitude persons and satisfactorily performance persons. They help manager to create a positive working environment in the work place. Manager always spend the time towards the poor performer in the organization. So, the positive worker becomes disregarded Recognition strengthens their positive characteristics and upgrades continued achievement.

MOTIVATION AND PERFOMANCE OF WORK FORCE

Work force in a mining organization is playing the most important role and the role of manager as a leader tried to accomplish organization objective by mounting a partnership with people. To get done the goal of the organization motivation in workplace is required. Management is concerned to provide motivation to its employees for achieving the target within the fixed time frame. Motivation is the psychological process which gives the job satisfaction to

employees. Exactly it is difficult to define motivation but it can be derived as the inner desire and ambitions [5]. In mining industry manager is a great motivator to motivate his employees for attaining the goal of the organization. Also manager act as an organizer to fulfill the desire and ambitions of the employees for completing the task. Motivation encourages always give the way, courage energy and determination to follow the organization goal. A motivate employee take action and does whatever and whenever it need to achieve their goals. From the beginning we should understand that what motivates the individuals as well as the team and how they are motivated to achieve the goal. According to Maslow theory an employee have five level of need and they are physiological, safety, social, ego, and self actualizing and he argued that lower level need had to be satisfied before the next higher level need would motivate employees [2]. Understanding the problems of the employees, giving them opportunities for growth and treated them as a part of the organization is the good motivator of the employees.

To motivate employees, it can be done by: -

- keep to be at work
- Take pride in their work
- Work attitude
- Does not display in their work
- Customer orientation
- Display a high level of commitment

Indian mining industry is always required the motivated people i.e. those are fully dedicated and more productive in any situation in the changing working environment. Manager is the person who has to know what type of motivations needed to his workers. There are some factors which play an important role to motivate employees. Such as

- Job Security
- Sensitive towards individual problem
- Trustworthiness to employees interesting work
- Good working environment
- Good Wage system
- Promotes to grow in the organization.

Most of the organization believes to motivate their employees because it influences the employee's performance by following way:-

1. Higher output
2. Lower Labour loss
3. Less number of absentee
4. Get better quality
5. Positive attitude
6. More accountability
7. Employees faithfulness
8. Employees yield

TECHNOLOGY AND PERFORMANCE OF WORK FORCE

It is no doubt that technology has become a very essential asset for the mining organization in today's business environment. We can choose the right technology which can improve our overall efficiency and productivity in the market as well as employee productivity, communication, collaboration and morale. First take time to determine the organization's needs which type technology should be deployed as well as the needs of workforce productivity. Now a day's employees are more advanced in adopting the new technology and adjusting with the technology. However technology cannot be solved all the problems. It depends on how the technology is used by the employees.

Communication is vital not only to employee productivity but company efficiency as well. Miscommunication can cost companies a lot of money. Fortunately, new communication tools and technologies can improve employee communication, collaboration and productivity and save your company a lot of money in the process. Technology can vastly improve a company's efficiency, employee productivity, engagement, collaboration and communication, but only if the right technology is chosen and implemented properly.

CONCLUSION

As the Indian mining industry is a big contributor to the country's GDP. Manpower productivity or performance is playing the major role in mining industry. No one needs poor performer and less productive employees in their organization. Less productivity and low efficiency levels are bound to affect and put at risk the sustainability and survival. Therefore, here are some of the factors that steps up to improve the employee productivity

- Accountability –all employees are accountable for their decisions and actions in the organization.
- Adequate follow up- As an employer you have the responsibility to set up the targets and organize to achieve the goal.
- Encourage, motivate, reward and recognize
- Tools and equipment to raise the productivity

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RESEARCH ARTICLE

Study of Spatial Variability of Soil Physical Properties

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ABSTRACT

A soil is composed primarily of minerals which are derived from parent material like rocks. Most of the mineral particles present in soils are composed of sand, silt, or clay. There are many characteristics that differentiate one soil from another. Soil physical properties is the base of chemical and biological processes and these properties depends upon various factors such as climate, landscape position and the use of land. The objective this work is to understand the physical properties of soils, which are mainly playing the dominant role in soil classification and types. It is also necessary to know about the significant role played by different physical properties in soils for various purposes, right from agriculture to engineering constructions.

Keywords: soil, liquid limit, plastic limit, physical property.

INTRODUCTION

The economy of most of the developing countries like India, mainly depends upon agriculture sector which is solely responsible to meet the food requirements of a vast population. Therefore, it is very important to increase the productivity of produced crop which mainly depends upon soil quality [3]. Soil is the composition of sand, silt, gravel, vegetal matter that is plant and decomposition of animal body. The term soil originated from Latin word solium which has different meaning in different profession groups [3].In the agricultural field, Soil means the loose material lying over the earth surface, forming by disintegration of rock and admixture of organic material, which supports to the plant life where in the Geologist field, it means the disintegration of rock overlying in the parent rock [2]. In the civil engineering field, it leads to all the inorganic material on the earth surface produced by weathering of rock being either transported or residuals

There are a number of factors which decides the characteristics of soil and its properties. These factors depend upon living organisms, rocks, air, water and minerals. There are different kinds of soil available and these soils differ in their texture, color, percentage of organic matter present and all these factors depends upon type of land, moisture,

climate and land cover etc. [8]. It may also be noted that these are not the only factors, there are other factors too which includes the moisture content of soil, erosion of soil, structure and texture of soil, the sustaining capacity of micro-organisms in a soil. Soil is considered to be one of the most valuable ingredients because any type of unwanted disruption in it, paves the way to worsen the standard of water and air which leads to a potential source of danger to living organisms [1]. There are various areas from where soil can be collected, like barrage area, drainage basin, jungle area, habitation etc. Soil can also be accumulated from cultivated lands as well as from rural areas. The components of soil appearance are sand, sediment and mud. The physical and chemical properties of the soil are influenced by the soil appearance. As soil is considered to have ideal quality of mud and a pool of nutrients. The ideal soil is the indication of a desired Greenland area. The density of soil available generally differs from 0.70gm/cc to 1.31gm/cc. The soil collected from cultivated fields contains less moisture content than that of the soil collected from forest area.

INDEX PROPERTIES OF SOIL

In history the various works were carried out by authors to study the index properties of soils. Terzaghi et.al.1996 gave a scientific definition of index properties which helped in differentiating soils in a given category [1]. The practical importance of the index properties and grouped index properties are classified into two classes: (i) Soil grain properties, and (ii)Soil aggregate properties. The former predicts the size and shape of individual grains present in a given soil and in clay soils, the mineralogical composition is very important. The important property of adhesive soil is relative density, whereas that of cohesive soil is the consistency.The structure of a soil is very important as it resists erosion and promotes water infiltrationand aggregate stabilitywhich is the property that affects porosity, field infiltration and saturated water capacity[4].As it is expensive to determine the aggregate stability, by wet sieving method, therefore this method is not carried out usually in research labs. Soil must be selected in such a way that the structure of the soil will be stable as well the the base should be strong and permanent [4]. This make the task of Geological Engineers difficult i.e.To analyses the index and other engineering properties of soil. To find out the index properties, we generally carry out the classification test. The geotechnical engineer can predict the properties of soil without performing detailed testing of soil properties [6]. Based on the index property data obtained from classification test other very important mechanical properties of the soil can be determined such as shear strength, permeability and compressibility. Adjacent geologic stratum may have identical or approximate soil properties. It should also be recognized that some properties might vary as a predictable function of a stratum [3].

EXPERIMENTAL WORK

In this work, detailed analysis of the liquid limit of the soil mixtures have been carried out by different categories of silts like that of rounded shaped, angular shaped, coarse grained and fine grained[5] .It has been reported that liquid limit of soil mixtures donot follow linear law and does not depend upon the shape of sand whereas depends upon the size of the individual sand particles.

Liquid limit of given soil sample

Liquid limit is captivating of moisture in which the groove set up by a standard tool into the soil sample supported in the standard cup which one is closes for 10mm being given 25 blows in a conventional manner to occupy low shear strength. Significance of Liquid limit is the knowledge of the general properties and stress history of soil obtained from the construction [4]. The compression index which helps in the settlement of analysis can be evaluated from liquid limit results. Soft Soil can be obtained by adjoining the natural moisture content to liquid limit. The soil is brittle and stiffer [3]. 120gm of oven dried soil mixed portion of material which is passed through 425 microns of I.S sieve. To develop homogeneous paste, the soil produced in a mixing disc fuses with distilled water. By spreading a fragment of paste with the help of few blows of spatula, it is placed in the cup of liquid limit device. It has cropped to

a bed of 1cm at the point of maximum thickness and excess of soil is returned to the dish. To form cleansed sharpened groove of genuine dimension, the soil kept in the cup is divided by the firm strokes of the grooving tool along the diameter through the center line. The cup is lifted and dropped by turning crank at the rate of two revolutions per second until the two halves of soil cake come in contact with each other for a length of about 1cm by flow only. The number of blows required to cause the groove close for about 1cm is recorded. A portion of soil is taken from the cup to regulate the percentage of moisture content. The experiment has replicate with dissimilar water contents at the minimum three more times for blows betwixt 10 and 40.

Plastic limit of given soil sample

In this property the water content in clay soil is determined below which it stops to behave like a plastic material. It starts to crumble when rolled in threads of 3mm diameter [4]. At this percentage water content, the soil losses its plasticity. 20gm of rigorously mixed part of the material is passed through 425 microns IS strainer. In the evaporating dish It is added with distilled water up to mass of the soil set off adequate plastic to be comfortably rolled with finger. This is permitted to mature at least 24 hrs to permit the water all over to the mass of the soil. Then after from this sample 10gms of soil mass has taken and it is rolled between plate of glass and fingers and make a perfect roll. The mass of soil has of thread of corresponding caliber to its length. Andthe stoke of rolling is 60 to 90 per minute. The rolling process has continued till the 3mm diameter width has found. After come out the crumble of 3mm diameter the rolling has stopped. After that the portion of soil mass has accumulated from that thread of soil mass.The collected soil mass has put it into a air tight container for resolution of moisture content. For getting the result in more perfection, the experiment has replicate at least 3 times.

RESULTS AND FINDING

To analyses and clarify the result for liquid limit experiment, the graph has been plotted between number of storm and moisture content on a semi log graph [1]. According to the data obtained from the graph, it has been found that the moisture content corresponding to 25 number of storms is 46.4%. It is considered as the result of liquid limit. After determination of liquid limit and plastic limit of soil sample, then the plasticity index has determined [6]. The plastic limit, is the mean of three water contents. Which has observed 16.3%.

Calculation of Plasticity Index

Following formula is applicable for calculate the plasticity index.

Pi = ll –pl

Ll = liquid limit of soil mass

Pl = plastic limit of soil mass

And pi=Plasticity Index of soil mass

PL=46.4%-16.3%=30.01 %

CONCLUSIONS

1.It has been observed that the percentage of water content in the soil decreases by increasing the number of blows.

2. According to the data obtained from graph-1, it has been found out that the Liquid Limit of the sample is 46.41% and the plastic limit of the soil is 16.3%.

3.After completion these experiments, it has been observed that the Plasticity index of the soil is 30.01.

4.The value of liquid limit helps in classification of fine grain soil.

5. The liquid limit value of the soil is very important to calculate some significant properties such as flow index and Toughness index of the soil.

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Table-1 Experimental work based on Liquid limit of soil sample

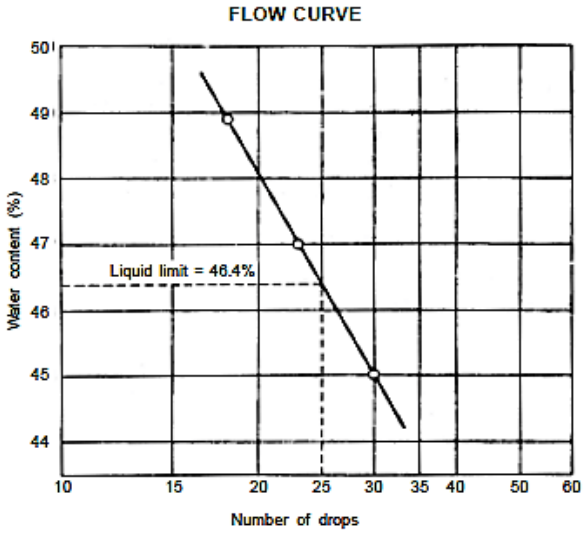
Sample number	A	B	C
Container number	A-1	A-2	A-3
Number of storms	18	24	33
Weight of empty container (C1), gm	43.7	45	45.7
Weight of container + weight of wet soil (C2), gm	77.5	82.4	77.6
Weight of container + weight of dry soil (C3), gm	69	76.20	72.20
Percentage Water content= w = ((C2 - C3) /(C3- C1)) x 100, %	32.1	24.20	12.10

Table-2 Experimental work based on Plastic limit of soil sample

Number of containers	C-1	C-2	C-3
Load of empty container(W1) g	25.20	22.75	22.82
Load of container + wet soil (W2) g	33.18	34.63	31.06
Load of container + oven dry soil (W3) g	32.10	32.62	30.00
Load of water (W2-W3) g	1.08	2.01	1.06
Load of oven dry + dry soil (W3-W1) g	6.9	10.87	7.18
Percentage of Water content (w)=((W2-W3) /(W3-W1)) ×100	15.65	18.49	14.76
Average plastic limit of soil mass= 16.3%			

Fig-1 Course grained soil with Casagrande apparatus

Fig-II Course grained soil roll with thread crumbles diameter 3mm



Graph-1(Flow curve between number of storms and water content)

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REVIEW ARTICLE

A Review on Inclusion of Cow Dung Ash to Mortar

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ABSTRACT

This paper presents a review and experimenting on cow dung ash (CDA). It is just to study the effect of CDA in various proportion when mix with white gypsum and soil. Generally, mortar is used worldwide in construction. It is a homogeneous mixture of cement, fine aggregate, water and some admixtures to modify some of its property. Here in this study, cement is replaced by white gypsum and fine aggregate by CDA and soil with a mixing percentage of 5%, 10%, 15%, 20%, 25%. White gypsum was added here due to it gives a good balancing of temperature and humidity.

Keywords: cow dung ash, white gypsum, soil.

INTRODUCTION

Now days several problems have causes of increasing temperature where it hampers the mortars performance. Some non-biodegradable wastes have also increased leading to un-hygienic conditions. Public should know the importance of waste material and fibers. It's can be used for both short and long term [1]. We can obtain fibers from various sources. Waste material is the major threat to environment. Cow Dung is obtained from cow excreta which is dried by sunlight., ash is obtained in black color when it was burn. It is containing Nitrogen, Potassium, Phosphorous and Calcium [2]. Cow dung is a mixture of organic material and fiber material, which is present in the cow's digestive system. After that the fermentation, absorption and filtration occur, [3]. India as a Developing countries, is trying to improving in the field of infrastructure. high cost of cement is a main challenge. the natural raw material like sand, gravel, water is largely use by construction sectors. Globally cement industry produced 7% of greenhouses gases in the earth's atmosphere, these cement production industries hampered the natural environment by producing poisonous gases like CO2, NO etc. for which ozone layer depletion by environment pollution and global warming. So that we need some changes [12]. Cow dung ash is plant matter which comes from cows' gut. cow dung has content 10-15 kg of nitrogen, phosphorus, carbon, potassium, and calcium.Cow dung has contained about 27% water and then when it gets burned it gives 34% ash.In India there are about 60 crore cattle's as per the

survey of 2012. Cow dung is also used as a heat source which for cooking food and also produce electricity by making biogas plants [5].

INCLUSION OF COW DUNG ASH TO MORTAR

In this experiment cow dungs are collected from the nearby area of khurdha .in this area cows are generally eat grass ,leaf's of plant ,rice husk .after the collection cow dung was burn in a temperature of 500 degree Celsius .after that is was sieved through 300 μm .soil is also taken from the local farming field and dried and sun and then it was converted in powder form. the soil powders the sieved through 450μm. white gypsum was also taken from the local market. which is easily available in the local market [9] .

MATERIAL NEEDED

In this we are using CD Ash and fine soil as a replacement of sand. both CDA and soil are showing the good mixability with white gypsum.

COW DUNG ASH: -The cow dung which is dried to sunlight becomes black in color after burning process. As a fuel cow dung is widely used in many countries in the world. It also use to produce biogas to generate electricity and heat. Cow dung is also use for making of mud house. cow dung is also used as a thermal insulator in cold areas[10].

Chemical properties of cow dung: Cow dung has contained nitrogen, phosphorous, calcium and potassium. (Smith and Wheeler, 1979). the cow dung is a composition of nitrogen, manganese and organic matter. it Contents zinc (84.1) copper (21.7) calcium (10.8) and phosphorus (8.0) [4].

Physical properties of cow dung: It is bulky in nature, large ash content, afterburning low volatile content, low carbon content, low burning ratio. After it was dried in the sun light it needs 450 to 5000 C temperature for burning, then the ash is collected and sieve through 300 μm and then store it in a air tight container to protect it from moisture [4].

FINEAGGREGATES; -zone II (IS: 383- 1970) sand can be used for the experimental propose which is generally available in local. We need to remove greater and stone particle, for which it nee sieved through 4.75 mm sieve [13]. Physical properties of fine aggregates are listed in Table1.

GYPSUM: Gypsum gives a comfortable and aesthetic look. It is a nature's product; it can be available easily in local market. It is free of odor. gypsum products and gypsum are generally used for interior and exteriors construction work. Gypsum has a property like fire resistance and noise insulation etc. [14]. Fire Resistance -It is fire resistant in nature. The presence of water within gypsum products can resist the fire for which there in chance of fire spreading. If gypsum plaster would possess water within it, then fire approaches towards the water, it will become evaporated. As a result, in can use as a protective layer of the gypsum product. This can stop the spreading of fire. This type of property is known as noncombustible property, it can delay the spreading of fire for hours depending upon gypsum material used [14]. Gypsum products have also sound insulation properties. So, Gypsum plastering is done for noise reduction. instead of a masonry wall of 110mm thickness, we can install a drywall of 75mm thickness to achieve same sound performance. Thermal Properties of Gypsum-The thermal properties of gypsum are a good balancing of humidity or temperature of a room or a house. Gypsum gives extra insulation properties to any construction work [14]. WATER: **-**normal supply water can be used for the experimental procedure.

METHODOLOGY

For the preparation of mortar, we are taking white gypsum, CDA (burnt and un burnt), soil in different ratio like 1:1:2,1:2:4,2:1:1,2:1:2,2:1:5.

BATCHING AND MIXING OF MATERIAL

Mixing of material was done by taking weight by percentage of ordinary white gypsum, cow dung ash and soil were 5%, 10%, 15%, 20%, 25%. We use hand mixer for making mortar [3]. First of all, I am taking CDA (un burnt), soil, white gypsum, Portland cement for making different samples in different ratio (fig 1). In (fig 2) (1:1:2) and (2:1:1) gives a proper appearance but strength is very less. After that we take, CDA (burnt), soil, white gypsum in (1:1:2) and (2:1:5) (fig 3) give proper strength and appearance.

CASTING OF SAMPLE

White gypsum, CDA was mixed, compacted and placed one layers and 2 moulds are set as 7*7*4cm and 7*7*5cm respectively. after 24 hour the samples were demolded and were kept for curing for 7 days, under a standard pressure and temperature condition casting was done.as per fig 4.

RESULTS AND DISCUSSION

From above sample the found that Compressive Strength 28.5 MN/m2, Maximum Setting Expansion 0.30%, Density (Wet 26.6 g/cm3), (Dry 26.4g/cm3).

CONCLUSION

This paper mainly highlights the significance and necessity of consumption of the waste material for manufacturing of sustainable material for construction. The cow dung is locally available and they can also reduce the cost of sand and white gypsum can reduce the cost of paint. White gypsum, Polymers, Fillers to make it smooth and reduce the need of curing. The product has now become very common and almost every new construction be it private home or commercial construction, the market has adopted the product blindly. The Perception is that it provides a very smooth surface and reduces the consumption of Paint. White gypsum has essentially the same properties as gray cement, except for color. The color of white cement is determined by its raw materials and the manufacturing process. Metal oxides, primarily iron and manganese, influence the whiteness and undertone of the material. For which we can replace our cement mortar by CDA (burnt), soil, white gypsum. it's also cost effective and easy to prepare. From the above review I got that if we mix white gypsum, soil and cow dung ash (burnt) in proper ratio it can gives us a cost-effective material which can also reduce the inside temperature of a house with a proper strength.

Table.1. Physical properties of fine aggregates

Properties	Values
Bulk density	1674 KN/m^3
Specific gravity	2.62
Fineness modulus	3.2%
Zone	II
Water absorption	1%

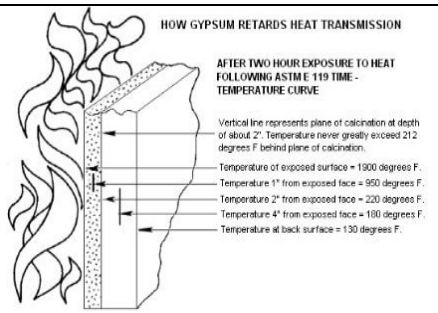

Fig.1. Fire Resistance Behavior of Gypsum material

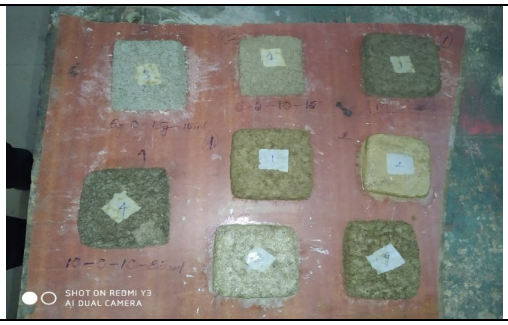

Fig 2. making of different samples

Fig 3. (1:1:2) and (2:1:1) gives a proper appearance but strength is very less

Fig 4. CDA (burnt), soil, white gypsum in (1:1:2) and(2:1:5)

Fig 5. Casting

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RESEARCH ARTICLE

Scope of 3D Technology for Mine Planning and Designing In Indian Mining Industry- A Review

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ABSTRACT

This paper tries to give a scope on application of 3D technology for Planning and designing in Indian mining industry. As per present production target of Coal India 2023 -24. There is an immense need of software modules and technology for optimal production in a safe environment. In order to implement and adapt the new technology to the industry there is a need for wide understanding of the software modules. In this discussed about the software band pack and in detail about the modules. The modules like 3D visulisation, date base management, tools for reserve estimation . It also dicuss about scope of 2D -3D mapping, Graphical image, user interface interactivivty, current trends in the 3D technology, vitual simulation, Artificial Intellligence. It also tries to throw light on present available softwares available in market and its review ratings.

Keywords: 3D technology, exploration, planning and designing.

INTRODUCTION

Coal India has a target for the production of 1 billion ton of coal for the year 2023-24. In India production of iron ore in the year 2018-19 is 200.96 million tonnes. The Production of metallic ore bauxite is 22,313 thousand tonne during 2017-18. From the above facts it can be understood that the mining industry need a strategic planning and design as required. For meeting such challenges required quantification of downstream processes and their integration into orebody models; spatial characterization of geo metallurgical variables and their integration into block models,

scheduling and mine optimization. (Dowd, 2016). Opencast mining has been proved very economical for low grade coal lying at shallow depth and there a lot of scopes(Valmike Sahu, 2017). Mining company needs a promising technology like 3D to manage explorations and production, optomize the human resources and equipment. The planning and designing factors have a direct or indirect bearing on the mine scheduling decision making for mining companies (Malisa, 2019)

Background

In modern mining, it is inevitable to have sharing of stream flow of data between corporate level and to the field level.The clefts that arise between these ovals creates a poor environment for managerial people to get a timely information efficient decision making. Any mining industry requires needs instantaneous visibility on production, quality, day shift timings, equipment status, and other regular centred operational parameters to achieve optimum and effective operations. Adapting of Industry 4.0 technologies at a mining industry, the integration of shattered a shop floor and production level systems enables absolute communication in discharging outstanding operations. Wireless sensor networking technologies have evolved significantly, and industrial sector is one of the beneficiaries. Communication technologies such as Zigbee etc.

3D modelling Technology in Band

The normal functionality of these 3D modelling software modelling carried out by packages include

Visualization

In 3d visualization includes realistic 3D graphics, exploring it immersively through virtual reality (VR) and analysing overlaid information through augmented reality (AR) without having to trawl through siloed databases is starting to gain traction in the industry.geological exploration data, Statstical data management, (MINING TECHNOLOGY, 2020) .

Modelling: 3D modelling software comprises of tools which can perform exploration of geological data, block modelling, surveying,drill and blast data, geological reserve estimation, design of open pit and underground minng, design of ramps, design of raods in open cast mines (MAPTEK, 2020)

Database Management – The data management software provison to deal data like drillhole datamanagement, it manages, stores and process the data. It records the data related to equipment, personnel, material. This data management provides the overall view of the current status of the mine. (MICROMINE , 2020)

Reserve estimation – The reserve calculation comprises of block model which is the foundation of almost all the design and planning decisions made during the mining process. Resource estimation relies on the development of detail resource model using data from different resources including data management .(MICROMINE , 2018)

- Mine Design
- Mine Planning and Scheduling

Model of Mine Planning and design Software

Flexibility is a routuine vague in all the advanced mine planning software packages. Regularly in any software there will be a core program that governs remaining modules and enables data exchange between the modules. The modularity function enables the user to import,validate and displays a wide variety of surface surface, drillhole and subsurface data (MICROMINE , 2017). Plenty modules are commonly available in hands, everything with specialized functionality. Such modules can include:

- 2D 3D mapping ,
- Contouring algorithms,
- Resource estimation

- Block modeling editor
- Reserving module
- Open pit design
- Underground design

Graphical image

The 3d graphical features governs every aspects of visualization and editing and analysis of data. Information from various sources such as packet databases, strings block models, etc. are visualized in 3D within the graphical environment. The 3D graphical mapping reveals the rock complexity of the mine. Graphical tools made it possible to document the geological phenomenon in digital form (Marcisz, 2018). In drill hole graphics interpretation uses a database data has a input source. Interactive graphic manipulation is performed by using the color graphics. Digitising with VULCAN tool is accomplished by using large format table digitiser (JOHNSON, 1987).

File Structures and Data Exchange

In the minerals industries, data comes from many different sources like such as drill data, assalyum data, survey data, field data or real time vehicle locations. So how the data will be shared or exchanged between two sever systems, even at offices and also two different software packages. In Open Mining format supports basic structures including points, lines, surfaces, meshes and volumes. Mining requires a huge spatial data and new technologies add to its complexity (GMG group, 2017).

User Interface and Interactivity

3D user interface since long period have a provision of desktop computing, Virtual environment, augmented reality,large screen display. In latest advance mining Virtual Reality has become a boon to the mining industry. User interface must be adaptive and customizable. The graphical environments give the user the visual capabilities to work with the data. The integrated interactive mine software for planning and scheduling is important for stream data flow (Kim, 2019).

Future Trends other than 3D technology

Mining design software has to face severly competitive market place which stable drives the levels of improvement to new levels. `3D imaging technologies plays a great role and have transformed the exploration of bigger mines.The 3D laser scanning which helps to capture the spatial data using laser light which is a new technology.

Industrial Internet of things -IIOT is a network of physical things adding sensors and interconnectivity to vehicles, machinery.This helps to advanced automation and operation of machines, ensure miner and equipment safety and visibility.

Virtual simulation and Artificial Intelligence -AI trying to reduces the time and cost requirement associated with physical testing by experimenting and analysing in a virtual setting. Mining companies aims how quickly and efficient can adjust parameters and re-simulate everyday mining processes with 3D modeling software (Mines and Technology London, 2019).

- Automated Machinery
- Robotics in Miming
- Driverless Vehicles in Mining

Current Industry needs

The 3D image approach for geological and mine exploaration is a good potential to estimate the reserves while designing the safe mining. Automated drilling helps in reducing the human intervention and safety . This manless operating drilling can be possible by the combination of control systems and Information Technology. This type of

advancement technology helps in achieving mininmizing the casualities and fatal rates. It can smoothens the tasks and helps to reach the high levels of accuracy compare to human acticities. The 3D printing is one area where still miming sector need to adapot at faster rate. 3D printing is process of making of physical objects from a digital model Mining (Bartels, 2016) . The table 1 shows about the data that how different softwares developed and popular in mining market and its rating from the reviews . The fig 1 depicts the different brand softwares developed for mine exploration and data interpretation.

COCLUSIONS

The 3D modelling software provide the band pack with features like Data Visulisation, modelling, Database management, mine designing, mine planning and scheduling. The Software module for designing and planning enables to exchange the data between different collegues and departments.The 3D image approach is best approach and a good potential to estimate the reserves. There is a hunger need for the industry to optimise the production at minmal cost in exploration, this all can be possible by proper prediction, sharing of information among different personnels in optimal decision making. So Indian mining industry has to wake up at faster pace and has to adapot the change.

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Table 1 Different Band softwares internationally developed for Mines (g2.com reviews)

S.no	Brand Software Packs available in the year 2020	Features	Rating out of 5
1	Surfer	2D, 3 D models, Contour maps	4.5
2	Geovia Surpac	Geology, Open pit and underground operations.	4.0
3	Data mine Discover suit	Compiling, visualizing, analysing, and mapping 2D and 3D spatial geoscience data	4.0
4	Vulcan	Validate and transform raw mining data into dynamic 3D models, mine designs, and operating plans	4.0
5	XLMiner	Business analytics, predictive model creation and testing	4
6	BIMS - Blast Information Management System	Planning, Controlling and decision making for optimizing mining operations	0
7	Carlson Basic Mining	AutoCAD/IntelliCAD mining add-on to Carlson Civil	0
	Carlson Geology	Manage drill hole data, plus calculate strata models, block models, quantities and qualities	0
9	Carlson Surface Mining	Mine design by testing layouts in plan, section and 3D	0
10	Geobank -Micromine	Capturing, validating and managing data	0
11	Coal Software & Systems	Surface mining, underground mining and wall mining solutions.	0
12	CXL Pit to Port	Plan, record, track, optimize, account, reconcile and report the tonnage, quality and value of bulk materials	0
13	Examine3D	Analysis for underground excavations in rock	3.5

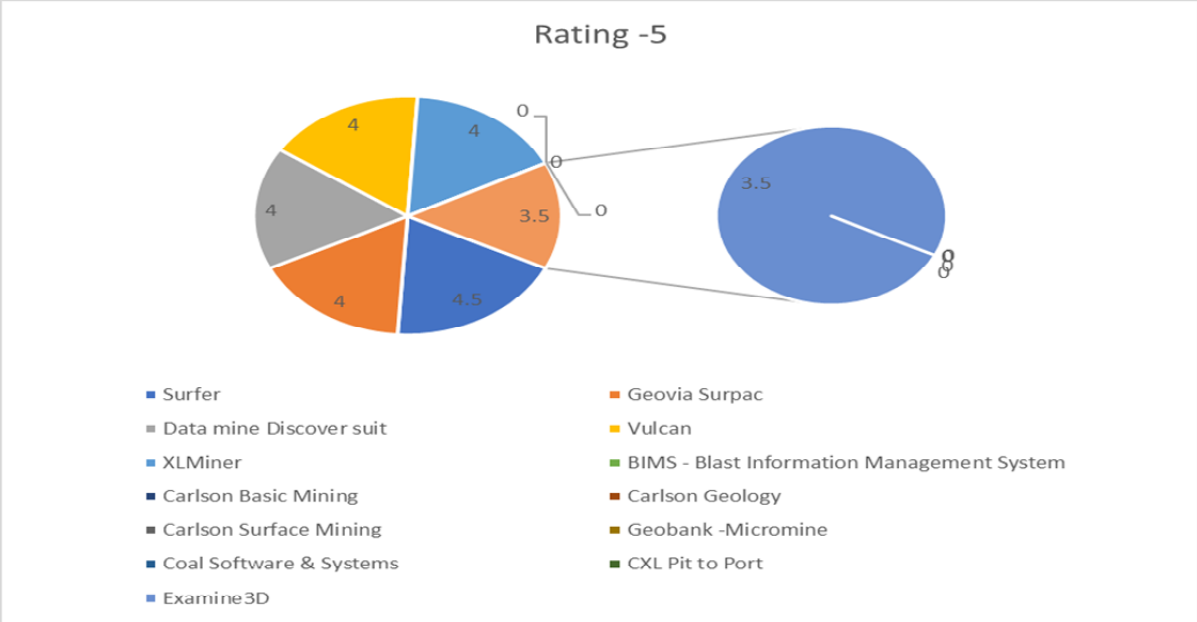

Fig 1 Pie of pie Chart shwing different brand mining softwares and rating

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RESEARCH ARTICLE

Elemental Inspection and UV Spectroscopic Characterization of Humic Acid

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ABSTRACT

Now a days in agriculture an intense usage of humic substances (HS) have generated a lot of interest among producers, consumers & regulators towards getting a dependable and economic method to quantify humic acid (HA) in raw ores & products. The efficiency of the extraction process & raw materials used greatly influence the quantity of HA that is get extracted. This study presents a through validated method for taking out HA from cow manure. The proposed methodology is found to be low cost & eco-friendly. The HA samples are analysed for elemental composition and ultraviolet–visible spectroscopy. The process investigated herein provides a promising solution to several environmental difficulties.

Keywords: Humic acid, Elemental Analysis, Ultraviolet-visible spectroscopy.

INTRODUCTION

For hundreds of years the humic substances have been major component of natural soil ecosystem due their extreme versality [1]. Humic substances are organic materials formed during the physical, chemical and microbiological transformation process of dead tissues of animal and plant. Naturally soil, oceans and fresh water contains a majority of the humic substances & are consist of C, O, N and small amount of sulphur. From the ancient age cow manure has been used as a fertilizer in agriculture. It plays an important role in increasing the yield of crops and also it enhances the soil quality. Mostly humic substances consist of micronutrients as well as macro nutrients which is required for plant growth. But mow a day's new varieties like vermi-composting, sediment have been used as a eco-friendly sources of fertilizer [2]. There has been extensive use of humic substances across the globe because of their assistance in agricultural soil with low organic matter. It also plays a important part in global cycling of nutrients and carbon.

Humic substances can be found with varying concentrations at various sources like river, lakes, oceans, etc. They are an unbelievably colloidal in nature and seldomly have been separated from its pure components. Parameters like pH, temperature, weather conditions heavily influence humification. The change in the physical and structural properties of humic acid is observed where there is a change in geographical region [3], i.e. a very low level of humic acid is found in marine or river. Depending on the solubility of humic substances it can be divided into several groups as humic acid (HA) and fulvic acid. Humic acid is insoluble for pH<2 but become soluble at higher pH whereas fulvic acid is soluble at all pH values [5].

In order to understand the binding of humic acid with organic matter and their environmental cycling the analysis of trace elements become essential. There is a growing demand of application of Humic substances industry and agriculture to which the knowledge of trace elements becomes vital. The presence of trace elements in humic substance (HS) extracted from peat, sedimentary & aquatic have been analyzed till now [6,7]. The primary objective of the conducted study was to develop eco-friendly and cost-effective methodology for extraction of humic acid from cow manure and find out the elements i.e nutrients present in humic acid. The process establish is economical and power efficient. The experiment is conducted at room temperature & pressure. There is no use of any supportive elements in the extraction process. The residue left after humic acid extraction is mended with HS and other organic/inorganic substances. The process of extraction is simple, executed at the laboratory scale with no risk of accidents. The main aims of the present study were to (1) develop methodology for extraction of humic substances from cow Manure, (2) characterise humic fractions, (3) elemental analysis of humic acid (4) Analysis of the absorption spectra of HA through UV- Visible spectrometer

LITERATURE REVIEW

There have been several works by various investigators on extraction and characterization of humic acid from different specimens. Fabiana de Souza et al. [6] presented an approach where humic acid was extracted from subbituminous coal. The extracted humic acid later used as ceramic dispersant. According to rheological investigation in an alumina suspension, use of HA is preferred in ceramic industry as dispersant. . For higher zeta potential and a lower turbidity, the results shown that for pH 10-11 is ideal for utilizing humic acid as dispersant. T. Anzai et al. [7] had prepared the rice hull magnetic activated carbon and studied the adsorption property for humic acid from water and high-gradient magnetic separation characteristics. Rice hull was impregnated with an iron nitrate solution and heat treatment was performed in both nitrogen and carbon dioxide atmosphere. In these processes, the rice hull was changed to activated carbon which had a lot of mesopores and nano size magnetite inside of it. Magnetization of RH-MAC increased with an enhancement of iron nitrate concentration during the process.

Seunghun Kang et al. [8] had presented a method where humic acid was obtained through progressive extraction from a soil. The process was executed 8 times by taking a solution of 0.1 MNa4P2O7 and 2 times by using 0.1MNaOH solution. The structural and chemical heterogeneity were characterized using different spectral techniques. Adrie Veeken et al. [9] had presented a study on composting of biowaste in a 80 1 composting device and changes in amount and characteristics of humic acids was observed. By treating with NaOH the humic acid was extracted, the result was then purified with HCl-HF and dialyzed. By GC/MS , elemental analysis, and UV visible spectroscopy were used for characterization. Hayes et al. [10] and Levinsky [11] demonstrated that using mineral nutrient solution with humic acid was less expensive to grow plants. Tarhan, [12] stated that the products containing HS were both cost effective and ecofriendly solutions that can be used for plant growth which in return would reduce the use of conventional fertilizers. An easy way to comply with IJRASET paper formatting requirements is to use this document as a template and simply type your text into it.

EXPERIMENTAL SECTION

Material

The dry cow manure was taken as raw material for the extraction of HA. At first the cow manure was air dried and then it was lightly grounded using agate mortar. sieved through a 20-mesh sieve. As it is a digested residue from animal rumen mostly enriched in different type of minerals enzymes, proteins etc. It is also a biodegradable non-hazardous compound. Analytically grade reagents & doubly deionized water were used for the entire process

Humic Acid Extraction

Pre-treatment

The humic acid fractions were extracted from manure of the cow. The distilled water was added with manure and stirred for 30 minutes at room temperature. The process was helpful for removing done for taking out the hay and through decantation the non-humic particle was removed. After removal of the non-humic particles, a slurry thus obtained treated with 0.1M NaOH and stirred for 12hour. Before doing the filtration process the mixture is allowed to settle down. After filtration, the filtrate was collected in a clean beaker which consist of soluble humic acid,fulvic acid and other biological material.

Humic Acid Components Separation & Preparation

The solid residue obtained after the filtration process contains HS and indissoluble bioorganic substance where as the filtrate contained soluble such as Humic Acid, Fulvic Acid, and other biological matter. As we know that humic acid is insoluble at low PH. Hence for better precipitation of humic acid the filtrate was acidulated with 0.1M HCl. Hydrochloric acid was added to the filtrate slowly with constant stirring at room temperature to get PH=1. The entire solution was kept undisturbed for 24hrs for better precipitation. The supernatant obtained after precipitation was centrifuged at 7000-9000 rpm for 30minutes. The Humic acid precipitates from all alkali extracts were collected after centrifuge. The humic acid obtained was then washed with double distilled water. It was then left for drying in hot air oven at 373 K.

Spectroscopic Characterization of Humic Acid

The useful information regarding composition can be found out through UV-Visible (UV-Vis) spectroscopy. The visible absorption spectra of extracted humic acid samples were recorded. For the identification and characterization of extracted compound, the resultant compound was mixed with alkaline compound. Visible spectrophotometric measurements were made between 350 and 650 nm

Elemental analysis-XRF

For understanding the texure, chemical and elemental analysis X-ray fluorescence (XRF) spectroscopy is used. X-ray fluorescence (XRF) analysis was carried out on pressed pellets of humic acids using an in-house system. The tube-excited XRF measurements were performed using a Seifert diffraction tube with Mo anode and Mo

RESULT ANALYSIS

In this section we present and compare the quantitative results obtained from the analysis of different spectra measured UV -Visible spectroscopy XRF methods, respectively. Humic acids thus obtained were dissolved in 0.1M NaOH and the absorption spectra were promptly determined using spectrophotometer. UV-Visible (UV-Vis) spectroscopy is one of the fundamental technique to provide effective information on the composition. The extracted samples of humic acid was dissolved in two different solvents $NaHCO_3$ and NaOH. About 25 ml of 0.05N of NaHCO3 and NaOH solution was prepared and obtained humic acid was dissolve in it. The visible absorption

spectra of extracted humic acid samples were recorded. Between 350 to 650nm the visible spectrophotometric measurements were. The spectra were recorded at wavelengths 240–700 nm range.

The absorption rate are rather featureless and the increase in intensity of the absorption values is almost consistently from 650 to 350 nm. The absorbance in the visible region, on the other hand, is more complicated to explain. According to some researchers it can mainly be related to extended conjugation in aliphatic or polyaromatic structures, quinoide structures and ketoneol-systems. The presence of metal complexes and inter/intra molecular donor acceptor complexes do affect it as well [10-13].The presence of heavy elements is being confirmed through the narrow absorption band at 350-450nm. Determination of heavy elements in humic acids is done by one analytical method that is XRF. The XRF analysis of humic acid shows that the presence of nonmetals, heavy metals and trace elements in it. Using XRF technique, concentration of 24 elements (Ca, K, Fe as major components; Ba, Sr, Nd, Na as minor components; some rare-earth elements: La, Ce, Sm, Eu; actinides: Th and U; transition metals: Co, Cr, Hf, Sc, Ta, Zn; alkali metals: Cs, Rb; non metals: As, Sb; and Br as halogens) could be quantified

Trace elements evaluated from XRF technique included iron(Fe), Manganese (Mn), Cobalt(Co),Tin (Sn) Europium (Eu) , colbalt (Co), Chromium (Cr), copper (Cu), iron (Fe), Dysprosium(Dy), Erbium(Er).This analysis confirm the presence of elements like silicon (Si), phosphorous (P), sulphur (S), chlorine (Cl), calcium (Ca), Iron (Fe), Sn, Eu, Dy and Er. The presence macronutrients like phosphorous and sulphur & micronutrients Fe make it viable for use for plant growth. The basic elemental composition, in isolated HAs are presented through below mentioned bar graphs. A significant contribution to major and trace element binding in humic acids can provide their structural features and functional groups, reflected as in their elemental (C, H, N) and functional composition.

CONCLUSIONS

HA extraction for cow manure can be carried out easily with basic laboratory facility employing the simple & cost-effective process shown herein. Investigation have been done regarding the presence of humic acid in cow manure and further confirmation is carried out through comparison and analysis of spectral data. The existence of humic acid in the cow manure has been analysed and is further confirmed by validating it with spectral data. The standard absorption data of HA is found to be in agreement with result of characterization of HA sample done using UV-Visible spectroscopy. The presented study confirms the use of cow manure as resource for HA extraction.

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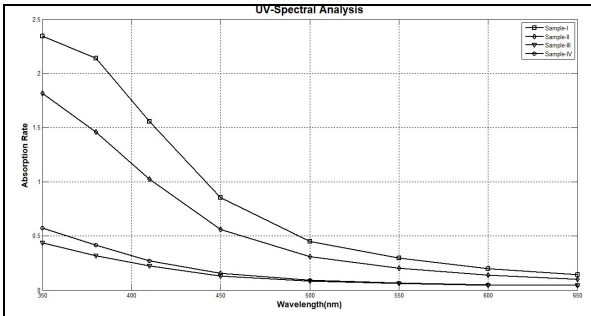

Fig-1 UV-Visible Spectra for Extracted Humic Acid

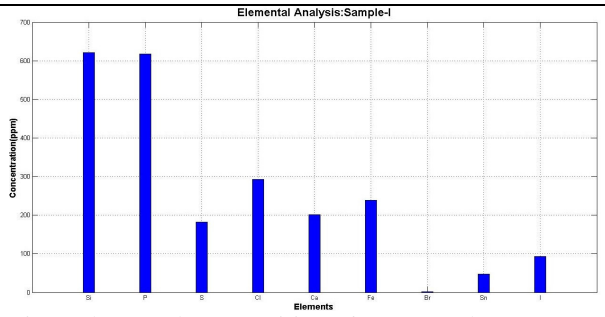

Fig- 2 Elemental Composition of HA-Sample-I

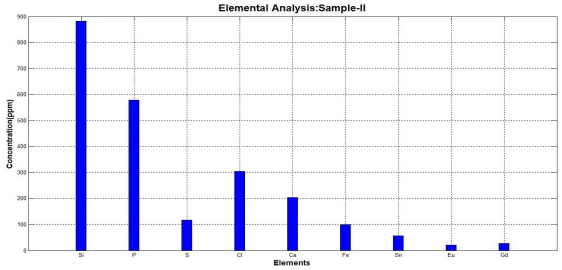

Fig- 3 Elemental Composition of HA-Sample-II

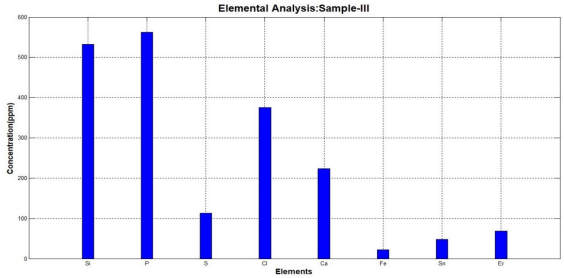

Fig- 4 Elemental Composition of HA-Sample-III

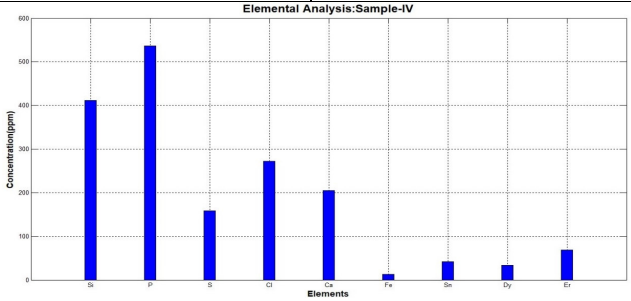

Fig-5 Elemental Composition of HA-Sample-IV

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RESEARCH ARTICLE

The Physical Quality Analysis of Surfactants for Optimization and Suppression of Coal Dust

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ABSTRACT

Great steps have been taken in maneuver way to defend coal workers' pneumoconiosis by controlling undesired respirable coal dust, but the level of coal dust in mines still a primary concern for exceeding its occupational exposure limits. The water-based spray system is the main pathway of dust control method in mines. Many studies have suggested a potential justify to improve spray dust collection efficiency by adding surfactant. Most coal dust is generated during the cutting of coal in the face area. With an increase in demand in the production of electricity and industrial works, the popularity of highly productive mechanized longwall methods leads to outrageous dust production. There are a number of field applications are available for effective dust control that can suppress coarser dust particles than finerone(< 75ɯm). Experiments have been carried out to facilitate the use of surfactants in controlling these generated fine coal dust particles. The interrelation between surfactant concentration and surface tension was studied to accordance with wettability and measure of contact angle on a coal bed, by the influence of different concentration of surfactant solution. The necessity fact of pH value of the solution was further researched and analyzed. The research came up with the following conclusions: surface tension of the solution decreases as the increases of surfactant concentration; wettability of coal dust is greatly improved with the increasing the concentration of the solution within a certain range; Triton X-100 was found to the most preferred surfactant to use in mines. The contact angle of coal body decreases up to concentration was reached to 0.5%. The wetting effect is improving with the increasing of the concentration for 0.3% ─ 0.5% and it has a great prospect in mines for coal dust suppression.

Keywords: Coal dust suppression, concentration, surfactant solution, wettability, contact angle, surface tension, hydrophilic, hydrophobic.

INTRODUCTION

One of the major challenges in underground coal mining is to encounter the accumulation of huge fine dust in working areas. The legacy of massive coal production, coarser coal dust which is entrained by the air flow ventilation system is deposited onto the floor and other surfaces of the airways channel and such anomalous coal dust deposits in the underground, form a lucrative safety hazard. If a methane explosion is about to occur, this dust can be retained in the mine atmosphere and may initiate a huge coal dust explosion. Range of respirable matter holds the percentage over 60% in the underground coal mine. Upto 8600 gm of respirable coal dust generated during the process of coal cutting excavation [1]. This airborne dust accumulated in the lungs for the prolonged exposure and cause numerous disease related to the respiratory system of a human organ. Statistically, the number of deaths caused by pneumoconiosis has exceeded the combined number caused by all other accidents in the coal mine, and the number of coal workers diagnosed with pneumoconiosis in India has increased by tens of thousands annually[1][2][3]. Even worse, the accident happened due to undesired coal dust explosion caused enormous casualties and economic losses.

Though water has always been the main means for controlling of this dust in the underground, it has in many cases reached its practical limits for dust suppression. With increasing coal production due to huge energy, the exhibition leads to find out a more effective dust suppression method is a desideratum. Since the effectiveness of the water to suppress the dust generated depends up on wetting of the particles, additives that can change this property will enhance wetting. Surfactants stand roll of playing for the coal dust suppression is extensive. Besides, dilution by adequate ventilation current, the use of water is abundant means of dust control in underground coal mines. The effectiveness of dust suppression using water depends upon more efficient wetting of the particles. If properly wetted, coal dust particle may either be carried away in the water or stayed more adhesive, so they cling to solid surfaces rather than being deported into the mine atmosphere. Furthermore, small airborne particles that would fail to settle when dry can increase in mass by wetting until they settle. Waterworks best when water is filled nearly so close to evacuating voids between individual particles since capillary forces hold the particles solidly together. As the water content between voids tumbles down this threshold level, capillary forces start to disappear and the adequate amount of surface tension will be no longer to provide dust suppression [3]. The major consequence of this whole process depends on the particle size distribution and the bestow properties of the water. In general, contaminated air streams are warm and nearly saturated. When cool water is sprayed into a stream of unsaturated air, it evaporates rapidly, saturating and cooling the air stream in the process. The abundance moisture over that required must be condensed out to keep up ideal immersion levels in the cooling air. This leads to expansion of the mass of little suspended particles, since the moisture that condensed out of required saturated air tends to form around existing dust nuclei. Wetting of dust particle is expanded firmly, which will pledge possible settling of coal dust, bringing about an effective duct removal until the temperature of the mine air stream approaches that of the water [4].

The newly formed dust particle can be restricted to become airborne matter either by effective interfering process of dust formation during cutting and handling or by maintaining newly formed particles to larger fragments. Dust encapsulation using water calls for following four steps: (i) Proper head on collision between dust particles and water droplets, (ii) Adhesion of dust particles to water droplets, (iii) Engulfment of dust particles by the water droplets and (iv) Agglomeration of wetted particles. The whole process of collision and the elegant agglomerations of wetted particles are determined by the effective aerodynamics of the systems and by the particle and droplet size and their added relative velocities, while adhesion and engulfment process depend upon the wetting characteristics prevailing between the particles and the sprayed water[5].Water is not very effective to capture dust particles during the generation of rapid and mechanized automatical coal production by the simple wetting process because largly coal particle surface is hydrophobic in nature and water has a high surface tension property which holds off foreign particles to get inside and need more amount of kinetic energy to expand its surface area for overcoming the barrier

of threshold limit to enter inside the droplet. Additives can facilitate wetting under such conditions.The goal of this investigation is to reduce the respirable coal dust concentration in coal mines. The main objectives are as follows, a) Behavior of the coal sample toward various surfactant solutions in different concentration in various tests. b) Statistical analysis through various experiment and determine the pH value of the solution. c) Selection of suitable surfactant solution with specific concentration for the suppression of coal dust.

METHODS AND MATERIALS

Sample collection and preparation: Coal samples were collected from Raniganj coalfield. They were crushed and made different size of block slices as per the standard experimental requirement. Along with this, the different concentration of surfactant solutions was accumulated and made to conduct the experiment. Experimentation: prepared coal samples were tested with different surfactant solutions viz. wettability test, contact angle measurement test, surface tension measurement test and observed the pH of the surfactant solutions. Analysis: All the experimental data were analyzed thoroughly to find out the best-fit surfactant solution in a specific concentration for suppression of coal dust without any adverse effect on the environment.

RESULTS AND ANALYSIS

Experimental results

The experiments were carried out on 3 different surfactants along with in-situ coal samples of Raniganj Coalfields and the results are depends in the following tests. Wettability test is 15 gram of -75 um coal dust weighted from weighing machine was allowed to free fall into the solution of different concentrations of surfactants to immerse completely within time period limit and the time was noted down in sec measured by the stopwatch.

Contact angle measurement test

This test was conducted by Drop Size Analyser (DSA100) to find out the contact angle between the coal block slice sample and the surfactant solution as shown in Table 2.

Critical surface tension measurement test

Varying of critical surface tension of solution with increasing concentration of surfactant solution and measured through Interfacial tensiometer as shown in Table 3.

Measurement of pH

The pH value of all the 3 surfactants solutions was measured in higher concentration and the results are described as shown in Table 4.

Analysis of wettability test

The relationship between wetting time and concentration of surfactant solution: Three different types of surfactants were used for the analysis in different concentration and in each of the cases, the wettability increased as the time consumption for the complete immersion of the coal dust into the surfactant solution is decreasing with the increasing of the concentration of the surfactant solution. Results show remarkable improvements in wetting time while concentration is increasing from 0.05% to 0.5% (Figure 1). Yet, wetting time didn't improve as needs be after the convergence of 0.5%.It is presumably because of the fact that it reached a saturation concentration where any further adsorption happens slowly or not under any condition and maintains a relatively stagnant graph of wetting time in response to a further increase of high concentrated surfactant solution. The relationship between the surfactant and coal dust suppression: Sodium dodecyl Sulfate and Sodium dodecylbenzenesulfonate both act very closely with coal dust. Their behavior against the specific concentration for coal dust immersion quite similar and the relative time difference is 14 sec where Sodium dodecyl sulfate completely immerses in 48 sec at 0.42% and that of

Sodium dodecylbenzenesulfonate in 36 sec at 0.48%. But in the case of Triton X-100, it makes a huge difference of wetting time of 45 sec and 30 sec respectively at a critical concentration of 0.5% of wetting time 5 sec. (Figure 4.2).

Analysis of contact angle measurement test

The relationship of coal block surface and contact angle made by surfactant solution: Each of the surfactants was made with different concentration solution to observe the behavior of the contact angle made by the solution droplet over coal block slice surfaces followed by 20 sec waiting time by the instrument (DSA100). And was observed the similar pattern of the graph of wettability test. The contact angle, θ is also decreasing with the increase of concentration surfactant solution (Figure 3). Results of wetting are improved in a similar way as the decreasing contact angle leads to a better wettability. Sodium dodecyl sulfate, Sodium dodecylbenzenesulfonate, and Triton X-100 have the relative lower contact angle with the coal block surfaces are 12^0, 4.2^0 and 0^0, respectively in response to the concentration of 0.4%, 0.45%, and 0.5%, respectively (Figure 4). But after that certain range, the contact angle between solution droplet and coal block surfaces as the solution attains its saturation limit of absorption.

Role of contact angle and of surfactant solution in response to coal dust suppression: Coal surface is hydrophobic in nature and it has the property of highly porous surface in terms of surface behavior. In addition, to convert the coal dust hydrophilicity, the surfactant plays a vital role in different concentration to make a perfect solution that coal can adhere to it easily and that leads to contact angle between solution droplet and coal surface decrease gradually. In the same way here in our experiment all the different concentration of the solutions were tested and the result to be found that Triton X-100 shows the greater affinity toward coal dust at concentration 0.5% by arose 0^0 contact angle with the coal block surface (Figure 5) and made Triton X-100, the best surfactant for coal dust suppression in terms of contact angle measurement comparison to Sodium dodecyl sulfate and Sodium dodecylbenzenesulfonate.

Analysis of critical surface tension measurement test

The relationship between surfactant solution and critical surface tension reaction in response to coal dust suppression: Surface tension is the most essential properties of the solution surfactant that affects the wettability of the coal dust. When surface tension of the solution is low, it enhances the hydrophilic nature for suppression of the coal dust. In our laboratory test, It was found that with increasing concentration of surfactant solution, the decreasing of the surface tension occurred. In the same way, it follows the graph of wettability test and contacts angle measurement test. Sodium dodecyl sulfate, Sodium dodecylbenzenesulfonate, and Triton X- 100 shows the great reduction of surface tension 17.50 mN/m, 14.23 mN/m and 8.01 mN/m respectively at the specific concentration of 0.45%, 0.45%, and 0.60%, respectively. But after a certain range, the surface tension of the surfactants get saturated and further reduction is not allowed or maybe decreases slowly (Figure 6).

Importance of surface tension of surfactant solution on coal dust suppression : Initially, Sodium dodecyl sulfate showed a great reduction of surface tension as the concentration of the solution increases gradually as compared to Sodium dodecylbenzene sulfonate of surface tension 29.38 mN/m and 29.23 mN/m respectively at a concentration 0.08% (Figure 7). Then the surface tension of Sodium dodecyl sulfate surpassed the surface tension value of Sodium dodecylbenzene sulfonate and maintained as the concentrations of the surfactant increases, that reveals in our experiment, Sodium dodecylbenzene sulfonate has the greater wettable capacity than sodium dodecyl sulfate. Comparison with Triton X-100, it showed the lowest value of surface tension in every measured value of concentration. That shows, Triton X-100 is the best surfactant in terms of critical surface tension reduction test in the experiment.

Measurement of the pH of the surfactant: Surfactant solution can greatly decrease the surface tension of water, enhances the wettability of coal body, and plays an important role in suppression of coal dust. However, its solution streams into a seepage discard as fluid and possible of contamination of ground water.So as to assess whether this can cause secondary pollution, The studies were being carried out for the chemical properties of the solution and the

pH value was measured. It was found that none of the surfactants had a great effect on environmental pollution as their range came in between 7 and 10.5 which is slightly basic in nature.

CONCLUSIONS

Experimental studies were conducted on physio-chemical properties of 3 distinct surfactants**.** i.e. Sodium dodecyl sulfate, Sodium dodecylbenzenesulfonate, and Triton X-100 and their wettability on coal dustBy the analysis of the surface tension of the surfactant at different level of concentrations, the result suggests that making a solution by adding a surfactant in the water in a particular concentration can adequately reduce the contact angle of coal block, and incredibly reinforce the wettability of coal body and coal dust. There have been great possibility in water infusion in the coal seam and dust suppression by misting. The following conclusions have been drawn from the investigation: In the analysis conditions, the wettability of the Triton X-100 solution affects greatly and quickest with the increase in concentration. The most suitable concentration is 0.4% ─ 0.6%; The contact angle, θ of the Triton X-100 solution decreases with the increase in concentration. When the solution is 0.5%, its contact angle is zero. This further validates the best concentration being 0.4% ─ 0.6%; The surface tension of the Triton X-100 solution decreases quickly with the increase in concentration, and its surface tension is very small. The most suitable concentration is 0.6% which again validates its concentration being 0.4% ─ 0.6%; The pH of the Triton X-100 solution is nearly neutral. It is completely suitable for suppressing the coal dust in the mine.

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Table 1: Results of the wettability test

Sl. No.	Surfactant Concentration, C%	Time in Sec		
		Sodium dodecyl sulfate	Sodium dodecylbenzenesulfonate	Triton X-100
1	0.01	298	279	178
2	0.02	271	244	146
3	0.03	256	183	128
4	0.04	174	158	115
5	0.05	147	128	103
6	0.06	141	125	96
7	0.07	132	122	90
8	0.08	125	117	84
9	0.09	122	111	79
10	0.1	115	108	78
11	0.11	116	105	75
12	0.12	106	101	71
13	0.13	103	97	69
14	0.14	99	96	68
15	0.15	94	93	65
16	0.18	91	88	63
17	0.2	87	82	61
18	0.22	83	79	59
19	0.25	81	76	54
20	0.28	77	75	50
21	0.3	75	68	48
22	0.33	73	63	45
23	0.35	71	62	40
24	0.38	62	57	38
25	0.4	52	48	25
26	0.42	48	44	20
27	0.45	51	36	17
28	0.48	52	34	12
29	0.5	52	35	5
30	0.6	54	38	7
31	0.7	56	39	11

Table 2: Results of contact angle measurement test

Sl. No.	Surfactant Concentration, C%	Contact angle (θ), degree		
		Sodium dodecyl sulfate	Sodium dodecylbenzenesulfonate	Triton X-100
1	0.01	60.3	46.6	37.5
2	0.02	55.2	42.9	34.3
3	0.03	49.0	39.2	33.2
4	0.04	45.5	36.6	30.8
5	0.05	38.4	35.5	30.1
6	0.06	35.9	33.1	28.7
7	0.07	33.8	31.3	27.3
8	0.08	31.2	30.6	25.5
9	0.09	28.7	30.5	24.1
10	0.10	26.5	28.7	23.6
11	0.11	24.3	27.4	22.0
12	0.12	24.2	26.1	21.4
13	0.13	23.4	25.0	19.9
14	0.14	22.7	23.8	18.5
15	0.15	22.1	22.2	17.8
16	0.20	18.6	17.7	13.3
17	0.25	16.3	13.5	11.1
18	0.30	15.4	11.2	8.50
19	0.35	12.9	8.40	6.20
20	0.40	10.3	6.20	4.60
21	0.45	11.6	4.20	2.70
22	0.50	11.7	4.70	0.00
23	0.60	12	5.30	2.10
24	0.70	12.2	5.50	3.80

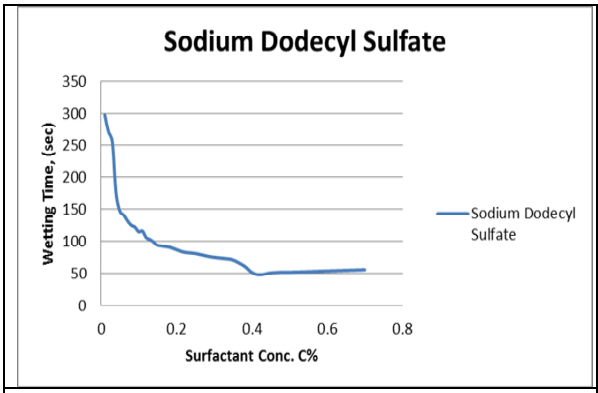
Table 3: Results of critical surface tension measurement test

Sl. No.	Surfactant Concentration, C%	Critical surface tension(γ), mN/m		
		Sodium dodecyl sulfate	Sodium dodecylbenzenesulfonate	Triton X-100
1	0.01	32.14	36.82	28.37
2	0.02	30.16	34.28	27.83
3	0.03	28.37	32.89	26.93
4	0.04	29.99	31.67	26.68
5	0.05	30.09	30.39	26.38
6	0.06	29.68	30.23	26.19
7	0.07	29.22	29.92	26.01

8	0.08	29.38	29.70	25.79
9	0.09	29.69	29.23	25.75
10	0.10	30.29	28.92	25.63
11	0.11	30.12	28.77	25.42
12	0.12	29.72	28.05	25.27
13	0.13	29.46	27.37	25.33
14	0.14	29.73	27.13	25.31
15	0.15	28.66	27.01	25.25
16	0.20	26.32	25.87	22.21
17	0.25	24.68	23.89	20.45
18	0.30	22.79	21.38	17.29
19	0.35	20.37	19.08	15.54
20	0.40	17.52	16.43	12.28
21	0.45	17.50	14.23	10.39
22	0.50	17.88	14.42	8.14
23	0.60	17.98	14.56	8.01
24	0.70	18.17	15.32	8.16

Table 4: pH value of surfactant solutions.

Surfactants	Concentration, C%	pH
Sodium dodecyl sulfate	0.5	7.93
	0.6	8.31
	0.7	8.72
Sodium dodecylbenzenesulfonate	0.5	9.56
	0.6	9.87
	0.7	10.12
Triton X-100	0.5	7.83
	0.6	7.83
	0.7	8.54



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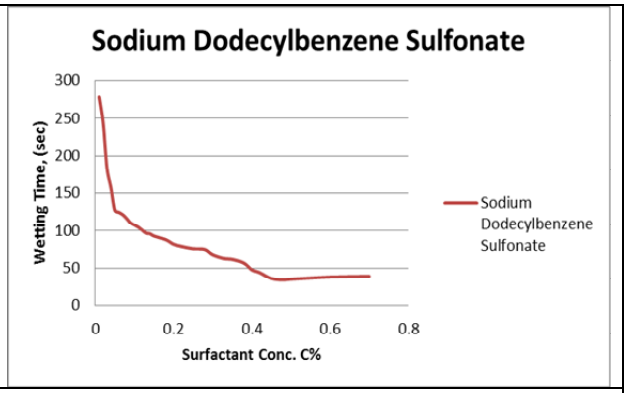

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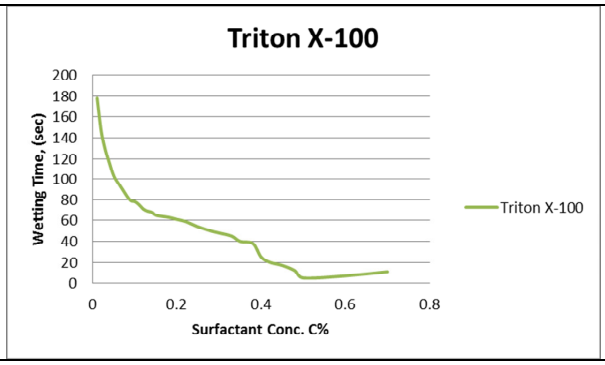


(c)

Figure 1:(a) Relation between surfactant concentration and wetting time of Sodium dodecyl sulfate; (b) Relation between surfactant concentration and wetting time of Sodium dodecylbenzenesulfonate; (c) Relation between surfactant concentration and wetting time of Triton X-100

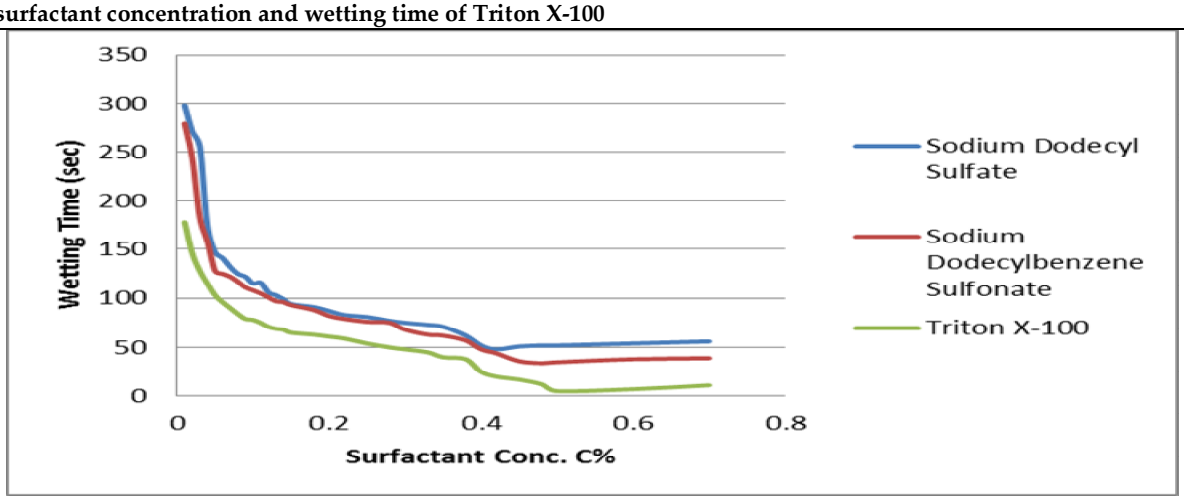


Figure 2:Behaviour of coal dust in response to complete immersion inside the different concentration of surfactant within a certain time period

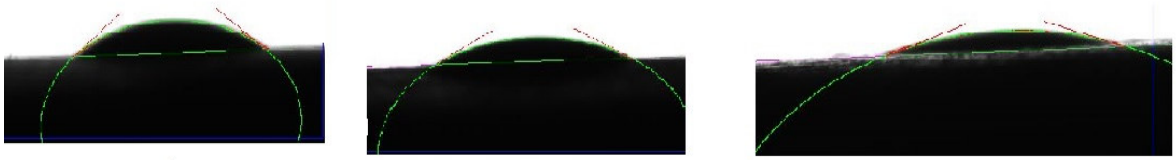
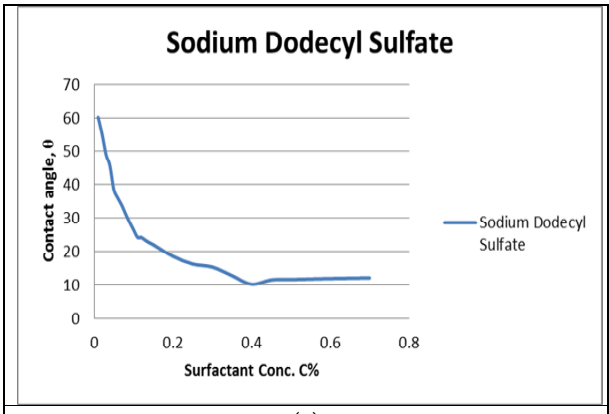


Figure 3: Effect of different Triton X-100 concentration on contact angle: (a) 0.05% (b) 0.15% (c) 0.25%



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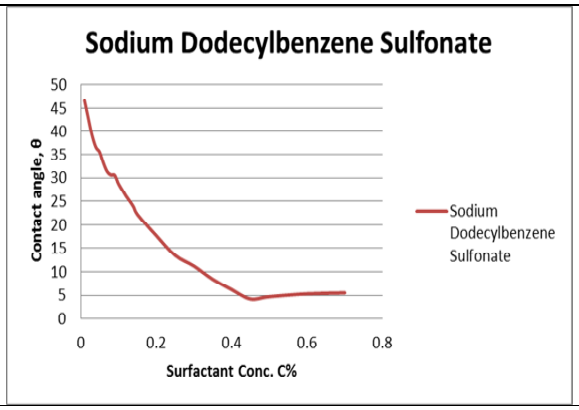

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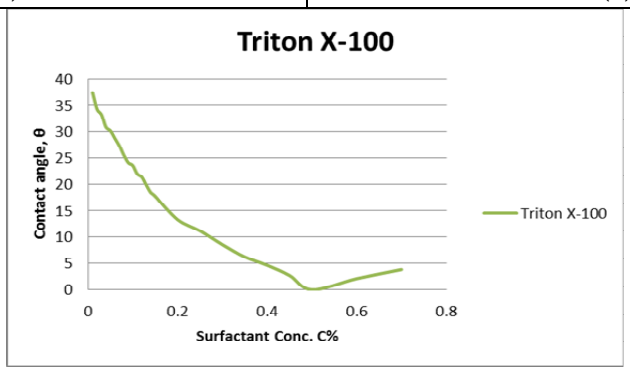


(c)

Figure 4:(a) Relation between the concentration of surfactant solution and contact angle, θ of Sodium dodecyl sulfate; (b) Relation between the concentration of surfactant solution and contact angle, θ of Sodium dodecylbenzenesulfonate; (c) Relation between the concentration of surfactant solution and contact angle, θ of Triton X-100.

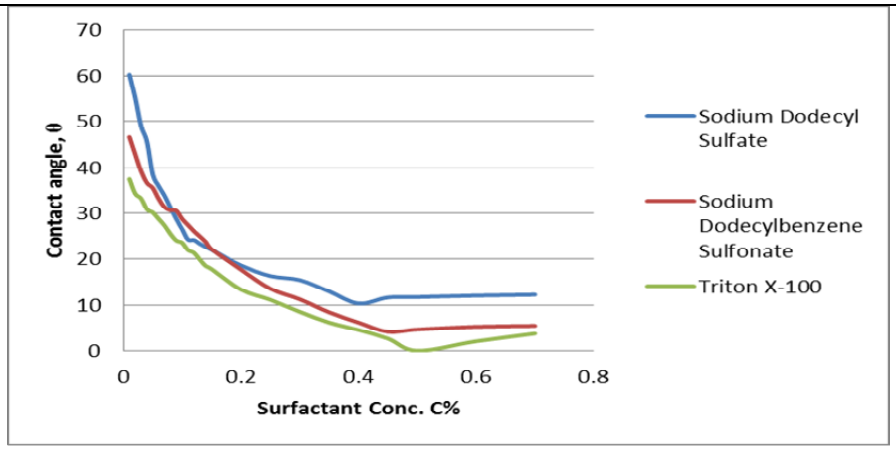
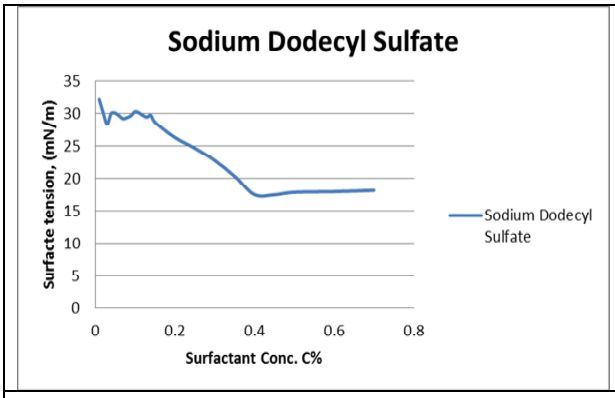
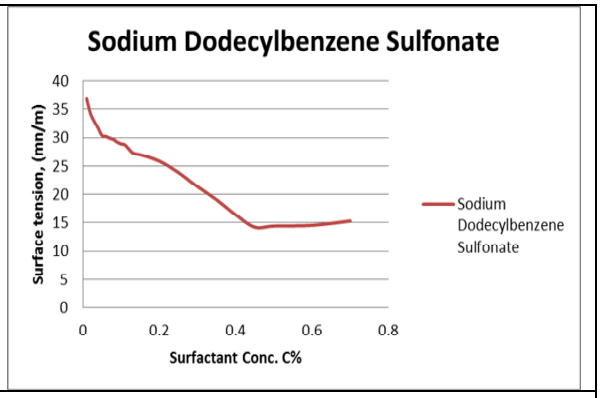


Figure 5:Behavior of surfactant solution in different concentration in response to making contact angle, θ on coal block surfaces



(a)



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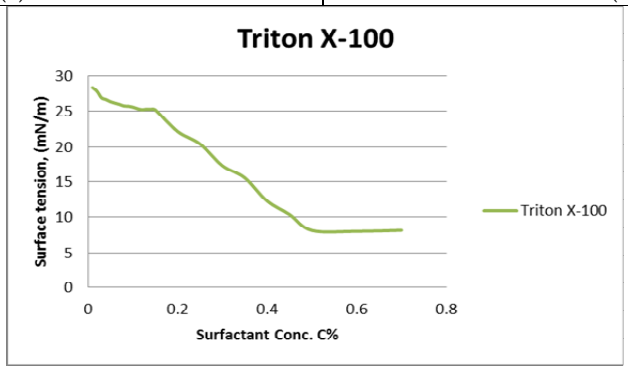

(c)

Figure 6: (a) Relation between surfactant concentration and surface tension of Sodium dodecyl sulfate; (b) Relation between surfactant concentration and surface tension of Sodium dodecylbenzene sulfonate; (c) Relation between surfactant concentration and surface tension of Triton X-100

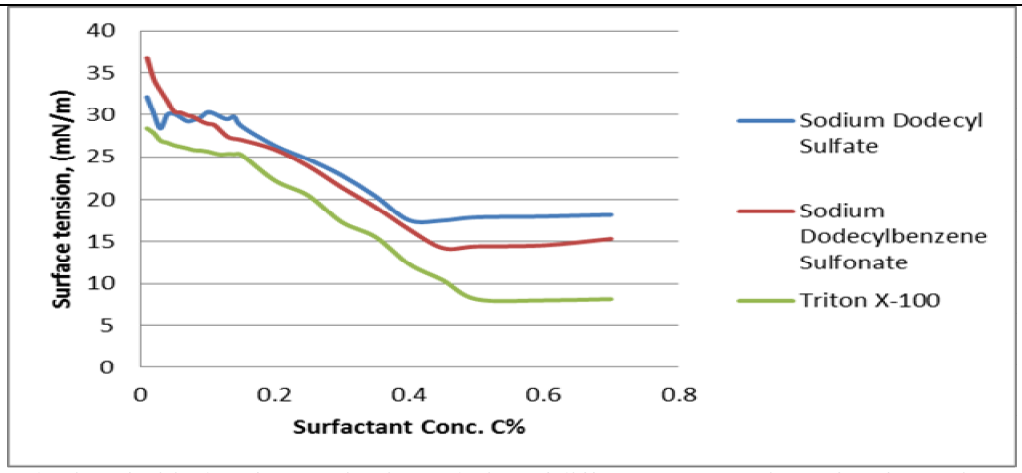

Figure 7:Behavior of critical surface tension in a solution of different concentrations of surfactant in response to coal dust suppression

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RESEARCH ARTICLE

Academic Performance of Intermediate Students: Factors affecting Learning and Strategies to Overcome it

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ABSTRACT

The ultimate goal of education is not confined in pen and paper but it comes under the development of the society. Educational skill is the key weapon to bring the modernity. However specially for the intermediate level of students, there are some factors related to the students, parents, schools & society which either directly or indirectly affect the academic performances of the students. The foremost purpose of this research paper isto identify the main factors both inside and outside of the school thatinfluence the academic performance of the students and which methods (especially from the school side) to be applied to overcome it .

Keywords: development, education, students, performance, skill .

INTRODUCTION

"Education is the most powerful weapon
which you can use to change the world."

The future goals and objectives of the students is determined by the efficiency of the students and their academic performance.The academic performance of the students can be measured in terms of attendance in class, assignments, tests, examinations, and curiosity for participating different events & competitions. However the attentiveness & proper follow-up from parents upon school, encourages & accelerates both the teachers & school administration to improve the academic strategies by providing extra classes for students, adopting effective teaching-learning methods and instructional strategies, using technology, rewarding students for good performance which encourages the students and when they achieve low grades, than they usually tend to work more to make improvements [2]. Education is not only for the development of the students but also for the development of the society as well as the nation.

230 students pursuing Diploma program from four campuses (70 from Bhubaneswar, 60 from Paralakhemundi, 50 from Raygada & 50 from Balesore) of Centurion University of Technology & Management were inspected carefully. Basing upon the survey, some factors were found which influenced their academic performance and accordingly some interventions needed for their improvement. In intermediate school, learning strategy plays an important role to improve academic achievements. This level of students being in adolescence period, face many problems related to age. At the same time some of them transit from one medium of study to another, school environment to college environment etc. As a whole, this level being a transition period from different ends, adds some extra factors that affect their performance. Such factors affecting their path of success as described below.

Factors affecting the Academic performance of the Students

The factors that influence the academic performance of the students have been stated as follows:-

Environment of the Classroom

The classroom environment is the vital part of education and as well as academic performance .The primary duty of a teacher is to create a disciplinary and well order environment in a class[3].Teacher should be familiar with their students. It promotes mutual understanding ,amiability and co-operation among them ,then it would help the students learn better and improve their academic performance.

Attitude of Student

Students'attitude on learning determine their ability and willingness to learn. In higher secondary School , the goal oriented students usually posses positive feelings regarding their school experiences . It is vital for the students to possess positive thinking in terms of their school, teacher and academic subjects. To dedicate themselves wholeheartedly towards learning and generate the desired academic outcomes are possible in positive attitude of the students[1].

Skills and Abilities of the Teacher

No doubt teacher is the role model of the whole teaching learning process and playes the central character of academic performance of students . So they most depict professionalism approachable nature , listen and provide solutions to the students and he most have adequate knowledge and information about the subject concept, usage of technology , modern and innovative method of teaching , discipline and well organising skill. They should be strict up to a limit and focus on enhancement of academic performance of students[1].

Learning Resources of the School

The textbooks, notes, learning materials, handouts, technology,library facilities and laboratory facilities includes the essential materials of the students . It will help a student to achieve a goal. But in some cases, especially the students belonging to deprived, marginalised and socio-economically background section of the society, can't afford the books and materials required forlearning sotheydepend upon the library facilities[1] .

Services of Guidance Counselling

The students of higher secondary school facednumberof problems and difficulties that are directly related to their age and immotion. Such problems like violence, criminal acts, drug abuse etc influence their learning potential vigorously which further results in creating poor academic standard and unemployment.These factors have also both direct and indirect impact upon their physical and mental conditions and also their lives. In this case counselling and guidance services plays a vital role in removing them from such difficulties. This services need to be developed in schools by assigning suitable faculties. The assigned faculties can help the students, by identifying their problems, suggesting necessary solutions of their problems, encouraging and motivating them to concentrate upon theirstudies and becomeresponsible and ideal members of the society [5].

Motivational Factors

"Motivation is the key for success."

In academic study, some of the topics are difficult to learn and understand at that timestudents need help fromothers. It is a foremost duty of a teacher as well as parent to motivate and encourage to the child and that will leads to solve this problem, so that they are able to acquire complete understanding of the concept and some time it will create a wonderful path, that will develop academic performance of the students [4] .

Health and Psychological Factors

"Healthy body is linked to a healthy mind."

It shows that for a student, the most important factor is psychology and physical health. Its obvious that, without having a good health condition a person can't contribute properly. In the same way the mental conditions of a student also affected by the physical conditions and hence when a student is not healthy, then he will not be able to contribute an active role towards learning. A good health condition also generates positive thinking which leads to positive academic outcomes[4].

Social Environment

The classroom is not meant for class and exam oriented for getting more marks. It enhances a social circle and friendship which have a positive effect upon the academic outcomes of the students. When a student prepares for task, the group study results more positive impact in terms of motivation, satisfaction & happiness [3]. School is the best place where students get more oppertunity to develop their social circle and it will help them to solve academic problem, andtheir mind will be broad.

Balancing Life and Technology

No doubt technology plays a vital role in the development of not only the nation but also the Universe now a days. We can't imagine a society without technology in this generation and future. But sometimes either the unnecessarily use or excess use of technology may act as an obstacle in the way of human race. For a specific example, mobile phones have many usefulness for all of us. But its excessive use creates bad impact on the brain and eye. Now a days some students are becoming addicted with the excess use of mobile phones even some of them are suffering from the diseases like text addiction. Also some of them are using it most of the time for entertainment purposes. As a result they are approaching towards many psychological as well as physical disorders. They are losing their creativity and concentration.

Pedagogy

A teaching process comprises the rules and strategies used by teachers to promote students learning.These methods and strategies should be appropriate and encouraging to the students. It is the perfect method that is suitable for the students. The pedagogy needs to be uploaded basing upon the needs and abilities of the students. Sometimes it is found that the teachers become not able to reach the level of the students. They continue their teach as per their own level. As a result the students can't gain the knowledge properly and become boring. That is why a student centric pedagogy should be adapted by the teachers in most of the time.

Parents-Students Breezing

Parents play a vital role for the growth & development of the children [3]. Basically the parents need to encourage and motivate the children towards their goal, support them in some difficulties and access to activities that enable the child to master key developmental tasks. Parent is the first teacher of child and should remain the best teacher throughout his life .They can also help and solve any academic problem of their child. So that they are able to acquire complete understanding of the concepts and some time it will create a wonderful path that will develop the academic performance of the students.

Benefaction of School Factors regarding the Academic Performance of Students

There are following factors that affectthe academic performance of the students such as :-

Expertise of the Teachers

Hardly there is an argument over the fact that, the objective of teachers is to promote their teaching skill. So that the student's learning and development can be improved. The expertise of the teacher's main part in teaching learning process isInstructional strategies, communication and their approachable attitude. When teachers depict professionalism then they will be appreciated by the students and they take pleasure in learning from them . The school managements need to give more emphasis on teachers training programs. For example In schools when teachers get upset and angry usually due to incomplete homework, assignment and deprived academic performance of the students, they can't find the necessary interventions to improve them further. The training programs both encourages and enhances the teachers basing upon the day to day needs of the students. Keeping all those things in view, Centurion University offers Faculty Development Programs(FDP) in every months on different topics. Some of the FDP topics are based on " Students motivation", "Artificial intelligence", "Personality development", "Creative thinking", "Communication skills", "Problem solving & decision making skills" "Computer programming languages", "Science & technology" etc., Fig-1: Faculty Development Programme

Shaping of Habits and Discipline

Good habits & discipline make us feel good. Hence, it has importance through out the life. This includes going to bed and waking up in time, taking foods in time, behaving suitably with others etc. In case of students, good habits & discipline make them to set goals better by wedding out the distractions in their life and then achieve it easily. Good habits makes the students to be a life long learners. Hence the schools should give emphasis on shaping of habits and discipline. For example, in hostels the Incharges should be instructed to make the the students wake-up early in the morning and do some exercises. Similarly the students should be instructed to do suitable amount of cycling, swimming, walking everyday. In the same way the students should be taught regarding inter personal skills and life skills to be adapted during any critical situation. Some people give emphasis on some miror issues and values them a lot while those things can be easily ignored. Those things obstructs them to improve further. Hence, during the students life they must be acquainted regarding the problem solving skills. In Centurion University, a daily routine has been shared to every students through e-mail regarding the everyday activities whose main concern is to habituate the students in the basic habits starting from "Early to Rise" to "Early to Bed". Along with the two extremes the routine also contains the specified timings for other habits like cleanliness, exercise, bath, diet, studying, playing, praying etc. The hostel wardens and faculties have been instructed to encourage the students to follow the routine properly. The violations against each student are recorded by the hostel wardens and faculties. Basing the record the most disciplined student is rewarded at the time of Annual function.

Emphasis on Values

The ideas that guide us in action, planning, executing and goal setting are generally treated as values. Among all these ideas, values are concerned with the manner of our actions, rather than the consequences. A person understanding and executing the values becomes a successful easily. Keeping this in view, the school managements should make necessary arrangements to introduce and habituate the students regarding the values. For example, the students must be introduced with the values like, how honestly, openly or generously to treat people, how they can act more generally, how to approach and keep things. Its obvious that, without having the values a person can achieve the goal properly. Also a powerful person without having values can't execute his role properly and hence can't exist for along time. The students following the values become benefited throughout their life.

Centurion University intruduced special classes from September 2014 which aims only to introduce the importance of human values. Those classes are generally conducted for 1hour duration and thrice a week(Monday, Wednesday & Friday). Every topic in the classes are based on the importance of ethics, innovation, responsibility, teamwork,

trust and so on. The CSR department conducts some events blood donation camps, arranging visits to orphanage, old age homes in order to realize their problems and serve them as per their own feasibility wherever required. In addition to this the School of Vocational Education & Training(SoVET) has introduced "Community Action Learning Programs(CALP)" in which the students are visiting the nearest community and serving the people by repairing their electrical and electronic devices, motor vehicles in free of cost. After all the actions taken by the University, it has been found that most of the students are realizing the importance of human values and as result the percentage of indisciplinary cases is reducing in every year. Fig-2: Blood donation camp & visit to old age homes.

Extra Remedial Classes for Academically Poor Students

If some extra focus will be provided then the poor students shall also receive more and there curiosity will be increased towards study . A case study was conducted at Centurian University, Jatni campus to verify the impact of extra focus towards the academically poor students. 70 diploma students who were very poor academically such that they could not clear some papers even appearing 3 times in the improvement examinations. They were provided 2 hours daily classes for 6 days for a particular subject that is total 12 hours of preparatory classes . After the exam , surprisingly 60 out of 70 passed . So we can believe that if 10% of this extra focus will be provided from beginning then the rest students would be passed too.

Non Scholastic Activity

The schools are providing extra curricular/non-scholastic activities like music, singing, dancing, role playing, sports, art works, physical activities , game etc. to students for developing their concentration. When students involved in these activities, it will increase their concentration, regarding learning ability, creativity, understanding capacity . So for the students extra curricular activities plays a vital role in improving the performance of the students. In order to achieve this, Centurion University offers Yoga classes, physical exercise classes, gym center, swimming pool, environment cleaning programs etc to improve their concentration level and keep them healthy. Fig-3: Non-Scholastic Activity

Use of Technology

No doubt use of technology is facilitating not only in the process of learning but also in inquiry or discovery. The use of technology mostly points towards the use of innovative skills or methods to reach a certain goal. The use of computers and internet facilitates it in a vital way. For example, Internet serves as the source of obtaining knowledge and information like unlimited material, notes, animated imagination of concepts, audio-visual aids and many morels. In present technology is made use of preparation of projects , reports and assignments . In Centurion University, most of the classes either theory or practical are using the technology to facilitate the teaching-learning process and achieve high efficiency.

Benefits of Rewards

Rewards are essential to encourage the students for improving their learning potential which further results in amplifying their performance academically . Generally when teachers ask the students to reward some positions in a particular test or competition in a class, the students become more interested to work hard. And as a result of which then can score good grades in the race. The parents and teachers become happy for their good performances and with this the students further get motivated to improve. In Centurion University the rewards are not only given in terms of the academic performance but also basing performance in extra curricular activities, contribution for social services, good habits & discipline, innovation and collaboration etc. Fig-4 Rewards and Celebration

The System of Evaluation

Among the different important strategies to improve the learning potentiality and poor academic performance of the students, the system of evaluation plays a vital role. This system should be such that, it could provide encouragement & motivation to the academically poor students while satisfaction to the rest. Generally this system

includes class works, home works, tests, competition, quizzes etc. But at the time of evaluation, the evaluators shouldn't be influenced by the social or economical background of the students. In addition to that, some other factors like religion, gender and race shouldn't be considered at the time of evaluation. This type of isolated system independent of such external factors, provides excitement to the students to improve further. In Centurion University, every aspect in the evaluation system comprises four main components as process, impact, outcome and summative evaluation. So that the performance of students can be evaluated subsequently which make the the students as well as the evaluators more vigilant to identify the mistakes or deficiencies. Accordingly necessary steps are taken.

Library Facilities

Library is a crucial place of teaching learning process as it contains both textbooks & reference books, newspaperrs, magazines journals etc, which are meant for borrow and read . For some economically backward students it's not feasible to purchase books as per their needs.Those students can be benefited by using the library facilities to fulfill their learning requirements. Now a days this facility is becoming more advanced by providing computers(E-lab) with internet which facilitates the learner to search or inquire something more quickly. Again the most important advantage of this facility is to help all type of students to enhance their mind to investigate or inquire some new ideas as they are getting all the sources in a particular place[6] . Centurion University provides a well conditioned central library in each campus which contains not only the academic books but also almost all the news papers, magazines, ethics, journals etc. In addition to this, it provides a well conditioned study room and many computers with internet facility. Besides that, every department and class rooms also have a mini library for the immediate reference. Fig-5: Library facilities

Facilities of Laboratory

It is clear that labrotaryis the best place for practical demonstration especially science subjects. The students remember more and for a long time, while they observe a thing rather than listen something. Observing , recording, counting , investigating , testing and analysing are the main theme of practical work. Chemical equipments and other tools are also involved in it[6]. Centurion University provides necessary and sufficient number of well furnished laboratories like engineering Physics Lab, Chemistry lab, CAD lab, analog and digital electronics lab, computer lab, Communicative English lab etc with internet faculties and advanced technology based instruments. This facilitate the students to gain a practice or skill based learning rather than a theoretical or conceptual one. Fig-6: Laboratory facilities

Learning Tools

The tool is an eminent factor in teaching learning process. A student most need learning materials those includeuniform, bags, stationeryitems, handicrafts, sports gear and so forth. Sometime the parents cannot afford these things which is a negative manner for the education of an individual. Centurion University provides most of the required learning materials from university side. Besides that any type of learning material is available inside the campus. The e-materials are shared to the students by respective department. All those things facilitate the teaching-learning process in an advanced manner.

CONCLUSION

From theabovediscussion, itis clear that education is an important factor for the development of the society. In the academic performance, the teacher and students aretwo sides of a coin. Education shows the positive and negative direction of the society . There are some factors that affect the academic performance of the students. The factors includes students attitude and environment of the classroom resources of the school , parents' role in academic performance social environment, healt&psychologicalfactors and motivational factors etc. At the same time,there are alsocertain strategieswhich can improvethe academic achievements.

There are also certain contribution of school factors regarding academic performance of the pupils those include expertise of teachers, extra remedial classes for the academically poor students, non scholastic activities, use of technology,rewards and so forth. At last in order to achieve good academic outcomes, the students must be sincere and dedicated towardstheir career and their atmosphere must be peaceful and affable .

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Fig-1: Faculty Development Programme


Fig-2: Blood donation camp & visit to old age homes


Fig-3: Non-Scholastic Activity


Fig-4 Rewards and Celebration

Fig-5: Library facilities

Fig-6: Laboratory facilities

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RESEARCH ARTICLE

Learning Reflection Record: A Multipurpose Tool to Student Success

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ABSTRACT

Education is the process by which knowledge develops leading to change in behaviour and character of an individual. It enables an individual to do worthwhile activities by improving through self-reflection that empowers an individual to assess 'why' and 'how' of the incidence. Subsequently, the answer to 'what's next' to be done originates creating the strategy to the desired outcome. In this article, maintaining the (one page) daily learning reflection record (LRR) has been considered as a tool for students to practice self-reflection from the early stage of life. The study at Centurion University of Technology and Management (CUTM) highlights the dramatic course of integrating LRR to the academic routine of School of Vocational Education and Training (SoVET), starting from an unwilling exercise to the most coveted celebration day of a semester.

Keywords: Education, knowledge, learning, Training, students.

INTRODUCTION

Global education involves both knowledge and perception.There are increasing changes in educational systems together with changes in technology, economy and social life impacted by globalization[1]. As technology is changing vastly world wide, different countries are approaching various methods for the competence in the learning. Over the last decade there has been increasing interest in reflection as a tool for improving practice in education [2]. Learning is the process which helps in acquiring new or modifying the existing knowledge, skills, values and utilizing it in day to day activities. It is also an internal activity with a key to personal development.

Learning outcomes are indeed key to a meaningful education, and focusing on learning outcomes is essential to inform diagnosis and improve teaching processes and student learning. While there is a long tradition of learning outcomes assessment within institutions' courses and programmes, emphasis on learning outcomes has become more important in recent years [3]. We educate ourselves through many ways and learn many new things, but until

and unless we utilize our learning, it has no value. It is very much essential to reflect what we have learnt or learning in our day to day life, whether in schools, colleges or in universities. Else the learning has no value unless it is being utilized for the betterment of an individual, community or society [5]. Reflection is all about students experiencing their own thinking process with the assessment of "why" and "how" of the learning. An important feature of "Learning Reflection" is that through this we can learn about ourselves.In this context, a state enacted multi-sector University, Centurion University of Technology and Management,have used a model successfully by implementing writing of Learning Reflection Record (LRR) at School of Vocational Education and Training (SoVET).

Visionary Proposition for LRR

It was started from a incident when a particular branch of final year students bunked their class for some reason, when it come to the notice of the head SoVET, He thought to punish them not through monetary fine but in an innovative way. He asked students to design their class room by their own idea to make their class room more informative and attractive for learning, students did fabulous work to design their class room but when they were asked to write their own learning experienceof the renovationof the class they have done, few students could explain it beautifully about how they made their class room more attractive by the team work and with better understandings between them.But at the same time most of the students found it difficult to share their experience by writing, even if theyparticipated actively in the work. It became a matter of serious concern and from this exercise, it was clear that the students were unable to reflect on what they are learning in the class and had perceived nothing from the class room teaching as well as from lab.

This very thing forced the entire team with senior managements to take a major and productive step to overcome from such a sensitive issue. The team SoVET with Senior management discussed number of methods and finally came up with a solution. Writing learning reflection was the ultimate solution, where at the end of the day, students have to write the learnings in a prescribed format about what they learnt from each and every class as well as in lab and how they can connect those learnings in their day to day activity and reflect the outcome. Finally this method turned out to be a successful one in overcoming the issues.

Implementation: Improving through Impacts

Yes, it is obvious that whenever something positive is going to take place , all negativity pour on their power and strength to defame the positiveness of a valued thing. This same thing also happened while bringing the writing of "Learning Reflection Record" in to practice. It was completed in three different phases, in each phase we faced some challenges and we move forward by making strategically changes and got improved results in each phase.

Phase-I

It was stated stared in 2017-2018 academic session, at that time our main objective was to make students habituated to record the reflection of their learning and to create some evidence of their learning, for that senior management team had decided to distribute a tool which was LRR Format-1(Fig.-1) and also a workshop was conducted on how to write LRR. They were asked to write whatever they have learnt in that given format and was to be checked by the faulty assigned. At the end of the session when the whole process was analysed, It was observed that a good improvement in the students like they wrote their daily LRR at the same time there were different challenges faced by students as well as faculties. As per some student's feedback, it was a difficult new habit to practice, and also some students were not clear about what to write and how to write. It was also found that some students were casual due to lack of motivation as there were no marks or grades for writing LRR. From a faculty prospective It was a quite challenging task to monitor LRR of every student every day.

Phase-II

As it was a very nice initiative taken by management, We all the faculty of SoVET with senior management wanted to carry forward the process to a higher level, for that senior management team thought to bring certain changes in the format as well as in the process. Keeping in the mind different challenges faced in beginning stage, our main objective was how to improve capability of students to enhancement on Reflection as well as their English writing skill by regular monitoring. In second phase, a new modified LRR format-2(Fig.-2) was introduced. To make them cleared about what to write and how to write, a workshop on "How to capture learning from the portions taught"was conducted. They were asked to write LRR in 3 possible components such as (a) Learning (Classroom), (b) Learning (Lab. / Practice), (c) Learning (Life).

Students were instructed to write LRR in the last period of the day & different faculties were assigned to monitor and sign the LRR of different branch students. To motivate students to write their LRR sincerely, they were informed that they will be awarded internal marks on LRR.Every individual student has to submit two copies of all the LRR sheets by book binding them and best writer of LRR of every branch is rewarded on a special event "Learning Celebration Day". The idea behind this occasion is to make students feel further fascinated and passionate to write their daily LRR sheet. At the end of the session when we assessed the whole process of writing LRR, we found significant improvement of students in their writing skill as well as organizing the LRR, more importantly reflection skill of the students were also changed a lot. By organizing "Learning Celebration Day" and rewarding them significantly raised their interest. Like previous year, this time also we had faced different challenges while implementing. Students found it difficult to recall and reflect learning of the whole (long) day in the last period and for a faculty, it was very tough to check the LRR of whole class efficiently in 55 minutes. We found underutilization of resource allocated for LRR monitoring due to 6hrs/week and still few students were not fully motivated to write LRR.

Phase –III

Despite of various challenges in phase-II we had also tasted remarkable improvement in students writing skill and thinking process which made us more determined to take LRR into highest level. This time our main objective was to bring 100% motivation among all the students, at the same time we had also focused on quality improvement by better monitoring the process. For that a new format of LRR(Format-3) was distributed among the students. As SoVET under multi-sector private state University, Centurion University of Technology and Management, Odisha, India, senior management team decided to launch LRR as a 0.5 Credit (Workshop) Course per semester. As per new provision students were instructed not to write their whole LR page in the last period, instead they were given last 5 to 10 minutes of each period to record LR in the box provided for that particular course.Every day in the last 15 minutes LRR was data-stamped for transparency at the same time there were 3 periods per week allocated in their timetable to check LRR by assigned faculty. By executing above methods it was observed notable development in student's activity. Students are writing their LRR, as a new discipline of academics, the earlier defaulters are seriously writing as a part of the credit based course to pass. Students have improvedappreciably in reflection as well as in English. Still there are some challenges for the whole team like reflection capability of students needs to be improved to connect learning to real life problem solving on which senior management with team SoVET working on. The progress so far through different phases has been summarized in the Table below.

Reflection: Realization of Reality

Learning reflection of a student examines the approaches to different topics and experiments, it also encourages them to make it as a habit in the workshop also. It improves self awareness, creative thinking skills and better understanding within them. As a diploma student, they are in the primary stage of technical learning so in this stage they need the better understanding of different technical skills. By making habits of writing LRR for every subject they can get more clarity on different subjects. With writing LRR being integrated into existing courses at School of Vocational Education and Training, Centurion University of Technology and Management may set an example for others providing diploma courses.[3,4]

Reflection was very much essential for a student for each assignment. Writing of "Learning Reflection" helped many students to improve their thought to self-evaluate and identified unclear area of their learning. *Piyush, one of our current batch 2nd year miningstudentsays:"I reflected back on what I had done in my 1st year and realized that maybe in some portions I could have explained better. By writing Learning Reflection I found improvement in my thinking and analysing process."* Most of the times, students complete their assignments without knowing the reflection of it, this is due to lack of thinking habits or we can say due to lack of writing habits.For this students needs to think and write the key points of his study and it gives the student an opportunity to document their learning journey and improving their English writing skill which is also very helpful for their future endeavours. *AsjadHussain, one of our Alumni (Mechanical branch,)says, "I was average in English, when I started writing Learning Reflection, I used to write it in my own word and after coming back to my room I used to analyseit compare my learning in text book as well as in online sources to rectify my errors. It is a beautiful concept for me .By writing Learning Reflection I got more confidence in English writing skill also which is helping me now in my professional carrier".* Through reflection, students personalised different learning theories and how to apply theories in practice. *AbhisekTripathy, final year Electrical branch student says, "Writing Learning Reflections helped me to understand the project because I thought about them more consciously. It helped me to analyze the theory a little more because I had gone through them after the project was completed. I think that is a important learning tool to come back to the theory and can analyze its effectiveness in a real life situation".* Writing of learning reflection activity allows students to conceptualize the experience, and raise the knowledge to a higher level [2].

CONCLUSION

This study contributes to the practice of writing learning reflection pointing out how its implementation from an underrated exercise to credit based integration is a pprogress through reflection in itself. It is all about students own thinking process, and being able to make those transparent to others. It enables assessment of the "why" and "how" of the learning, and what needs to be done as a result. Centurion University always supports the staffs and students to achieve and practice things which are skill oriented. Recording it for evidence and reflection makes the learning process more meaningful and connecting. This experiment within academics on one hand has illustrated the whole event as continual transformation of students response to the habit of reflection, while on the other, has enhanced their writing, thinking and interpreting skills. Besides, it creates an opportunity to author the book of their own reflection of 3 years and preserve it as a souvenir for future reference. Not only during this 3 years academic programme but also for life, the practice of reflection enhances the analysis skills for conscious decision making. Therefore, LRR being termed as a multipurpose tool to studentsuccess is justified.

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Table 1 .Time line progress of strategy and Outcomes of learing reflection Record

Time Line Progress of Strategy and Outcomes of Learning Reflection Record				
Phase No	**objective**	**Tool**	**Strategy**	**Observation**
Phase-I (August 2017-July-2018	• Leaning evidence • Habit of reflection	LRR (Format-1)	• Workshop conducted on how to write LRR • LRR format was distributed	Improvement: • Students wrote their daily LRR Challenges: • For some students, it was a difficult new habit to practice • Some students were not clear what to write and how to write. • Monitoring LRR of every student every day, was difficult • Students were casual due to Lack of motivation (marks/grades)
Phase-II (August 2018- July 2019)	• Writing skill (English) improvement • capability enhancement or Reflection • Regular monitoring	LRR (Format-2)	• Workshop "How to capture learning from the portions taught". • To write LRR in 3 possible components: (a) Learning (Classroom) (b) Learning (Lab. / Practice) (c) Learning (Life) • Students will write their LRR in the last period of the day • Assigned faculty to monitor and sign the LRR • Internal Marks on LRR • Book bind and distribute in a special event (Learning Celebration Day) • Best LRR rewarded	Improvement: • Students writing skills and organizing LRR improved • Students reflection skills improved • Learning Celebration Day and Rewards significantly raised students interest Challenges: • Students found it difficult to recall and reflect learning of the whole (long) day in the last period. • Difficulty to check the LRR of whole class efficiently in 55 minutes • Still some students were not fully motivated • Underutilization of resource due to 6hrs/week allocated for LRR monitoring
Phase-III (August 2019-April 2020)	• Motivation to write LRR • Quality Improvement • Better monitoring	LRR (Format-3)	• LRR becomes a 0.5 Credit (Workshop) Course/Semester • Whole LR Page is not be written in the last period. • Last 5 to 10 minutes ofeach period is to record LR in the box provided for that particular course. • Everyday last 15 minutes LRR will be data-stamped for transparency. • 3 periods/week to check LR by assigned faculty	Improvement: • Students are writing LRR, as a new discipline of academics • The earlier defaulters are seriously writing as a part of the credit based course to pass • Improvement in reflection • Improvement in English Challenges: • Reflection capability needs to be improved to connect learning to real life problem solving

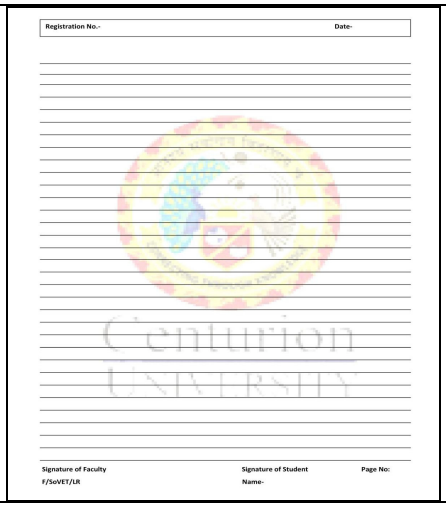


Fig.-1: LRR Format-1

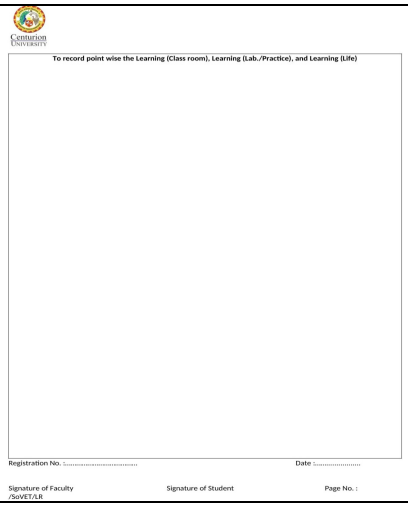


Fig.-2: LRR Format-2

(a) Best LRR selection process

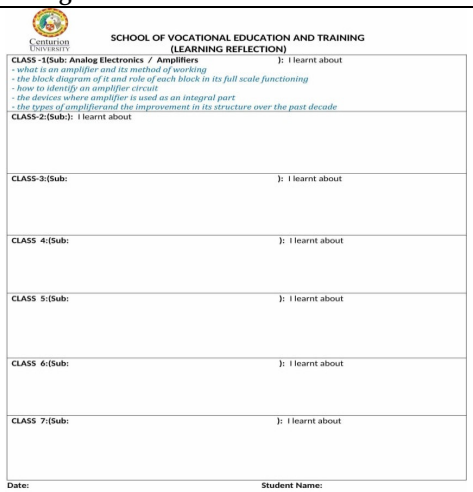
(b) Best LRR Reward by Hon.Vice Chancellor

(c) LRR Sample Cover

(d) Celebration after LRR distribution Learning Celebration Day

(e) Glimpse of Fulfilment and Happiness

Fig.3.LRR distribution & Celebration



SCHOOL OF VOCATIONAL EDUCATION AND TRAINING
(LEARNING REFLECTION)

CLASS -1(Sub: Analog Electronics / Amplifiers): I learnt about - what is an amplifier and its method of working - the block diagram of it and role of each block in its full scale functioning - how to identify an amplifier circuit - the devices where amplifier is used as an integral part - the types of amplifierand the improvement in its structure over the past decade
CLASS-2:(Sub:): I learnt about
CLASS-3:(Sub:): I learnt about
CLASS 4:(Sub:): I learnt about
CLASS 5:(Sub:): I learnt about
CLASS 6:(Sub:): I learnt about
CLASS 7:(Sub:): I learnt about

Date: Student Name:

Fig.-4: LRR Format-3

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RESEARCH ARTICLE

Emotional Intelligence: A "Latent" Emotional Capability in Rural Women Entrepreneurs

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ABSTRACT

Entrepreneurs' EI is a "latent" emotional capability that impacts their transformational leadership orientation. The entrepreneurs' EI is taken into consideration, since higher EI and transformational leadership impact entrepreneurs' ability to better cope with environmental dynamism and increase growth probabilities. The objectives of the paper are to 1) identify the emotional intelligence factors important for women entrepreneurial growth, 2) find out the emotional intelligence level of rural women entrepreneurs in the selected districts of Odisha and 3) design a need-based entrepreneurship development training framework for rural women. The literature and scholarly articles on EI and women entrepreneurship are used to frame our argument. The study uses EQ-I 2.0 self-report measure, DNA Model of Entrepreneurship and a questionnaire for the purposes of the study. The paper explores the emotional intelligence level of rural women entrepreneurs in the selected districts of Odisha, namely, Gajapati, Koraput and Rayagada as they have large rural populations and are predominated by SC and ST. The sample of the research was selected via stratified random sampling. The finding reports the important EI factors for women entrepreneurial growth. Thus, the paper shows a way forward to support women entrepreneurs to increase their emotional intelligence, and suggest integration of a new model in the Entrepreneurship Development Programme training module.

Keywords: Emotional Intelligence, Entrepreneurship, leadership, capability.

INTRODUCTION

It is said that women's entrepreneurship might be the tool needed to improve the labour force's gender balance in India (Insights, 2017).The emergence of entrepreneurs in a society depends to a great extent on economic, social, religious, cultural and psychological factors prevailing in the society. Rural women increasingly run their own enterprises, yet their socio-economic contributions and entrepreneurial potential remain largely unrecognised and untapped. In India women constitute around fifty percent of the total population (Revenga and Sudhir, 2012). But the total number of women entrepreneurs does not contribute to fifty percent of total entrepreneurs in India. Many entrepreneurs struggle to start or keep their business afloat because of lots of hardships. There are problems in raising finance, support services, marketing them, meeting quality standards etc. Women entrepreneurs in particular face problems such as juggling multiple work/life responsibilities, traditional attitudes of the society apart from the general hurdles that their counterparts i.e. male entrepreneurs face. Women Entrepreneurs usually have restricted mobility compared to men because of the social influence, this leads to low awareness. The conditioning is such that there is low confidence and low self-esteem. Further, the authority of women is taken up lightly by the subordinates as women are considered to be soft by nature. SHG movement in the country has already brought many of the rural women together for savings and economic activities. The banks have been able to grade the SHGs and the bank linkage has helped the women SHG members to get access to loans. These loans have been used for income generating activities leading to setting up of micro enterprises. But, the micro enterprises have not been able to grow to its full potential. Many a times the business is started in the name of the women SHG member, but most of the decisions/ problem solving with regard to the business is done by the men of the family. The women entrepreneur of the enterprise is dependent on her husband or father or brother. The emotional intelligence (EI) level is possibly low which leads to seek this kind of support.

Emotional Intelligence and female entrepreneurship are the key factors in economic development. Bar-On(1997) definesemotional intelligence as an array of personal, emotional, and social abilities and skills that determine how well the individual functions in his or her given environment. Emotional intelligence is also defined as a set of emotional and social skills that influence the way we perceive and express ourselves, develop and maintain social relationships, cope with challenges, and use emotional information in an effective and meaningful way. Emotional intelligence (EI) as defined here and applied in the Emotional Quotient Inventory (EQ-i 2.0) reflects one's overall wellbeing and ability to succeed in life.Entrepreneurs' EI is a "latent" emotional capability that impacts their transformational leadership orientation. Entrepreneurs are seen as agents able to initiate and identify new ideas and then transform them into economic and social activities (Gartner, 1985; Ireland et al., 2001; Lumpkin and Dess, 1996; Schumpeter, 1965; Shane and Venkataraman, 2000).This is positive sign for the development of women entrepreneurship. Women entrepreneurs are those women who take the lead and organise the business or industry and provide employment to others. Entrepreneurship development among rural women helps to enhance their personal capabilities and increase decision making status in the family and society as a whole (Ahmed &Mazumdar, 2015). This paper aims at exploring emotional intelligence of rural women entrepreneurs to succeed in business, overcome all the hurdles of attitudes of the society, boost up their self-esteem. The paper studies the role of emotional intelligence in helping the women entrepreneurs manage their home life and work life successfully and also overcoming the hurdles at work posed to them because of the attitude of the society.

Literature Review

The concept of "Women entrepreneurship", a global phenomenon has become prominent in India in the latter half of the eighties. India is a land of enterprises, where almost 70 percent of the population is still self-employed and some place this estimate as high as 80 percent. An entrepreneur is a person who is able to scan the environment, marshal resources and implement actions to bring into existence a commercial venture, which can initiate and establish large, medium or small enterprises (Sharma Ajay, et al. 2012). Now women's entrepreneurship has been recognised as an important untapped source of economic growth. The literacy rate among women has increased from 54.28 per cent in

2001 to 65.46 per cent in 2011. This is positive sign for the development of women entrepreneurship. The women of today have the capability to analyse, organise and mobilise the surrounding situation for social transformation (Verma, 2015). Literature reveals that EI is a missing factor in the entrepreneurship research and discussion, and also development of entrepreneurship is related to a capability of an individual to analyse his/her emotions and values. Recent times have seen researchers focusing on personal qualities of the entrepreneur that develops outstanding businesses. Sexton and Bowman (1985) had characterized entrepreneur as tend to be 1) tolerant of ambiguous situations, 2) prefer autonomy (autonomy may be described as self-reliance, dominance, and independence), 3) resist conformity, 4) be interpersonally aloof yet socially adroit, 5) enjoy risk-taking, 6) adapt readily to change, and 7) have a low need for support. Being stable emotionally is very crucial for the entrepreneurs with stress. Several studies suggested that EI has a positive effect on creativity which it is one of the most important core competencies for entrepreneurs. EI is an important factor in the prediction of entrepreneurial outcomes (Chell, 2008; Ahmetoglu, Leutner& Chamorro-Premuzic (2011) and entrepreneurial behaviour (Bahadori, 2012).

Given the social nature of entrepreneurial activities, EI can predict entrepreneurial success. Indeed, several authors suggest that higher levels of trait EI are necessary to exploit opportunities and innovations (Chell& Baines, 2000). Therefore, there is a relationship between entrepreneurs' EI and their success (Karimi, Kloshani&Bakhshizadeh, 2012). Emotional Intelligence improves an individual's social effectiveness which is considered as one of the important elements of the success of an entrepreneurship. Higher the emotional intelligence the better social network, which in turns lead to better business relations. If emotional intelligence is high individuals can enhance their abilities to accurately recognise emotions own and others, to put emotions for better use (maximise their own performance and in various tasks) and to manage them effectively (intimate relationships, in problem-solving, decision-making, expressing appropriate, controlling emotions) (Grewal, Brackett &Salovey 2006).

According to Boren (2010), emotional intelligence has implications for entrepreneurial situations and social interactions such as negotiation, obtaining and organising resources, identifying and exploiting opportunities, managing stress, obtaining and maintaining customers, and providing leadership. Rhee and White (2007) in their study on emotional intelligence of entrepreneurs, found that entrepreneurs demonstrated high level of self-confidence, trustworthiness, achievement orientation, service orientation, change catalyst, teamwork and collaboration.

Objectives

The objectives of the study are to:

1. Identify the emotional intelligence factors important for women entrepreneurial growth
2. Find out the emotional intelligence level of rural women entrepreneurs in the selected districts of Odisha
3. Designa need-based entrepreneurship development training framework for rural women.

For the purposes of the study, the researchers use Baron's EQ-i 2.0 Model which also share Entrepreneurs' core traits. The EQ-i 2.0 is a self-report measure designed to measure a number of constructs related to EI. The model focuses on the five factors viz., self-perception, self-expression, interpersonal, decision making, and stress management.

SELF PERCEPTION

- Self-Regard is respecting oneself while understanding and accepting one's strengths and weaknesses. Self-Regard is often associated with feelings of inner strength and self-confidence.
- Self-Actualizations is the willingness to persistently try to improve oneself and engage in the pursuit of personally relevant and meaningful objectives that lead to a rich and enjoyable life.
- Emotional Self-Awareness includes recognising and understanding one's own emotions. This includes the ability to differentiate between subtitles in one's own emotions while understanding the cause of these emotions and the impact they have on the thoughts and actions of oneself and others.

SELF EXPRESSION

- Emotional expression is openly expressing one's feelings verbally and non-verbally.
- Assertiveness involves communicating feelings, beliefs and thoughts openly, and defending personal rights and values in a socially acceptable, non-offensive, and non-destructive manner.
- Independence is the ability to be self-directed and free emotional dependency on others. Decision-making, planning, and daily tasks are completed autonomously.

INTERPERSONAL

- Interpersonal relationships refer to the skill of developing and maintaining mutually satisfying relationships that are characterised by trust and compassion.
- Empathy is recognising, understanding and appreciating how other people feel. Empathy involves being able to articulate your understanding of another's perspective and behaving in a way that respects others' feelings.
- Special responsibility is willingly contributing to society, to one's social groups, and generally to the welfare of others. Social Responsibility involves acting responsibly, having social consciousness, and showing concern for the greater community.

DECISION MAKING

- Problem solving is the ability to find solutions to problems in situations where emotions are involved. Problem solving includes the ability to understand how emotions impact decision making.
- Reality testing is the capacity to remain objective by seeing things as they really are. This capacity involves recognizing when emotions or personal bias can cause one to be less objective.
- Impulse control is the ability to resist or delay an impulse, drive or temptation to act and involves avoiding rash behaviours and decision making.

STRESS MANAGEMENT

- Flexibility is adapting emotions, thoughts and behaviours to unfamiliar, unpredictable, and dynamic circumstances or ideas.
- Stress tolerance involves coping with stressful or difficult situation and believing that one can manage or influence situations in a positive manner.
- Optimism is an indicator of one's positive attitude and outlook on life. It involves remaining hopeful and resilient, despite occasional setbacks.

METHODOLOGY OF THE STUDY

As discussed, the study is grounded on an entrepreneurship perspective. Three districts of the state of Odisha are selected, namely, Gajapati, Koraput and Rayagada as they have large rural population and predominated by SC and ST. Women entrepreneurs are selected using stratified random sampling. Women Entrepreneurs list was collected from the District Industries centre. The SHGs list was generated from District Women and Child welfare offices. Twenty women entrepreneurs are randomly selected from each district.

Data collection was done using structured questionnaire consisting of 40 questions. The respondents were asked to provide a rating for each question on a 7-point LIKERT Scale. This questionnaire aimed at capturing responses from the women entrepreneurs on the five dimensions of EI i.e., self-perception, self-expression, interpersonal, decision making, and stress management. The questionnaire is framed with statements like 'I have high self-esteem','I feel sure of myself in most of the situations', 'I set reasonable and challenging goals','I am self-directed and self-controlled in how I think and act', 'I am able to say what I feel or understand', 'I can strongly protest against mistreatment', 'I feel that I can handle many things at a time', 'I can usually appreciate the other person's viewpoint even if I do not agree to it', 'I am happy to help others to find out solution for their problems', 'I like to get an overview of a problem before trying to solve it', 'My goals are realistic and my patience allows me to work towards

them steadily', 'I do whatever I can to keep myself under control', 'I Stick to the way I do things', 'If I am faced with a difficult situation, I constantly role the problem over in my mind becoming anxious and worry','I generally hope for the best'.

IMPLICATIONS of the study

The research has practical implications for women entrepreneurs. The research aims to strengthen the capacity of rural women entrepreneurs' associations through EI to advocate for and serve the needs of their members, support research on rural women's entrepreneurship (at local, regional or national levels) and disseminate information on good practices in promoting sustainable businesses run by rural women.

EMOTIONAL INTELLIGENCE AND ENTREPRENEURSHIP

Based on research into the mindset of today's entrepreneurial leaders, DNA model comprises an entrepreneurial leader. At the nucleus ofthe model are the opposite, yet complementary characteristics of an opportunistic mindset combined with a unique attitude to risk failure. The nucleus is combined with the idea of "locus of control"-a belief in control over one's environment. This is bolstered by the ability to see opportunities and a willingness to take risks, to seize opportunities. Surrounding the core of the model are six guides to action that entrepreneurial leaders live every day. They are passion, persistence, the ability to work with a team yet follow their own instincts, the creation of a "success culture", an eye for niches and market gaps, and a focus on building an ecosystem to support the venture. Through literature review, the researchers identified the emotional intelligence factors important for women entrepreneurial growth which is illustrated in Table 1.

The paper discusses the emotional intelligence level of rural women entrepreneurs in the selected districts of Odisha. The Average score of the women entrepreneurs on eachdimension of EI is shown in Figure 2. The overall score was 4.42 on a seven-point scale. The average score with regard to Interpersonal was 5.19 being the highest across all the dimensions. The lowest average score was 4.03 for Decision making.The sub-dimension scores for the 5 dimensions was found and classified as low or high score. The data analysis result points out that the women entrepreneurs score high at self-regard, empathy, social responsibility, impulse control, emotional expression, flexibility and optimism. The women have low score in self-actualisation, emotional self-awareness, interpersonal relationship, problem solving ability, reality testing, assertiveness, independence and stress tolerance.

NEED-BASED ENTREPRENEURSHIP DEVELOPMENT TRAINING FRAMEWORK

The study puts forth a need-based entrepreneurship development training framework (see Figure 3) that outlines three dimensions which the study has shown to influence the entrepreneurial skills of rural women. The program design has resulted from an understanding of the context and need. EDP training modules should incorporate EI into design, implementation and evaluation. The participants can focus on the development areas through EI Training. At the same time, areas where the participants excel can be leveraged to their full potential to maximise effectiveness in daily tasks. The paper shows a way forward to support women entrepreneurs to increase their emotional intelligence and suggest integration of EI module in the Entrepreneurship Development Programme training module.

ENTREPRENEURSHIP DEVELOPMENT PROGRAM

- Characters of an Entrepreneur
- Business opportunity identification
- Schemes and support system
- Product, Market, Competition, Quality, Capacity utilisation
- Project proposal, Total cost of the project, Sources of Finance
- Costing and Profit calculation

- Accounting
- Working Capital Management
- Calculation of Depreciation and interest and installment amount
- Projections

CONCLUSION

The paper has explored the areas that need improvement. The program design has resulted from an understanding of the context and need. The participants can immediately begin developing those areas through EI Training. At the same time, areas where the participants excel can be leveraged to their full potential to maximise effectiveness in daily tasks. Hence, Entrepreneurship Development Programme (EDP) training modules should incorporate EI into design, implementation and evaluation. Thus, the paper shows a way forward to support women entrepreneurs to increase their emotional intelligence for overall wellbeing and success.

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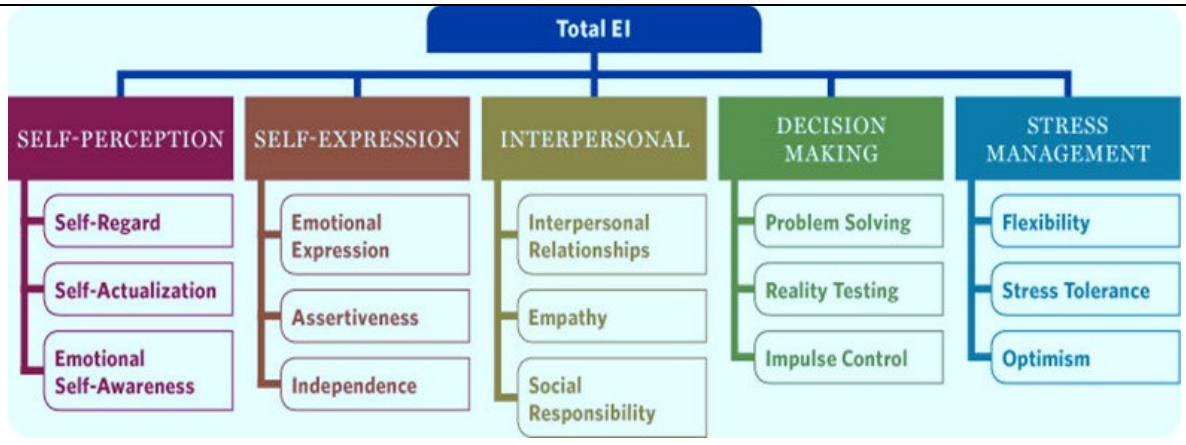
Table 1. EI Factors important for women entrepreneurial growth

Characteristics of an Entrepreneur	Factors/Sub factors of Emotional Intelligence
Ability to take risks	Self-awareness, self-actualisation and stress tolerance
Innovation	Creativity and task-orientation
Visionary	Emotional leadership
Teamwork & leadership	Flexibility, adaptability and interpersonal
Open minded to people & towards failures	Social responsibility
Social skills	Empathy and interpersonal
Confidence	Assertiveness and self-realisation
Decision-making	Problem solving, reality testing, impulse control and optimism
Autonomy	Independence

Table 2. Average score on EI Dimensions

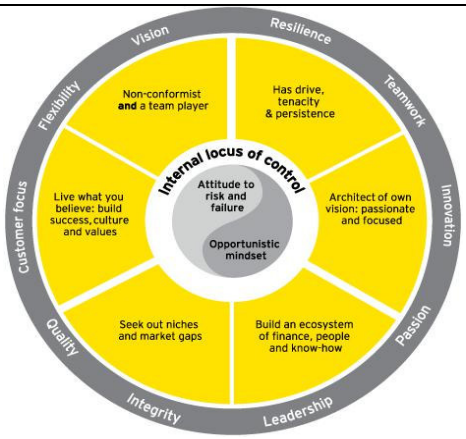
Dimension with Average Score	Sub-dimension	Score
Self-perception (4.38)	Self-Regard	High
	Self-Actualization	Low
	Emotional Self-Awareness	Low
Interpersonal (4.03)	Interpersonal Relationships	Low
	Empathy	High
	Social Responsibility	High
Decision-making (5.19)	Problem Solving	Low
	Reality Testing	Low
	Impulse Control	High
Self-expression (4.2)	Emotional Expression	High
	Assertiveness	Low
	Independence	Low
Stress-management (4.33)	Flexibility	High
	Stress Tolerance	Low
	Optimism	High

On a 7 point Likert scale, scores less than 4 are treated as low score whereas greater than 4 are treated as high score.



Source: http://www.eiconsortium.org

Figure-1.Total EI



Source:http://www.ey.com/Publication/vwLUAssets/Nature-or-nurture/$FILE/Nature-or-nurture.pdf

Figure-2. DNA Model of Entrepreneurship

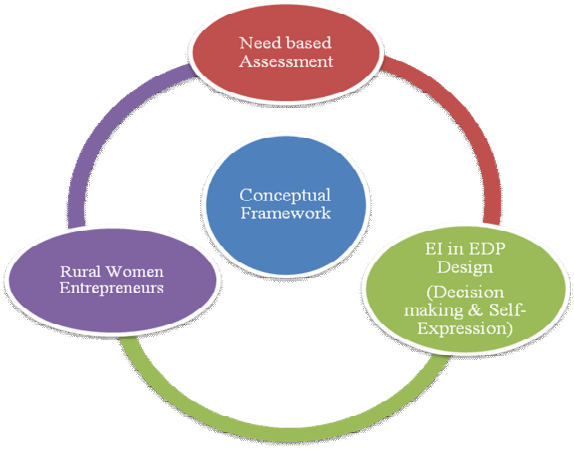


Figure-3. Conceptual Framework for Rural Women

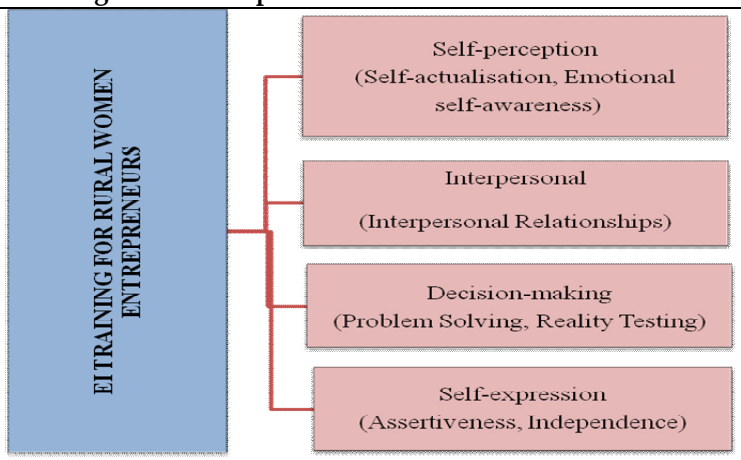


Figure-4. EI Training Module for Rural Women Entrepreneurs

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RESEARCH ARTICLE

A Study of the Gap between Expected and Perceived Quality of Life among the Elderly People in Odisha

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ABSTRACT

Aging is a natural process of life. The ageing of the population has become a dominant demographic characteristic of the 21st century. According to the Census of India 2011, the senior citizens constitute 8.6 per cent of the population and number 103.84 million in India. This population is expected to grow up to 173 million by the year 2026 and to 324 million by the year 2051. The percentage of senior citizens in the total population of Odisha is higher than the national average. In Odisha, the present proportion of 9.5 per cent of senior citizens is estimated to reach 13.8 per cent, numbering 62.69 lakh in 2026.The senior citizens in Odisha are not a homogenous group and special attention needs to be given to the complex variations and diversities within the senior citizen population. These figures indicate a demographic transition and it will consequently require policy interventions to help them have better quality of life. This paper aims to measure the gap between Expected and Perceived quality of life using the standardized questionnaire, OPQOL-35 as developed by Ann Bowling. OPQOL measures the Quality of life in 8 dimensions viz. 1) Life overall, 2) Health, 3) Social relationships, 4) Independence, control over life, freedom, 5) Home and Neighbourhood, 6) Psychological and emotional well-being, 7) Financial circumstances and 8) Leisure and activities. OPQOL-35 was used to measure both expected and perceived quality of life of the respondent. The analysis done using paired t-test shows that there is a significant difference between the Expected and Perceived scores of all the dimensions of QOL, except for the dimension Independence, control over life, freedom. The highest gap was found in Psychological and emotional well-being. These dimensions need to be addressed by the society.

Keywords: Quality of Life, Expected, Perceived, Gap, Senior Citizens, Policy

INTRODUCTION

Aging is a natural process of life. The ageing of the population has become a dominant demographic characteristic of the 21st century. Senior citizens are persons aged 60 years and above, as per National Policy on Older Persons (1999). According to the Census of India 2011, they constitute 8.6 per cent of the population and number 103.84 million in India. This population is expected to grow up to 173 million by the year 2026 and to 324 million by the year 2051. The proportion is expected to increase to 11 per cent in 2025 and reach 31.9 percent in the year 2100 as said in UN-DESA (2011) World Population Prospects: The 2010 Revision, Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat. These figures indicate a demographic transition. India becomes a special case as it is a developing country and a dramatic increasein the numbers of senior citizens will consequently require policy interventions on the socioeconomic front such as pension outlays, health care and housing among many others. Odisha is no exception to the demographic transition of population ageing both in numbers and proportion of the population. The percentage of senior citizens in the total population of Odisha is higher than the national average. The number of senior citizens has grown from 22.81 lakh in 1991 to 30.39 lakh in 2001 and 39.8 lakh in 2011.The present proportion of 9.5 per cent of senior citizens is estimated to reach 13.8 per cent, numbering 62.69 lakh in 2026.The senior citizens in Odisha are not a homogenous group and special attention needs to be given to the complex variations and diversities within the senior citizen population. Some features which are found in population of Senior citizens' of Odisha, as identified in the Odisha Senior Citizens Policy 2016, are Higher Rural Ageing, Regional Differences, Feminization of Ageing, Ageing of the Older Senior Citizens, Old Age Dependency, Economic Dependency, Living Arrangements, Senior Citizen Households in Poverty, Migration and Vulnerability Disability among Senior Citizens etc.

Social security has been made the concurrent responsibility of the Central and State Governments. There have been many policies framed from time to time by the government aiming at the well-being of older persons. The latest policies are Odisha Senior Citizen Policy 2016 and the National Policy on Ageing. The Policy visualizes that the State will extend support for financial security, health care, shelter, welfare and other needs of older persons, provide protection against abuse and exploitation, make available opportunities for development of the potential of older persons, seek their participation, and provide services so that they can improve the quality of their lives. Principal Areas of Intervention and Action Strategies are Financial Security, Health Care and Nutrition, Home, Welfare, Protection of Life and Property, Family etc. Ageing is characterized by progressive loss of adaptability (Evans, 2002). Usually, older people face diverse problems in their later lives, such as declining physical functions, increasing disability and chronic illnesses, changes in socio-economic status, social isolation and neglect,and loneliness (Victor, et al., 2000; Browning & Thomas, 2013). It is well recognized that these factors negatively influence Quality of Life (QOL) of the elderly. Longevity leads to increasing demands on health care. Hence, QOL is a very important aspect to examine for the well being of older people.

Quality of Life is a very complex concept. It is also a multi-dimensional concept (Farquhar, 1995; Bowling & Gabriel, 2004; Baernholdt, et al., 2012) and has been used to mean health status, physical functioning, symptoms, psychosocial adjustment, well-being, life satisfaction, and happiness (Ferrans, et al., 2005). Ferrans and Power (1992) defined QOL as a person's sense of well-being that stems from satisfaction or dissatisfaction with the areas of life that are important to him/her. WHOQOL Group (1993) defined QOL as individuals' perceptions of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards and concerns. In addition, quality of life is described as a wellness resulting from a combination of physical, functional, emotional and social factors. Bowling and Gabriel (2004) postulates that QOL is a multi-dimensional collection of objective and subjective areas of life, the parts of which can affect each other as well as the sum.

OBJECTIVE OF THE STUDY

The objective is to find whether there is a gap between Expected and Perceived quality of life of Elderly people. Further, this study would help us to identify the dimension of Quality of Life where there is a gap between the expected and perceived QOL. The society and government can then focus on those dimensions for improving upon the QOL of Elderly people.

METHODOLOGY OF THE STUDY

QOL was measured by the OPQOL-35 (Bowling, 2009; Bowling &Stenner, 2011). The Older People Quality of Life, OPQOL instrument comprised of 35 statements related to QOL under eight dimensions such as "life overall" (four items), "health" (four items), "social relationships" (five items), "independence, control over life and freedom" (four items), "home and neighborhood" (four items), "psychological and emotional well-being" (four items), "financial circumstances" (four items) and "leisure, activities and religion" (six items). The participants were asked to indicate their response by choosing 1–5 possible options from the Likert Scale.Questionnaire (OPQOL-35) was used to measure both expected and perceived quality of life of the randomly selected respondents. The gap was calculated between the expected score and the perceived score of these 35 questions. Average gaps for each of the 8 dimensions were calculated. Paired t- test was done on the scores of each of the 8 dimensions to find whether the difference between the expected and perceived was significant.

ANALYSIS OF THE STUDY

The Scenario of the Senior Citizen in Odisha, (as per the Odisha Senior Citizens Policy 2016)is shown in the following figures: The percentage of senior citizens in the total population of Odisha is higher than the national average (Fig.1). There is a steady rise in the population of senior citizens 80 years and above in Odisha as in the rest of the country . This section of the oldest senior citizens have specific age related needs, giving rise to specific policy challenges that are to be given serious attention in the coming years such as geriatric care services, health services, etc. There have been already policies in place by the Government of India, envisages State support to ensure financial and food security, health care, shelter and other needs of older persons to improve the quality of their lives.In India, 'Old age dependency ratio' is defined as the number of persons in the age group of 60 or more per hundred persons in the age groupof 15-59 years. In Odisha the old age dependency ratio is 14.1 per cent and higher than thenational average. (Fig. 2) The old age dependency ratio is higher for females at 14.5 per cent and even higher in rural areas at 14.9 per cent while the ratio in urban areas is 10 per cent. Data from the National Sample Survey on Condition of the Aged (Sixtieth Round) for Odisha shows that in Odisha 77 per cent women senior citizens and 32 per cent men senior citizens residing in rural areas and 80 per cent women senior citizens and 33 per cent men senior citizens residing in urban areas were economically fully dependent on others. The National Schemes and State Schemes for Senior Citizen are as follows:

- The National Policy for Older Persons 1999 With the objective to encourage individuals to make provision for their own as well as their spouse's old age; to encourage families to take care of their older family members; to enable and support voluntary and non-governmental organizations to supplement the care provided by the family etc.
- Central Sector Scheme of Integrated Programme for Older Persons (IPOP) The objective of this programme is to improve the quality of life of senior citizens by providing basic amenities like shelter, food, medical care and entertainment opportunities and by encouraging productive and active ageing through providing support for capacity building of Government/ Non-Government organizations /Panchayati Raj Institutions/ local bodies and the community at large. Under the scheme financial assistance up to 90 per cent of the project cost is provided to non-governmental organizations for establishing and maintaining old age homes, day care centers and mobile Medicare units.

- National Programme for Health Care for Elderly (NPHCE) This programme of the Ministry of Health and Family Welfare has the following objectives, viz, to provide an easy access to promotional, preventive, curative and rehabilitative services, to the elderly through community based primary health care approach, to identify health problems in the elderly and provide appropriate health interventions in the community with a strong referral backup support, to build capacity of the medical and paramedical professionals as well as the caretakers within the family for providing health care to the elderly, convergence with National Rural Health Mission, AYUSH etc.
- National Social Assistance Programme (NSAP) This programme is implemented by the Ministry of Rural Development under which Central assistance is given towards pension to senior citizens belonging to a household below the poverty line which is meant to be supplemented by at least an equal contribution by the State government. It presently comprises of the Indira Gandhi National Old Age Pension Scheme (IGNOAPS), the Annapurna, the Indira Gandhi National Widow Pension Scheme (IGNWPS), the Indira Gandhi National Disability Scheme (IGNDS) and the National Family Benefit Scheme (NFBS).
- Separate Rail Ticket Counters and Concessions The Ministry of Railways provides separate ticket counters at various passenger reservation system centersand also provides 30 per cent and 50 per cent concession in rail fare for male and female senior citizens respectively.
- Income Tax Exemptions The ministry of Finance exempts senior citizens from income tax as under:

i. For senior citizens above 60 years and above up to Rs. 2.50 lakh per annum

ii. For senior citizens above 80 years and above up to Rs. 5 lakh per annum

iii. Deduction of Rs. 20,000 under Section 80D is allowed to an individual who pays the medical insurance premium for his/her parent or parents who is a senior citizen

iv. An individual is eligible for a deduction of the amount spent or Rs. 60,000 whichever is less, for medical treatment of a dependent senior citizen

- Insurance Regulatory Development Authority (IRDA) The Ministry of Finance has instructed all general health insurance companies to allow senior citizens entry into health insurance schemes till 65 years of age; maintain transparency
- Pensions Portal In order to enable senior citizens to get information regarding the status of their application, the amount of pension, documents required, etc. Government of India has set up a portal.
- Concessions in Airlines The National Carrier, Air India provides concession up to 50 per cent senior citizens of 63 years and above in air fares.

Odisha State Government Schemes and Programmes

- **MadhuBabu Pension Yojana:** To compensate for the loss of earning capacity of citizens such as the elderly, diseased, invalid and widows and to protect them from impending destitution the State Government has instituted the MadhuBabu Pension Yojana. A monthly pension of an amount fixed by the Government from time to time is paid to each beneficiary. Over 22 lakhs persons are covered.
- **BarishtaNagarikaTirthaYatraYojana:** To give an opportunity to poor Senior Citizens of all faiths to go on a pilgrimage the Government of Odisha provides a complete tour package covering multiple destinations by rail travel including travel insurance, food, accommodation, road travel, tour escort, travel kit and medical facilities from medical professionals.

Analysis of the data collected

The respondents mostly perceived that enjoyed a good Quality of Life and for many others it was Alright. Very less percentage said they enjoyed very good life. 4 percent shared that their Quality of life was bad. None of them perceived their life to be very bad.The difference between the expected scores and the perceived scores of QOL was calculated. It was observed that the average gap was found to be highest, i.e. 0.89 in Psychological and emotional well-being, followed by the gap value of 0.8 in the dimension Social relationships. The average gap of 0.71 was found for the dimension Financial Circumstances. The elderly people had difficulty with respect to financial conditions in general. Most of them were partially or fully dependent on the other family members. The average gap was high also for Home and Neighbourhood. The lowest gap was observed for the dimension Independence, control over life,

freedom.The average gap between the expected and the perceived scores with regard to dimension Health was 0.4, because the respondents had a practical view with regard to their health. Almost all respondents were of the view that they expect their health in old age will not be as vibrant as in the youth.

Testing of Hypothesis

The following are the hypothesis proposed for the 8 dimensions of Quality of Life.

- H_01: There is no difference between the expected score and the perceived score of the respondents with regard to dimension Life overall.
- H_11: There is a difference between the expected score and the perceived score of the respondents with regard to dimension Life overall
- H_02: There is no difference between the expected score and the perceived score of the respondents with regard to dimension Health.
- H_12: There is a difference between the expected score and the perceived score of the respondents with regard to dimension Health.
- H_03: There is no difference between the expected score and the perceived score of the respondents with regard to dimension Social Relationships.
- H_13: There is a difference between the expected score and the perceived score of the respondents with regard to dimension Social Relationships.
- H_04: There is no difference between the expected score and the perceived score of the respondents with regard to dimension Independence, control over life, freedom.
- H_14: There is a difference between the expected score and the perceived score of the respondents with regard to dimension Independence, control over life, freedom.
- H_05: There is no difference between the expected score and the perceived score of the respondents with regard to dimension Home and neighbourhood.
- H_15: There is a difference between the expected score and the perceived score of the respondents with regard to dimension Home and neighbourhood.
- H_06: There is no difference between the expected score and the perceived score of the respondents with regard to dimension Psychological and emotional well-being.
- H_16: There is a difference between the expected score and the perceived score of the respondents with regard to dimension Psychological and emotional well-being.
- H_07: There is no difference between the expected score and the perceived score of the respondents with regard to dimension Financial circumstances.
- H_17: There is a difference between the expected score and the perceived score of the respondents with regard to dimension Financial circumstances.
- H_08: There is no difference between the expected score and the perceived score of the respondents with regard to dimension Leisure and activities.
- H_18: There is a difference between the expected score and the perceived score of the respondents with regard to dimension Leisure and activities.

The Hypothesis were tested by paired t-test at $\alpha = 0.05$. The results are as follows:

CONCLUSION

There are many policies made by the Government to provide better QOL to the elderly persons. But, yet there is a gap between what is expected and what is perceived by the elderly people in all the dimensions of Quality of Life, viz, “life overall”, “health” , “social relationships”, “home and neighborhood”, “psychological and emotional wellbeing”, “financial circumstances” and “leisure, activities and religion”, except for “independence, control over

life and freedom". This shows that government a lot is yet to be done by the family members, the neighbourhood, society and the government to provide a better quality of life to the Elderly persons.

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Table 1. Demographic Details of the Respondents

Gender	**Percentage**
Male	50%
Female	50%
Age Group	Percentage
65 to 70	60%
70 to 75	24%
75 to 80	6%
Above 80	10%
Family structure	Percentage
Alone	18%
Joint	48%

Nuclear	34%
Living with	Percentage
Son	40%
Daughter	8%
Son and Daughter	2%
Spouse	40%
Alone	10%
Economic Dependency	Percentage
Dependent	28%
Partially dependent	44%
Independent	28%
Quality of life	Percentage
Very Good	8%
Good	46%
Alright	42%
Bad	4%
Very Bad	0%

Table II

Dimension of QOL	Average Gap (Gap= Expected –Perceived)
Life overall	**0.5**
Health	**0.4**
Social Relationships	**0.8**
Independence, control over life, freedom	**0.26**
Home and neighbourhood	**0.66**
Psychological and emotional well-being	**0.89**
Financial circumstances	**0.71**
Leisure and activities	**0.35**

Table III

Life Overall	Variable 1	Variable 2	
Mean	**3.755**	**3.43**	Since, $P \leq \alpha$, reject H01. There is a difference between the expected score and the perceived score of the respondents with regard to dimension Life overall
Variance	**1.633140704**	**0.879497487**	
Hypothesized Mean Difference	**0**		
t Stat	**3.436973289**		
P(T<=t) one-tail	**0.000358085**		
t Critical one-tail	**1.652546746**		
P(T<=t) two-tail	**0.00071617**		
t Critical two-tail	**1.971956544**		

Table IV

Health	**Variable 1**	**Variable 2**	
Mean	**3.575**	**3.185**	Since, P ≤ α, reject H02. There is a difference between the expected score and the perceived score of the respondents with regard to dimension Health
Variance	**1.552135678**	**1.186709**	
Hypothesized Mean Difference	**0**		
t Stat	**4.10306483**		
P(T<=t) one-tail	**2.97182E-05**		
t Critical one-tail	**1.652546746**		
P(T<=t) two-tail	**5.94365E-05**		
t Critical two-tail	**1.971956544**		

Table V

Social Relationships	**Variable 1**	**Variable 2**	
Mean	**4.46**	**3.716**	Since, P ≤ α, reject H03. There is a difference between the expected score and the perceived score of the respondents with regard to dimension Social Relationships
Variance	**0.46626506**	**1.280466**	
Hypothesized Mean Difference	**0**		
t Stat	**12.52594859**		
P(T<=t) one-tail	**1.53037E-28**		
t Critical one-tail	**1.650996152**		
P(T<=t) two-tail	**3.06074E-28**		
t Critical two-tail	**1.969536868**		

Table VI

Independence, control over life, freedom	**Variable 1**	**Variable 2**	
Mean	**3.8**	**3.66**	Since, P is not ≤ α, do not reject H04. There is no difference between the expected score and the perceived score of the respondents with regard to dimension Independence, control over life, freedom
Variance	**1.507537688**	**1.28080402**	
Hypothesized Mean Difference	**0**		
t Stat	**1.334420971**		
P(T<=t) one-tail	**0.091795411**		
t Critical one-tail	**1.652546746**		
P(T<=t) two-tail	**0.183590823**		
t Critical two-tail	**1.971956544**		

Table VII

Home and Neighbourhood	Variable 1	Variable 2	
Mean	**4.445**	**3.845**	Since, P ≤ α, reject H05. There is a difference between the expected score and the perceived score of the respondents with regard to dimension Home and Neighbourhood
Variance	**0.660276**	**1.19696**	
Hypothesized Mean Difference	**0**		
t Stat	**199**		
P(T<=t) one-tail	**9.180542**		
t Critical one-tail	**2.81E-17**		
P(T<=t) two-tail	**1.652547**		
t Critical two-tail	**5.63E-17**		

Table VIII

Psychological and Emotional Well-being	Variable 1	Variable 2	
Mean	**4.295**	**3.52**	Since, P ≤ α, reject H06. There is a difference between the expected score and the perceived score of the respondents with regard to dimension Psychological and emotional well-being
Variance	**0.651231156**	**1.054874**	
Hypothesized Mean Difference	**0**		
t Stat	**14.68339298**		
P(T<=t) one-tail	**7.45606E-34**		
t Critical one-tail	**1.652546746**		
P(T<=t) two-tail	**1.49121E-33**		
t Critical two-tail	**1.971956544**		

Table IX

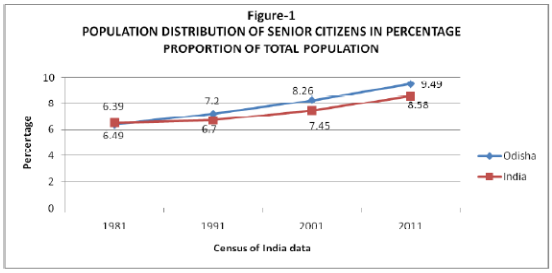
Financial Circumstances	Variable 1	Variable 2	
Mean	**3.7**	**3.18**	Since, P ≤ α, reject H07. There is a difference between the expected score and the perceived score of the respondents with regard to dimension Financial Circumstances
Variance	**1.547738693**	**1.575477387**	
Hypothesized Mean Difference	**0**		
t Stat	**4.307852615**		
P(T<=t) one-tail	**1.29422E-05**		
t Critical one-tail	**1.652546746**		
P(T<=t) two-tail	**2.58843E-05**		
t Critical two-tail	**1.971956544**		

Table X

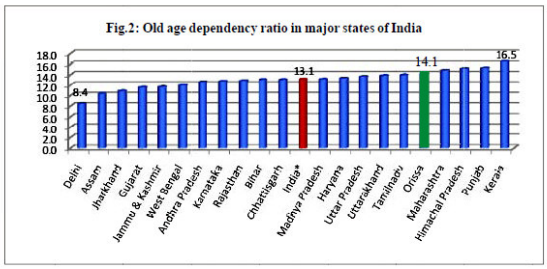
Leisure and activities	Variable 1	Variable 2	Since, P ≤ α, reject H08. There is a difference
Mean	**4.083333333**	**3.833333333**	

Variance	**1.193701226**	**0.995540691**	between the expected score and the perceived score of the respondents with regard to dimension Leisure and activities
Hypothesized Mean Difference	**0**		
t Stat	**4.752165987**		
P(T<=t) one-tail	**1.56535E-06**		
t Critical one-tail	**1.649965767**		
P(T<=t) two-tail	**3.13E-06**		
t Critical two-tail	**1.967929669**		

Note: As shown in Table no. 3 to Table no. 9, all the dimensions showed a significant difference, at $\alpha = 0.05$, between the expected score and the perceived score of QOL expect for the dimension Independence, control over life, freedom.



Source: Primary Data



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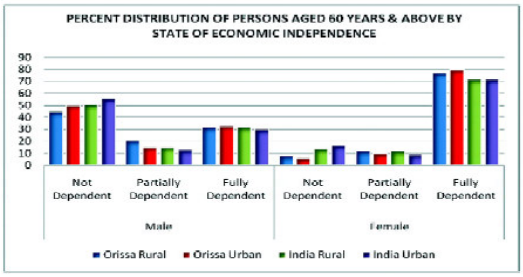

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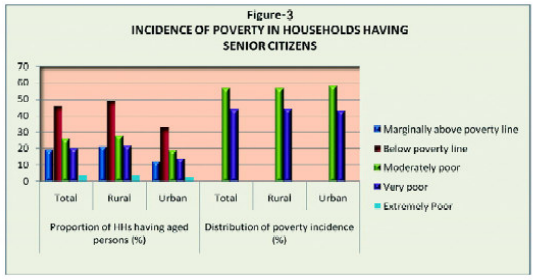

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RESEARCH ARTICLE

Tamper Proof Metering System

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ABSTRACT

It's difficult to imagine the world without electricity. Therefore, there is a need for legitimate use of energy. This won't be possible as long as current theft occurs. Hence there is a need to implement a successful power theft detection module. This paper presents a solution to the theft of electricity at a remote location. Base of the detection of theft is a concept of Differential Protection System. This will be helpful for different option for detection of electricity theft, they are theft location, getting an alarm of theft and cut off of power supply.This review also covers some of the existing challenges in its implementation and its potential applications.

Keywords: Current transformer (CT), Miniature circuit barker (MCB), Potential transformer (PT)

INTRODUCTION

The modern power system (PS) is a complex interconnected network which can generally be split into four important parts: generation, transmission, sub-transmission, distribution and loads. Due to the complex nature of PS, it is necessary to continuously monitor and protect its elements in order to avoid major contingencies as well as protect power theft. In the last two decades were a result of deviation in power flow, frequency, and voltage. Incomplete monitoring resulted in mis operation of protection devices and improper control techniques which leads to millions of customers out of electricity and billions of rupees of losses in the economy. Odisha currently is estimated to have 1.04 crore households with 56% electrification as on March 2015. The daily household consumption for rural is 2.19 units/ day and for urban it is 4.42 units/day in Fiscal Year 2015. The same has been projected to 2.67 units/day for rural and 5.60 units/day for urban household by Fiscal Year 2018-19. The total power available to the state is around 5,600 MW during Fiscal Year 2015 which is expected to increase to 89201 MW by Fiscal Year 2019 .There are four Distribution Companies serving electricity consumers in Odisha i.e.; CESU, NESCO Utility, WESCO Utility and SOUTHCO Utility. They are currently serving more than 54lakh consumers. Odisha suffers an annual loss to the of Rs 800 crore due to transmission and distribution loss as well as power theft. This paper focuses on an in-depth review of electricity theft of metering consumers of houses, factories, industries etc.

Electricity theft protection technology

Basic Principle

One CT is connected at the input point of line and second is connected to the output line of the meter and both the CT outputs are connected to a controller. In the controller we make a comparison in between the two CT by writing program and if there is an imbalance then there will some activity will happen simultaneously. A timer will get activated, which will track the imbalance for 10 minutes and after the predefined time (10 min) the power will cut off to the particular load and a message will be send to the service provider with the details of location.

Block Diagram of the Process

CT

A current transformer has a primary winding, a core and a secondary winding, although some transformers, including current transformers, use an air core. While the physical principles are the same, the details of a "current" transformer compared with a "voltage" transformer will differ owing to different requirements of the application. A current transformer is designed to maintain an accurate ratio between the currents in its primary and secondary circuits over a defined range. Split-core current transformers either have a two-part core or a core with a removable section. This allows the transformer to be placed around a conductor without having to disconnect it first. Split-core current transformers are typically used in low current measuring instruments, often portable, battery-operated, and hand-held

Energy Meter

An electricity meter, electric meter, electrical meter, or energy meter is a device that measures the amount of electric energy consumed by a residence, a business, or an electrically powered device. Electric utilities use electric meters installed at customers' premises for billing and monitoring purposes. They are typically calibrated in billing units, the most common one being the kilowatt hour (*kWh*). They are usually read once each billing period. When energy savings during certain periods are desired, some meters may measure demand, the maximum use of power in some interval. "Time of day" metering allows electric rates to be changed during a day, to record usage during peak high-cost periods and off-peak, lower-cost, periods. Also, in some areas meters have relays for demand response load shedding during peak load periods.

PT

The potential transformer may be defined as an instrument transformer used for the transformation of voltage from a higher value to the lower value. This transformer step down the voltage to a safe limit value which can be easily measured by the ordinary low voltage instrument like a voltmeter, wattmeter and watt-hour meters, etc.

LCD Display

A liquid-crystal display (LCD) is a flat-panel display or other electronically modulated optical device that uses the light-modulating properties of liquid crystals combined with polarizers. Liquid crystals do not emit light directly, instead using a backlight or reflector to produce images in colour or monochrome.

GSM Module

A GSM module or a GPRS module is a chip or circuit that will be used to establish communication between a mobile device or a computing machine and a GSM or GPRS system

Architecture, Standards and Data Processing

Circuit Architecture

Here CT is the main input sensor for detecting the differences in between the input and output and the signalsare feed to controller for detection. Whenever there is a difference in the values of the CT the controller will trigger the GSM to send a message to the service provider as well as it will cut off the power.

Measurement Layer

Measurement layer consists of current transformers (CTs) and potential transformers (PTs), analog units and MPUs. MPUs have a GPS with them to location stamp the data and they are send tothe electricity provider

Application of the Tampered Proof Meter

It can be used where ever there is a energy meter. It can be replaced with the old ones and the installation process will not be a difficult process to implement.

- It can be used in houses
- It can be used in industries.
- It can be used factories.
- It can be used in hospitals.
- It can be used in offices.

CONCLUSION

This paper provides an in-depth literature review of Tampered Proof Meter, its architecture, placement techniques and applications in distribution systems. The review also presents potential research areas techniques and Tampered Proof Meter applications in distribution systems. MPUs are deployed in large number in distribution networks but with the addition of more Tampered Proof Meter resources, they are will become popular in the distribution system. Most of the applications presented in this paper are currently in testing mode to be useful in the electric power industry. These applications use data analytics and machine learning algorithms for power systems security and resilience. With Tampered Proof Meter, the benefits gained in terms of reliability, resiliency and operational efficiency of the grid justifies its instalment. It is expected that with further proliferation of data resources Tampered Proof Meter can perform many of the aforementioned tasks with more accuracy and reliability.

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Data Collection Layer

Instants	CT1 data	CT2 data	GSM message	Status	Control relay	Output
1	1.37	1.35	None	Active	NC	ON
2	1.37	0.78	Theft in the connection	De-active	NO	OFF

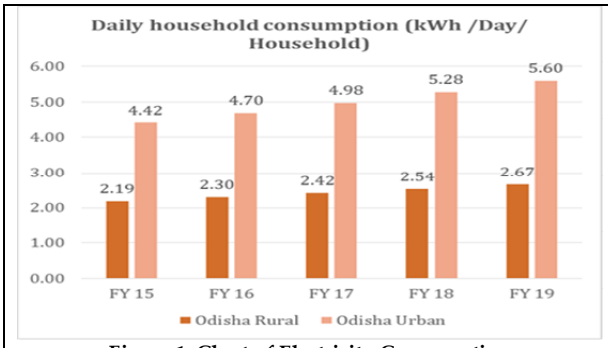

Figure 1: Chart of Electricity Consumption

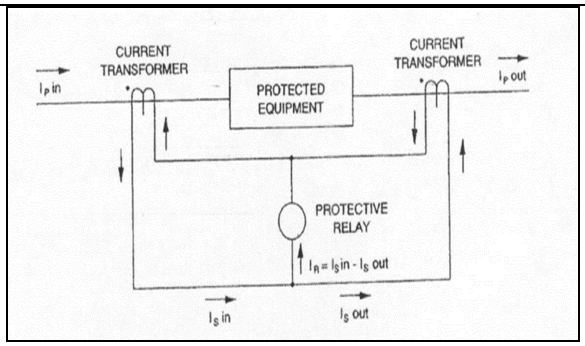

Figure 2: Differential Protection System in the Electricity Supply System

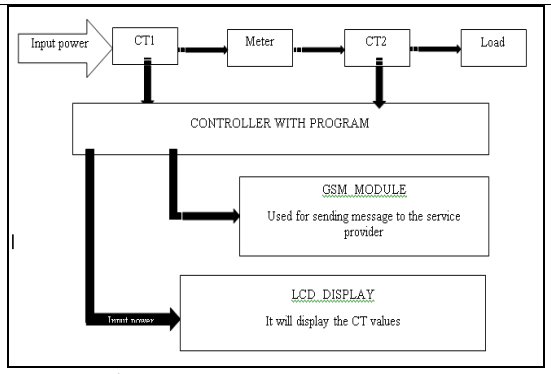

Figure 3. Block diagram of the process

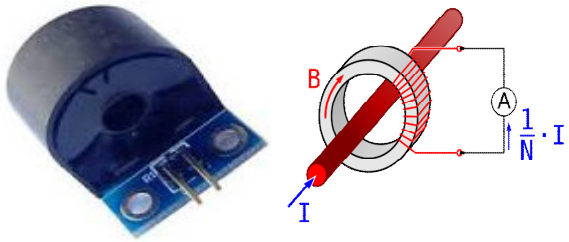

Figure 4 : Current transformer

Figure 5: Energy Meter

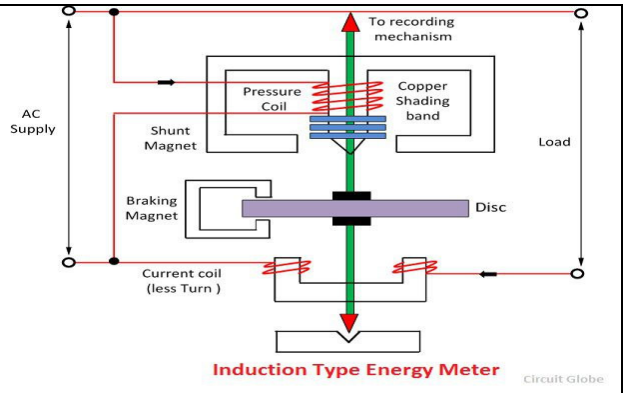

Figure 6: Induction Type Energy Meter

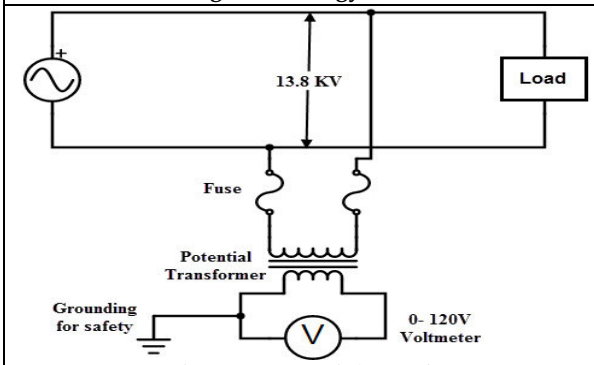

Figure 7: Potential transfer

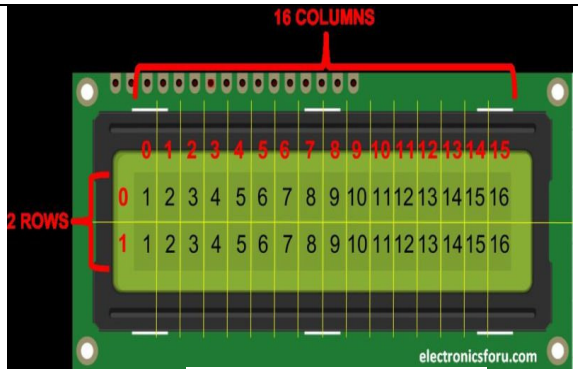

Figure 8:liquid-crystal display (LCD)

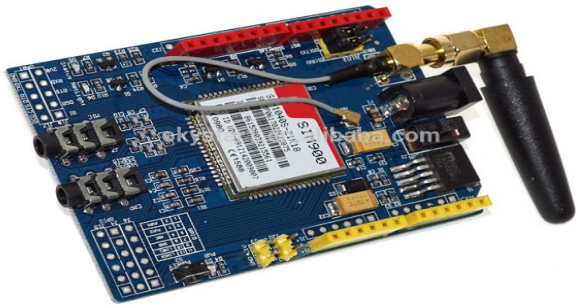

Figure 9:liquid-crystal display (LCD)

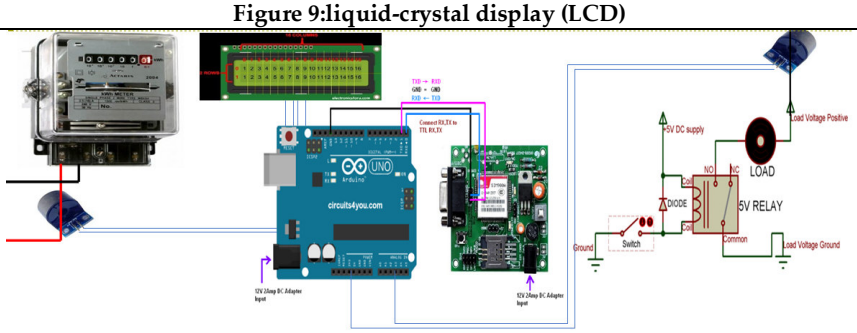

Figure 10:Circuit Diagram

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REVIEW ARTICLE

Review on Solar Parabolic Collector with Thermoelectric Generator

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ABSTRACT

Due to increase in population day by day, the demand of energy for fulfilling different necessity of human being also substantially increases. In order to meet the demand of energy, the dependency on fossil fuel also increase which results in depletion of fossil fuel and more pollution in environment. As a result of which many development is going on with Renewable energy. As renewable energy is clean, safe for environment, it is given much importance now days. Solar energy is one of the promising parts of renewable energy which is plentiful available and can be utilised to meet energy demand. In this article emphasis is given particularly on solar parabolic collector and various techniques to enhance the efficiency of the collector.

Keywords: PTC, Fresnel lens, Thermoelectric Generator, HTF

INTRODUCTION

The parabolic trough concentrators are used in many countries. Solar parabolic trough collector and its dominance in industrial and commercial aspect for medium temperature handling solar collectors are clearly visible in 20th Century. Parabolic collectors and dish collectors are having large demand now .The solar receiver is the important component of parabolic trough collectors. We can find some applications of solar energy in solar power plants, solar water heaters etc which is used to generate heat energy from solar energy. High efficiency solar energy concentrators are now gaining the attention of researchers to meet the necessity of energy demand. Anissa Ghomrassi et al. analysed performance of PTC by adopting two methods. In first method, SOLTRACE was used to calculate solar heat flux and Second method CFD was used to optimise the receiver tube performance. A new receiver tube was proposed which was covered with different diameters metallic layers. Temperature of working fluid increases with diameter of tube but radiation loss also increases. This disadvantage of increased radiation heat loss lead to the new design of receiver tube by transferring the same flow rate as adopted in first design [1].

Jiangfeng Guo et al.showed parabolic trough solar receiver performance was affected by mass flow rate of HTF, wind velocity, ambient temperature and angle of solar incident on receiver tube. The convective heat loss was obtained more than solar receiver heat loss. It was also noticed that exergy loss was the highest. It was investigated that optical heat loss was more than the heat loss obtained from solar receiver. Optical heat loss was also largely dependent on solar incident angle [2]. Jinmei Liu et al. showed the key factors in parabolic trough collector receiver, ie vaccum lifetime and characteristics. Due to the loss of vacuum inside the receiver, heat loss increases rapidly. Heat loss was 4 times more in receiver if hydrogen was used instead of vacuum. To enhance the performances, vacuum and residual gases were maintained properly. In this article, it was observed that nitrogen must be eliminated in advance so that vacuum life time of receiver was calculated properly [3].

Liangdong Ma et al. showed the solar collector with a two-layered glass evacuated tube & the absorber film. In outer surface of the absorber tube, absorber film was mounted. The analysis was made on the presence of air between absorber tube and cupper fin, heat loss coefficient of the collector, ambient temperature of air and absorber coating surface temperature. These were the significant factors to calculate the performance of the evacuated glass collector [4]. Jili Zhangal et al. explained Single U tube filled evacuated Tube and Double U tube filled evacuated Tube model. DUFET was analysed with help of theoretical analysis and experimental study. DUFET was utilised to enhance the heat transfer area as a result of which heat transfer efficiency of collectors got improved. The experimental results revealed the comparative study between SUFET and DUFET. Feasibility and Validation model was also examined [5].

Jili Zhangal et al. showed the importance of heat transfer efficiency of solar collector in solar heating and cooling models. In this article, U Tube filled evacuated tube collector was presented to reduce the thermal resistance between the absorber tube and the copper fin and to increase thermal efficiency of solar collector. The model was built with different u tube structures with various boundary conditions. The thermal three types of UFET were examined theoretically and experimentally for their thermal performance [6]. Rim Farjallahet al developed a three-dimensional numerical model. Model was designed to study the efficiency of the solar collector. The validity of the CFD model was compared with experimental analysis of different literatures. Different parameters like fluid mass flow rate, and the material properties were given importance. Evacuated tube filled with graphite gave good result than copper fin tube [7].

Liang Zhang et al performed experiment on a double glazing U tube receiver filled with vacuum. Overall heat losses from receiver were calculated by analyzing wind speed, vacuum glass tube, radiation [8]. Mohammed Halimi et al. conducted experiment with PTC using U shaped heat exchanger .The experiment was done in normal solar radiation. The study was concentrated on the effect of focal length, absorber diameter on performance of collector. It was also conclude that U tube positioning determines the variation in heat loss. Guiqiang Li et al. analysed the use of micro-channel heat pipe which can produce high heat flux from low heat flux. I t can be achieved by changing the area of evaporator and condenser .They introduced thermo electric generator with micro heat pipe. As a result of which performance was better and cost was reduced [10].

K.S. Ong et al. analysed solar collector fitted with thermoelectric modules, evacuated heat tubes, condenser to analyse electrical efficiency. The experimental set up consists of solar collector where heat was absorbed in evaporators. Experiments were conducted in ambient condition. In evacuated tube one inner and one outer glass tube was present. Aluminium fins were attached with inner glass tube. One heat pipe was inserted in the inner glass tube and aluminium fins were attached to the heat pipe. Thermoelectric generator was mounted in the condenser with water jackets [11]. Alibakhsh Kasaeian et al presented a model where parabolic trough collector was united with thermoelectric generator and photovoltaic cell. Researchers also relied on MAT LAB to study the effect of solar radiation and ambient conditions on system performance. Efficiency of collectors, thermoelectric generators and photovoltaic cell were analysed.

Lingkun Liu et al analysed a numerical model of solar collector .The model was designed in 3D. The temperature of solar cells, fluid outlet temperature was calculated for the model. Thermal and A. Abbas Nejad et al. investigated experimentally the effect of fresnel lens and thermoelectric generator to produce electrical power. Thermo electric generator transferred absorbed heat from solar energy to water reservoir. One side of thermoelectric generator was heated and another side was cooled. Due to this temperature difference, electric power was generated [14]. H. Zhai et al studied the solar collector of concentrating type with Fresnel lens. Due to the use of Fresnel lens, improvement in thermal efficiency was found out than normal evacuated type or flat plate solar collectors [15]. The flowchart mentioned below represents the literature gap found after going through various articles. This is a systematic approach of designing a new model for solar parabolic collector which can increase the thermal efficiency by incorporating Thermo electric generator and Fresnel lens.

CONCLUSION

Parabolic trough collectors are widely used now –a-days due to its medium temperature working conditions. In this article, the effort was taken to represent various techniques to improve the performance of solar parabolic trough collectors. From various literatures, different techniques are represented to minimise the radiation loss. Radiation shields are used for high temperature fluid. Instead of radiation shield, thermoelectric generators are taken into consideration for better performance. Thermoelectric generator with Fresnel lens helps in increasing the efficiency of PTC. Therefore, experimental set up is proposed with a noble design of PTC incorporated with thermoelectric generator and Fresnel lens.

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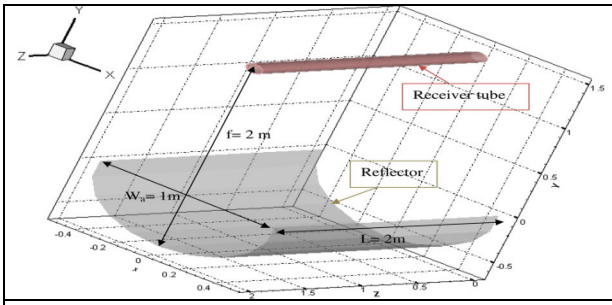

Fig. 1. Schematic diagram of Parabolic trough collector [1].

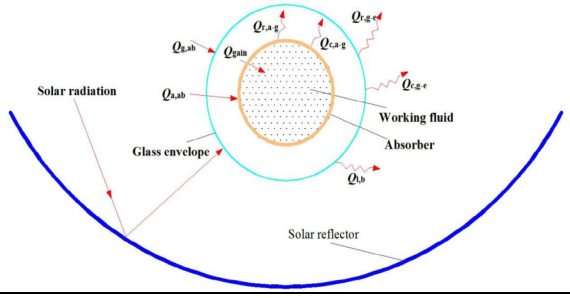

Fig. 2 The energy balance for solar receiver [2].

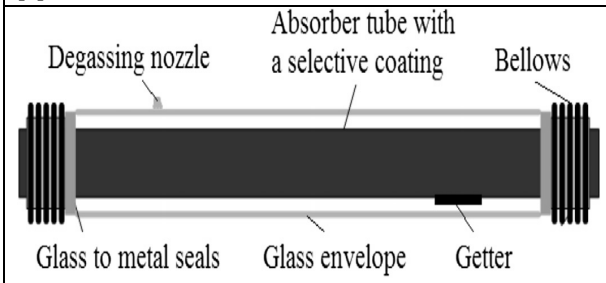

Fig.3 Schematic of a typical parabolic trough receiver [3].

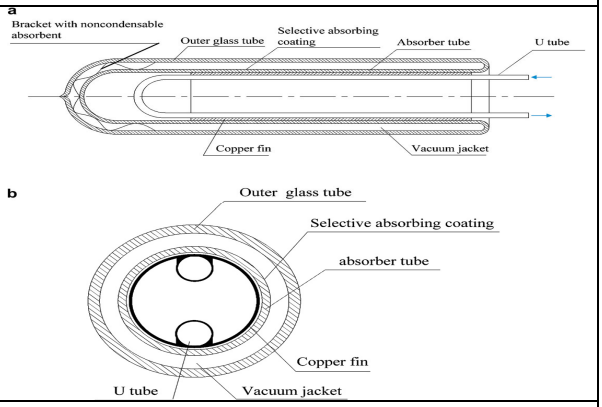

Fig. 4 (a) Illustration of the glass evacuated tube. (b) Cross Section [4].

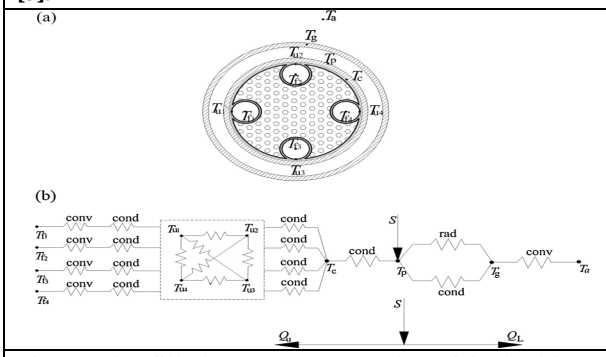

Fig. 5 The filled-type vacuum tube with double U-tubes (a) physical model, (b) thermal network of the filled-type vacuum tube [5].

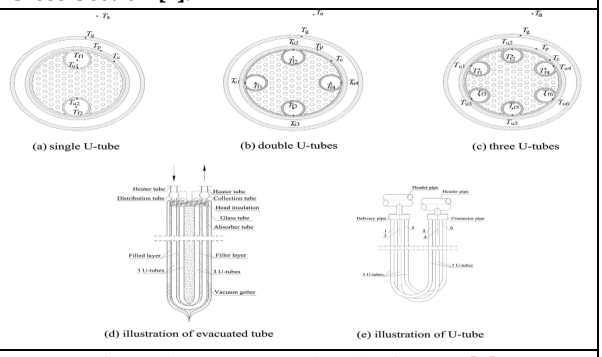

Fig 6. The structure sketch of UFET [6].

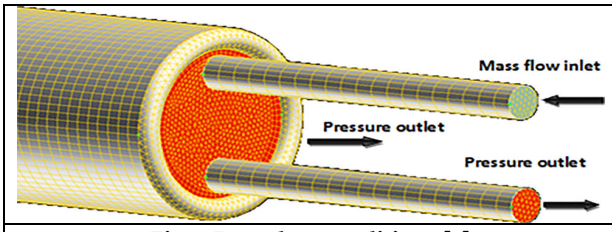

Fig 7. Boundary conditions [7].

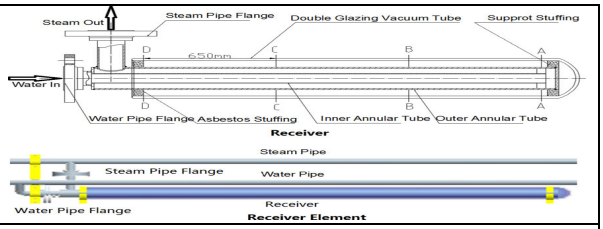

Fig 8. Structure of the U-type heat pipe solar receiver [8].

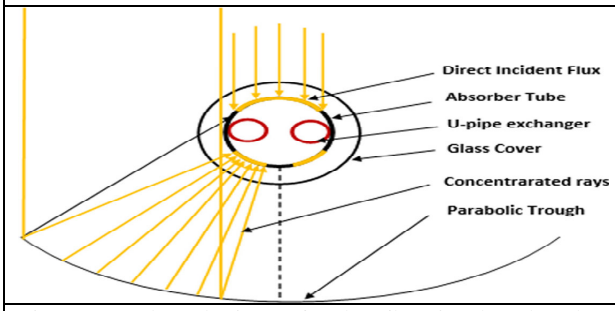

Fig 9. Developed view of solar flux in the absorber circumferential [9].

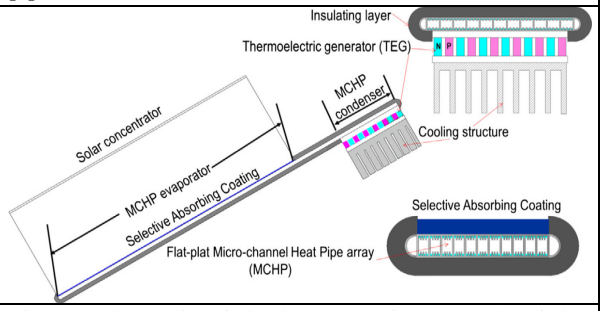

Fig 10. Schematic of the heat transfer network of the STEG-MCHP [10].

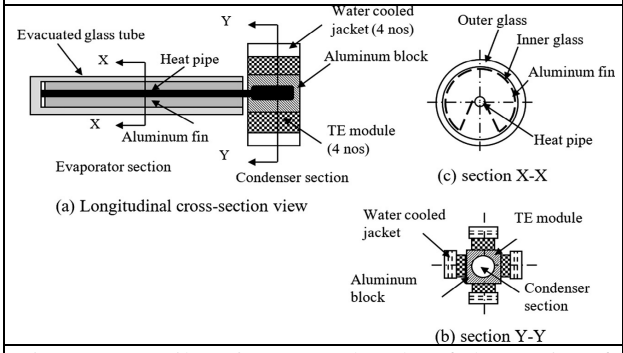

Fig. 11. Details of proposed solar / heat pipe / thermoelectric hybrid [11].

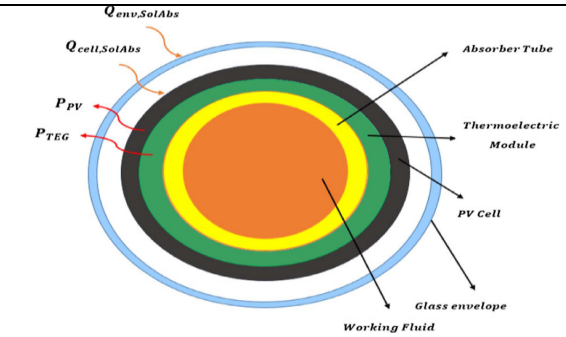

Fig 12. Cross-sectional view of the evacuated tube

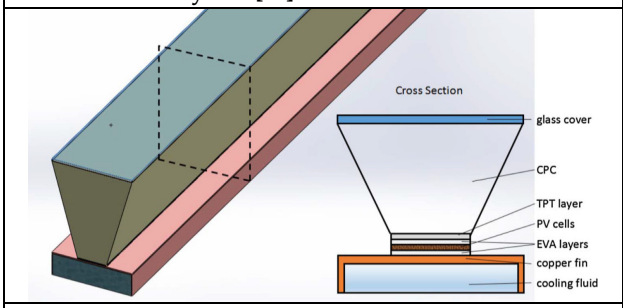

Fig 13. The simplified thermal model for calculation [13].

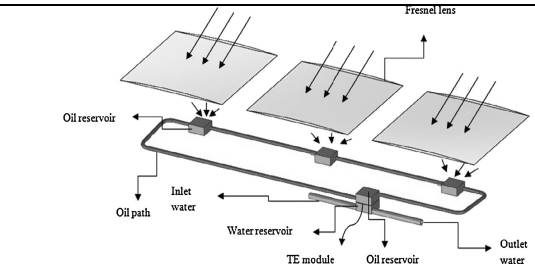

Fig 14. Schematic of the proposed design [14].

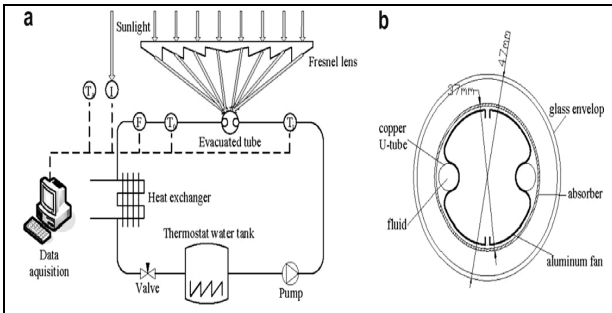

Fig 15. (a) Diagram of the test rig. (b) Cross section of evacuated tube absorber [15].

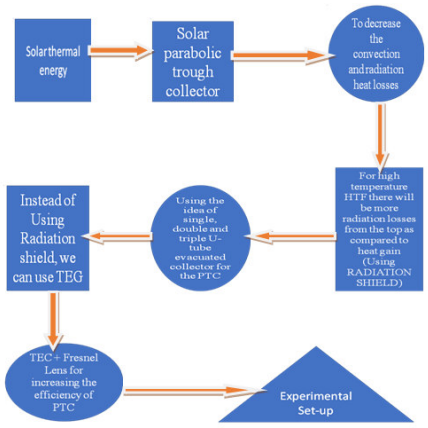

Fig.16. Flowchart - literature gap found after going through various articles

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RESEARCH ARTICLE

Preparation of Bio ethanol from Bamboo

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ABSTRACT

Bio-ethanol is a part of renewable energy which gives alternative to petroleum fuel. It is gaining popularity as it is a clean energy which helps environment to get cleaned and less polluted. Bioethanol can be produced from feedstock, biomass. In this article, effort has been taken to produce bioethanol from bamboo powder of different grain size. Three grain size of 45,125 and 250 microns are considered. From 45 micron grain size 134 ml, from 125 micron grain size 205 ml and from 250 micron grain size 220 ml bioethanol is produced respectively.

Keywords: Bamboo bioethanol, Rotary evaporator, Centrifuge Tubes

INTRODUCTION

Ning et al explained production of biodiesel with the use of microwave heating system. Bamboo-based heterogeneous acid catalyst is prepared by partial carbonization followed by sulfonation. This is utilized in esterification of oleic acid with methanol for biodiesel production [1]. Badwal et al presented various types of direct ethanol fuel cells which are currently under development. Emphasis was given on various sources of ethanol and their production methods [2]. Yang et al investigated method to produce more bioethanol form bamboo with the help of alkaline hot water [3]. Ganesan et al presented production of bamboo bioethanol using the simultaneous saccharification and fermentation process with cellulase enzyme and a thermotolerant yeast *Kluyveromyces marxianus* TY16 for efficient conversion [4]. Kuttiraja et al presented potential process to produce 143 L of ethanol per dry ton of bamboo process waste due to enzymatic saccharification. And dilute alkali pretreatment of the biomass [5]. Baeyens et al presented economic assessment, which showed production costs not only depended on the extent of applying process improvements, but also on the raw material used in the process [6]. Chakraborty et al assessed different biomass supported catalysts in terms of their efficacy in biofuel synthesis from various biomass feedstocks under varying process conditions [7]. Wang et al used acidic steam explosion to prepare bamboo chips as well as

alkaline steam explosion, bleached and unbleached kraft pulps. For the saccharification of pretreated bamboo biomaterials, cellulase formulations were applied with three dosages: 2, 6, 12 percents weights to dried pulps. [8].Chin et al reviewed to highlight the potential of bamboo as an alternative source of bioenergy production, particularly in a Malaysian context, with emphasis on the concepts, pretreatment, and conversion technologies [9].

METHODOLOGY

Material Processing*:* The raw bamboo was cut into standard size of 30 cm. The bamboo was then powdered and weighed, both individually and together.

Grain Size Calculation: The procured bamboo power was poured into the sieve separator to get rid of impure and obtain fine particles that could be used for the experiment. Grain sizes were obtained in all micro-metre and were 45um, 125um, 250um and 500um respectively. The first three samples were used to conduct the experiments. Brushes were used to transfer the separated grain samples into plastic polythene bags labeled with separate weights and sizes and the finest three (45um, 125um and 250um) samples were taken for the purpose of experimenting in the laboratory.

Rinsing and Washing: The bamboo powder was rinsed at 40 °C with distilled water. Weight of the wet bamboo was recorded. Bamboo powder was dried for 10 hours at 100 °C.

Heating in Furnace: The experiments were conducted in furnace. For each experiment, 1.50 g bamboo powder along with 50 mL solvent (Methanol+ Solvent) and catalyst (formic acid) mixture were used in the furnace. For preparation of Bio Ethanol using methanol solution, a ratio of 70:30 is taken where 70 parts of water is mixed with 30 parts of methanol. A combination of Magnetic Stirrer and Furnace/Oven was used to reach the required temperature for heating the sample at 170 degrees before being centrifuged.

Centrifugation: The samples are poured into Centrifuge tubes for 20 minutes at a certain speed (RPM) and allowed to be rotated. This process is done to separate the solid and liquid particles from solution.

RESULTS AND DISCUSSION

A solution of 100ml methanol resulted in a yield of 134ml at a temperature of 140 degrees. A solution of 100ml Methanol resulted in a yield of 205ml at a temperature of 170d egrees. A solution of 100ml Methanol resulted in a yield of 220ml at a temperature of 190 degrees. From the above observations we conclude that an increase of temperature more % yield obtained.

CONCLUSION

Bamboo is a woody grass which is sufficiently available in India and has good cellulose content which is used to produce bioethanol. In this article, effort has been made to collect the raw bamboo. It is dried and cut into various pieces of 30 cm and the powder form of bamboo is collected from these bamboo pieces. Three different grain sizes of bamboo powders are collected and with variation of temperature the production of bamboo bioethanol varies. Bamboo powder with grain size of 250 micron and at 190°C temperature in hot oven, highest production of bamboo bioethanol is achieved.

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Table.1. Distribution of grain size and weight

Sl. No.	Grain size (in microns)	Total weight (in gms)	Used weight for experiment	Weight after Washing	Weight after drying	Yield
1.	45	71.28	25	51.47	27.83	134
2.	125	68.59	25	53.91	25.16	205
3.	250	83.74	25	56.98	26.16	220

Table.2. Effects of Temperature on the Yield %:

Observation	Temperature (in Degree C)	Yield (ml)
1	140	134 (Ethanol)
2	170	205 (Methanol)
3	190	220 (Methanol)

Fig.1: The total sample weighed about 194 grams.

Fig.2: The bamboo powder in the Sieve Strainer for the purpose of grain separation.

Fig.3: The bamboo power was then weighed, both individually and together.

Fig.4: Samples separated after being weighed.

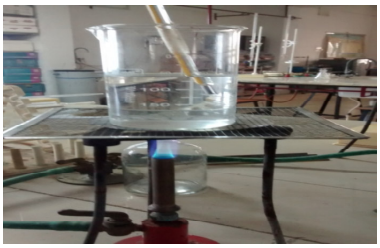

Fig.5: Specimen being washed in distilled water at 50 degree Celsius.

Fig.6: Samples collected into trays before being placed into the furnnace

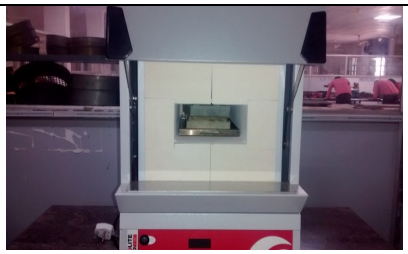

Fig.7: Samples placed inside the furnace

Fig.8: Samples taken out from reactor/furnace.

Fig.9: Samples taken post being heated up to 170 degree Celsius.

Fig.10: Samples after being centrifuged.

Fig.11: Rotary evaporator in running.

Fig.12: Collection Jars of 125ml capacity each.

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RESEARCH ARTICLE

Design and Fabrication of Smokeless Chulah

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ABSTRACT

Many women in rural India spends several hours a day cooking over an indoor open stove. This leads to increase the pollution in the environment also. Smokeless Chullah is an interesting concept to distribute among rural India women. In this article, initiatives were to design, develop and test a solution, able to reduce indoor pollution. Apart from the type and quality of the fuel used, design of the cook stove chamber is the deciding factor for the associated emission causing by the fuel combustion.

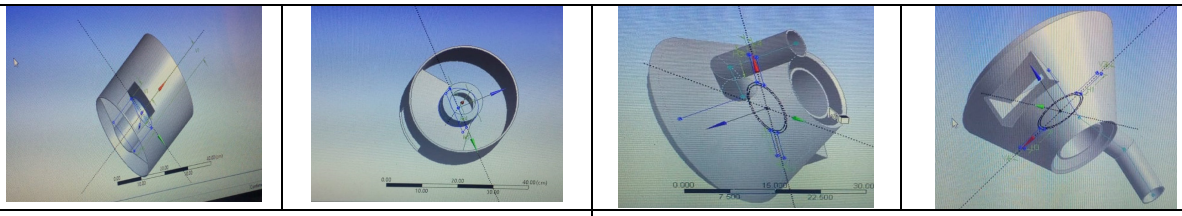
Keywords: Smokeless Chulah, Catia, Fabrication

INTRODUCTION

Rawlani et al. proposed a LOW SMOKE Multipurpose Chulha to increase heat utilization for the same mass of the fuel as compare to traditional chulah [1] .Bantu et al. designed and fabricated an improved charcoal stove using high density rocks and heat retaining techniques [2].Mishra et al designed and evaluated grill for roasting green maize cobs for saving in fuel. The improved smokeless biomass grill has been used for cooking food, boiling water and roasting/baking of vegetables and other [3]. Gregory L Simon investigated `dual adoption analytic framework' find out two technology innovation programs in Western India. This framework underscores the collaborative nature of technology mobilizations and how power is distributed across partnerships at different stages of the development process [4]. Das et al emphasized the challenges to use of smokeless chulha and suggested implementation strategy for large scale use of it [5]. Sharma et al. explained the importance of smoke less chulah for rural environment of India [6]

DESIGN, FABRICATION AND TESTING

We have gone through many products available in our market and took a reference or base for our project. The design should be feasible and economical so that it can go in the hands of common public or people lives in rural belt. We first design the product using Ansys. We also digitally analyzed it. We have done two designs and then chose one of them as our choice.



DESIGN-1 **DESIGN-2**

After a some discussions we have decided to go with the first design as it is feasible for us and will be economical to manufacture. We have taken out some analytical data from design.

MATERIALS AND TOOLS USED

Now it was time for fabrication so we started research on the materials that will be used. We have decided to take a market product as reference. After going throw this existing product we have got an idea about the materials and methods like

- Mild steel as the metal for body
- Glass wool for insulation
- Plaster of Paris for insulation for the base
- Allen Keys bolts .

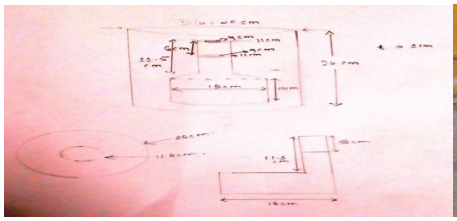
Fabrication

STEPS

1. First we bought the Mild Steel metal and bent it to for a cylinder and we cut a hole it that for putting the wood inside the furnace.
2. We cut two circular plates one equal to the dia of cylinder and other little less.
3. We cut a hole in same radius plate and also both a think iron place a cut a hole of same radius as plate. On the top plate the chimney was welded out.
4. Drills are drawn taking measurement from clamps of radius 7 mm on plate and 5mm on clam. Then the thread was drawn in clam using taping of M6
5. All the parts are join together using Allen key and glass wood was used for insulation. Plaster of pairs was placed in the base of furnace for insulation.

Step1:

The first step in fabrication is to do a sketch of the project with the dimensions the required to be manufactured.




Now we have to bring a Mild steel sheet of appropriate dimension to start fabricating. So we brought a Mild steel mental of 2mm thickness and length 17*70cm dimension.

Step 2

Now the sheet mental is being cut to required length equal to the diameter of the cylinder that need to be manufactured. Now that metal is bent using sheet metal bending machine. Then the bent sheet metal was welded to form a final cylinder.


Step 3

Now we have cut 2 circular sheets from the sheet metal using gas cutting , one sheet with same dia to cylinder and the other one little less so that in can go inside the cylinder. Also brought a thick circular iron plate of appropriate dia. Now all the plates were with 7mm drill.


Step 4

Now by using a less thick MS metal have a angle plate with 5cm radius. Then we cut a scrap metal pipe with proper length to form our chimney.

Step 5

Now we have to cut a opening using gas cutting in the cylinder insert the wood and fire would take place.

Step 6

Now in made of clamps for the allen key bolt with dia 5mm. These clamps then has to threaded using tapping tool for M6 bolts. Then these clamps are welded to the wall of the cylinder from inside so that it can work a holding device for the plates.

Step 7

All the parts are welded and bolting parts are joined together to form the final structure.

Step 8

All the parts now being prime red and then different color was applied for different parts.

Step 9

The final assembly was done using glass wool as an insulating agent and plaster of pairs.

Table 1. Cost of manufacturing

SL No	Material	Cost
1	Mild steel Sheet	Rs 1,380/-
2	Top iron plate	Rs 320/-
3	Glass wool	Rs 160/-
4	Plaster of Pairs	Rs 50/-
5	Allen key	Rs 100/-
	Total	Rs 2,010/-

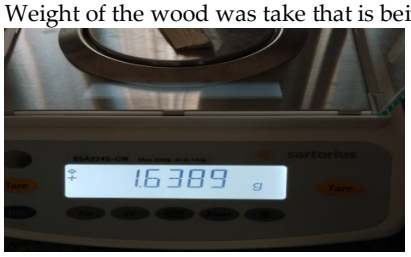
TESTING

Step 1

We compared our chulah with pre produced market chulah. The weight of the both Chula was taken.

Step 2

Weight of the wood was take that is being used.



Step 3

Wood was burned in both the chulahs and the reading of top face temperature, side wall temperature furnace temperature was taken.

Table 2.

SL.NO	PART OF CHULAH	OWN FABRICATED ONE
1	TOP FACE TEMPRATURE	102 °C
2	FURNACE TEMPRATURE	127.83 °C
3	SIDE WALL TEMPRATURE	32.778 °C

Table 3. Weight Testing of Chulah

SLNO	CHULAH	WEIGHTG
1	OWN FABRICATED	14.105KG

CONCLUSION

Smokeless Chulhas are used widely in rural and semi-urban areas due to its low cost. The chulah is fabricated so that flames are not directed outside. As a result more heat is absorbed by the vessel giving more fuel economy. This Chulah does not emit the smoke in the kitchen. This Chulah leads to the development of clean environment. It is also compatible and easy to handle.

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RESEARCH ARTICLE

Design and Fabrication of Solar Simulator

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ABSTRACT

The usage of the solar powered systems has been increasing gradually in both industrial and the other commercial areas. Integration of the solar power sources to the system needs a special care. In order to be sure that the system operates properly, many analysis and the tests have to be made. To make realistic experiments and the tests, the solar power source should be used. However, in most cases it cannot be practical to implement due to the weather conditions, working environment, possible problems for obtaining a solar panels on time etc. Even these constraints are handled, using solar panel during testing process can shorten the life of the solar panel or may damage it, therefore increase the cost of the system. The most practical and cost-effective solution is to design a solar simulator to take the place of a solar panel. This study suggested a solar simulator design method.

Keywords: Solar Simulator, Catia Design, Solar collector.

INTRODUCTION

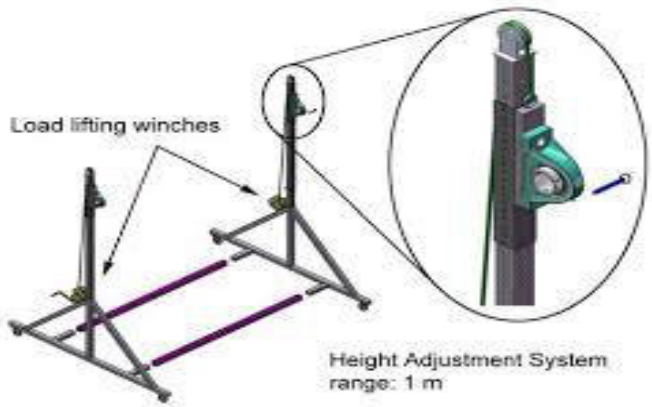
The demand of photovoltaic power systems are increasing day by day and the installation has been increased around the world because of the technological improvements, government support and etc. However, there are still issues to be overcome like electricity network performance due to partial shading or reliability of the PV power systems. So the testing of the solar panel systems is a crucial for the investigating these problems. Tests can be made two way, by using solar panel or without a solar panel. Obtaining a solar panel within a specific time can be difficult. The systems that are in design period can lead to time and cost issues when photovoltaic panels are employed for testing. Finally, the weather conditions may not be appropriate for the efficient testing and using halogen lamp with the solar panels would not be practical because of difficulties in experimental set up. In order to solve all these problems, a solar simulator which is acting like a solar panel, can be implemented. Solar simulators can be used to simulate the characteristics of the photovoltaic panel and their output do not depend on sun light and weather conditions. The

space that the solar simulator occupy is much smaller than the test system with the halogen lamps. It also provides a controllable indoor test facility under laboratory conditions, used for testing of solar cells, sun screen, plastics and other materials.It is also used to obtain artificial sunlight in green house project.

Moss et al designed and tested a solar simulator for testing solar flat plate collectors.For getting uniform simulation, internally reflecting lights were used [1]. Fraguas et al designed a solar simulator with LED lights [2]. Ozsoy et al presented a solar simulator with a size of 140x250 cm was established to test the solar collectors in the laboratory. Inside of the simulator, 46 pieces of 400 W and 4 pieces of 1000 W halogen lamps were used. The lamps were divided into four groups and their light intensities were adjusted with dimmers [3]. Wujun Wang reviewed different types of optical concentrators and light sources for solar simulators [4]. Sabahi et al presented design and construction of an efficient multiple-lamp solar simulator for investigating the performance of the solar collectors for scientific and industrial purposes.Metal halid lamps are employed as source of irradiance [5].

DESIGN, FABRICATION AND TESTING

We have gone through many designs available in journals regarding solar simulators. We finalised the following design that we selected as a base design for our project.



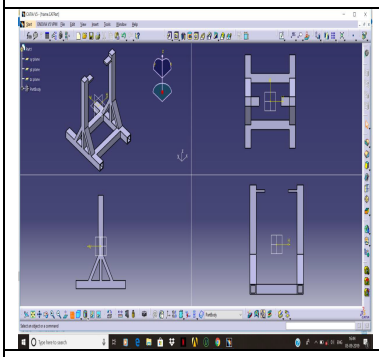
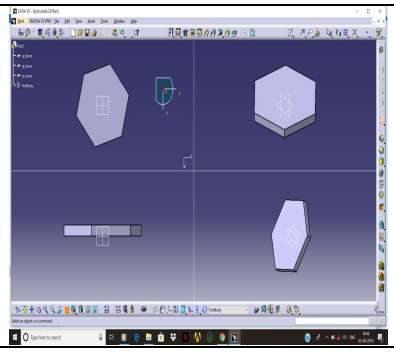
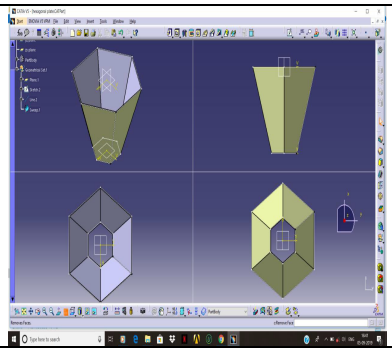
DESIGN

First we made the basic design giving the required dimension in CATIA. We made the different parts in CATIA and then assembled it in CATIA. Then we exported the CATIA files to ANSYS for analysis.

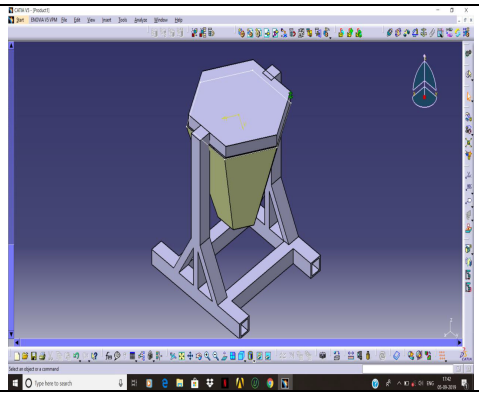
MATERIALS AND TOOLS USED

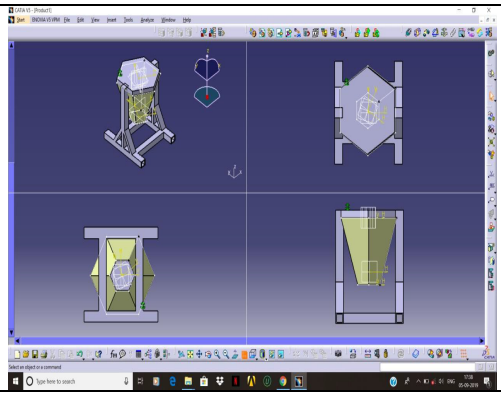
Now after the designing we decided to select the materials that are both economical and gives optimum result.

- Mild steel hollow metal rods
- Laminated piece of wood
- Aluminium sheet
- Wheels
- Allen key bolts
- L hinge
- Metal halide bulbs

FRAME	CEILING	REFLECTOR
		

ASSEMBLY DESIGN OF SOLAR SIMULATOR





FABRICATION

Step 1:First we have a sketch of the project to be made with accurate dimensions

Step 2: Now we have to cut the mild steel hollow rods according to the dimensions we need with the help of power hacksaw, weld them together to get the structure shown before.

Step 3: Cut the laminated piece of wood into a hexagon. This will be the frame for holding the metal halide bulbs

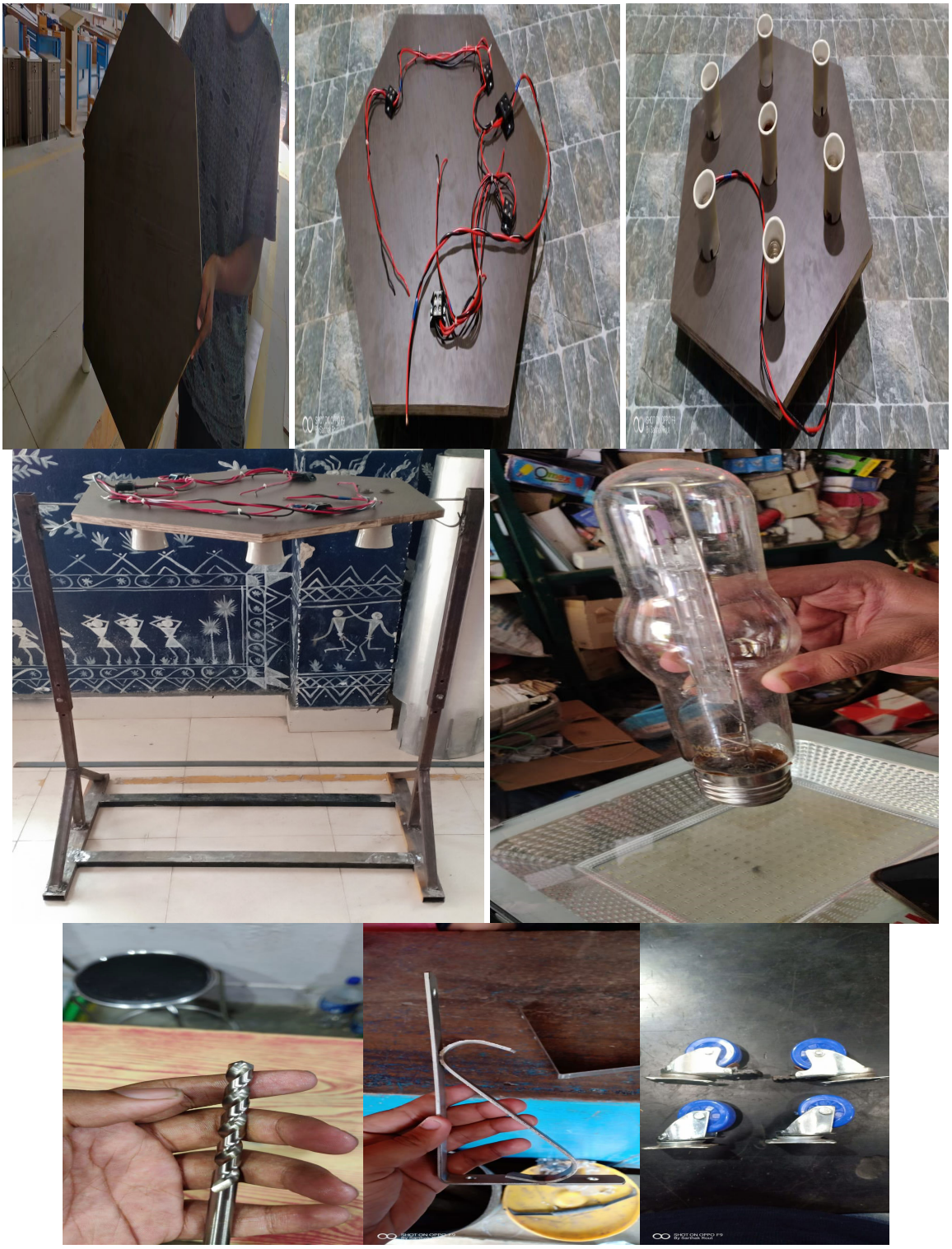
Step 4:Drill holes in the wooden frame for fixing bulb holders and passing electric wires. And fix the holders with help of screws on the frame.

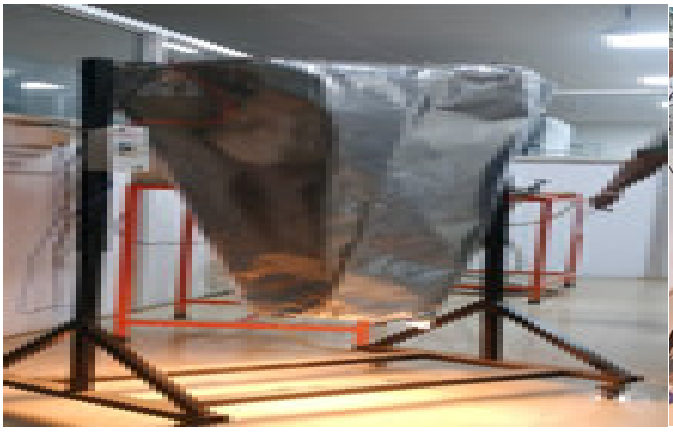
Step 5: Weld the L hinges on top side of the metal frame. This will support the wooden frame.

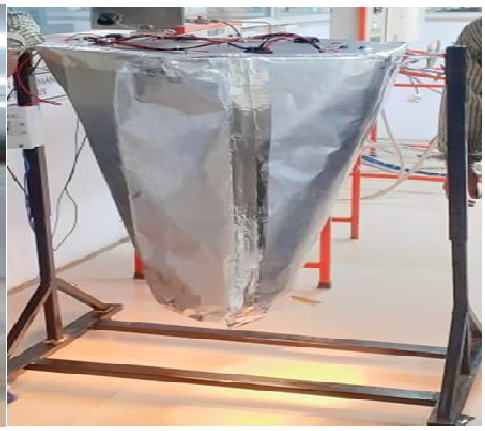
Step 6: Weld the wheels at the bottom of the frame so that it can be moved easily.

Step 7: On the aluminium sheet mark out the wire frame of the converging hollow hexagon. Cut it out of the sheet and bend it according to the marking to get the concentrator.

Step 8: With the help of nut and bolts fix the wooden frame with the "L hinge .
Step 9:Fix the metal halide bulbs in the bulb holder and the cover up the wooden frame and bulbs with help of the concentrator.







RESULT AND DISCUSSION

S.NO.	DISTANCE In cm	READINGS In lux	CONVERSION In watt/m²
1	6	54180	622.75
2	12	51660	593.79
3	18	50400	571.31
4	24	36540	420
5	30	31260	359.31

S.NO	MATERIALS	COST
1	2 WAY CONNECTORS	180
2	WIRES	578
3	BULBS	2450
4	HOLDER	560
5	15 A SOCKET	80
6	15 A TOP	85
7	MCB	165
8	CLAMP	200
9	ALUMINIUM SHEET	380
10	WHEELS	550
11	BLACK PAINT	80
12	ADHESIVE TAPE	290
13	SCREW	18
14	BLACK TAPE	5
15	TARPIN OIL	30
16	PAINT BRUSH	20
17	EXTRA ITEMS	80
	TOTAL	Rs.5751/-

CONCLUSION

We have done this project, solar simulator by utilizing the scraps in our university. We have collected the scraps from the scrap yard of our university campus and the left scraps collected from the advanced wood engineering department. Solar simulator is a device, often called an artificial sun that provides illumination approximating natural sunlight. The purpose of the solar simulator is to provide a controllable indoor test facility under laboratory conditions, used for the testing of solar cells, sun screen, plastics, and other materials and devices. Solar simulators play an important part in the development, testing and rating of solar collectors and other equipment utilizing solar radiation. This simulator greatly improves testing reliability and convenience, but in common with others, models only direct (or beam) radiation, and does not simulate the distribution of the diffuse component of sky radiation, which comes with varying intensity from every point across the sky dome. Comparision to other solar simulators we have done it in a very low amount of money, which can economically increase our efficiency and can be beneficial for utilisation.

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RESEARCH ARTICLE

Design and Fabrication of Paper Shredder

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ABSTRACT

Paper shredder is utilised for cutting the paper in small pieces to make waste management easier. This project model is made of from scrap material to build a paper shredder for recycling of paper wastage in domestic area, industries, organisation etc. As the paper shredders are very costly machines, efforts were made to build a low cost, light weight and compatible product. The purpose behind this project is to process the paper waste as cheap as possible by shredding where it is made for reducing cost of processing and transportation.

Keywords: Paper Shredder, Cost of equipment, Catia design.

INTRODUCTION

Ananth et al describes the importance of plastic shredder machine for clean environment. They also described the advantages of their model as it reduced the effort of human being for managing the plastic waste. They also presented numerical model and CAD model for their model [1]. Mohd Shaifudin Bin Azmi described the novel concept of his shredding machine which is only used to shred A4 size papers [2]. Siddiqui et al elaborated their design of paper shredder machine where Solid Works and Ansys was given much importance to design and analyse the parts of the shredder like types of blades, different profiles, designing a blade and frame [3]. Raut et al described the detailed study of various parts of shredder machine like stand (frame), transmission system and cutting system and machine elements which convert manual existing system to automatic system [4]. Pavankumar et al described the necessity and advantage of shredder with a different blade design [5]. Oreko et al designed machine to shred the required paper of 15 sheets at one go. Sandwiched between the strip forming rollers, which is made up of intermeshing washers, the washers grip and draw the paper sheet, and then formed strips [6]. Ware et al. proposed a new design of atomised paper shredder machine which is more economical and efficient than the conventional design [7].

DESIGN, FABRICATION AND TESTING

We have gone through many designs available in many journals regarding paper shredder. We finalised the following design that we selected as a base design for our project

DESIGN

First we made the basic design giving the required dimension in CATIA. We made the different parts in CATIA and then assembled it in CATIA. Then we exported the CATIA files to ANSYS for analysis.

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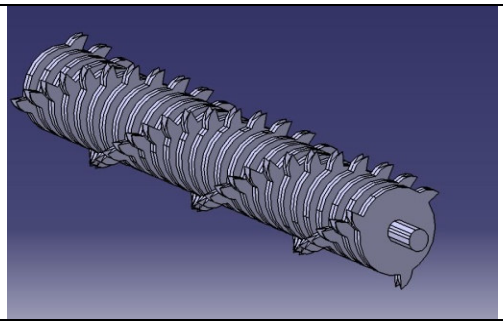
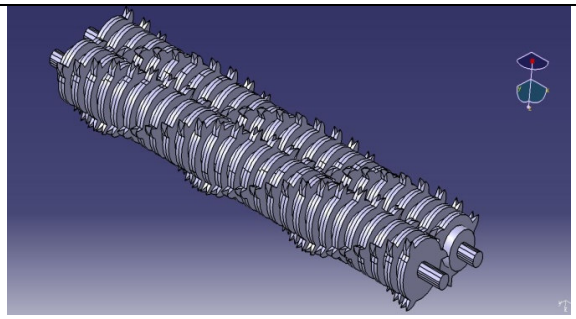
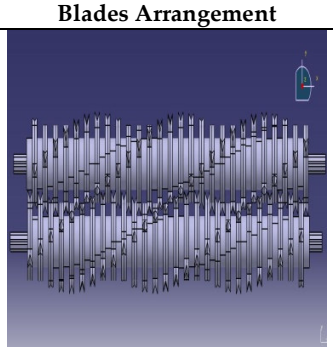
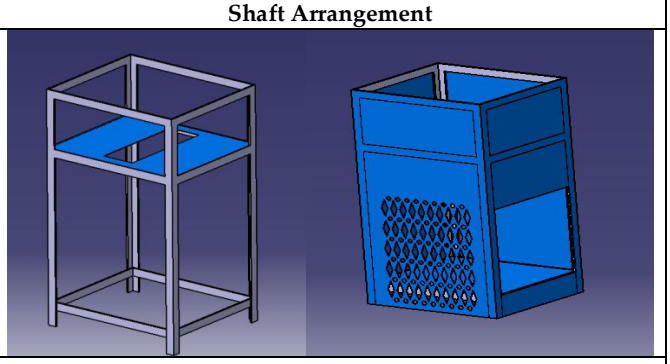
<tr><td>  </td><td>  </td></tr>
<tr><td>Blades Arrangement</td><td>Shaft Arrangement</td></tr>
<tr><td>  </td><td>  </td></tr>
<tr><td>Blade clearance</td><td>Frame</td></tr>
</table>

MATERIALS AND TOOLS USED

Now after the designing, the materials are selected that are economical and gives optimum result

- Servo motor (230v ,50 hz)
- Tungsten blades (1.35kg)
- Shaft (cast iron)-1.5kg
- Sheet metal (mild steel) -6kg
- L-shaped rod (mild steel)- 9kg
- Bearings
- Gears (helical & spur)
- Transportation

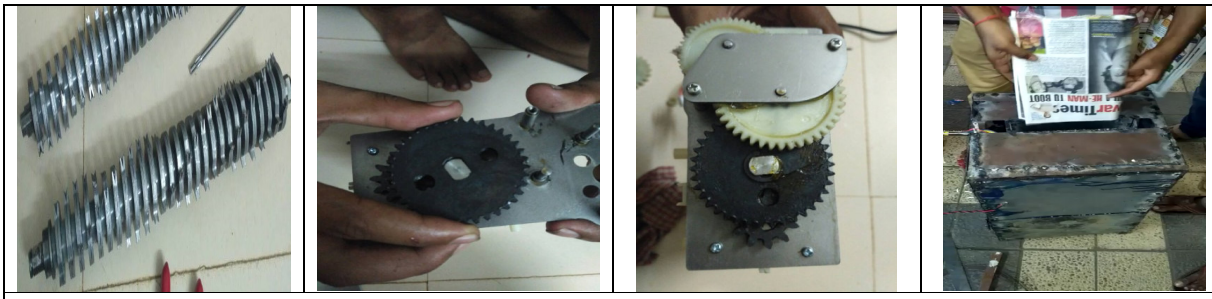


Fig.1 TOOLS

PREPARATION BEFORE USE

- Fingers, ties, ornaments, and any hanging article should be prevented from entangling into the entry slot of the unit to ensure the safety of human body.
- To avoid the damage of the cutting tool and guarantee the performance of shredder and CD destroyer, clips, clamps, staples, laminated article, photos, plastic bags, pouches, and cloth made items should be kept away from the entry slot of the shredder and CD destroyer.
- Don't shredding damp paper because of the damp paper is prone to tangle with cutting tool, thus decreasing the performance of the unit.
- It is suggested not to shred more than 200 sheets of paper at one time and the maximum continuously destroyed CD should not exceed 50 pieces.
- Keeping the unit in operation for long because of shredding paper excessively or due to paper and CD being struck.
- May make the motor out of order owing to overheating , in this case you can keep the until being off for 30 minutes, then start of the motor again after it has cooled off.
- It not necessary the unit should be kept from being in reverse mode, otherwise waste paper will be stacking at the entry slot of the unit, consequently affecting the performance of shredder.
- Unplug the power cord before moving maintaining and cleansing the unit and the basket.

SAFETY OPERATION INSTRUCTION

- Before clean the machine, please unplug the machine from power .if necessary, the user may wipe the unit with duster cloth wetted by gentle soft fluid.
- Do not place machine too far from power foe easy emergency disposal.
- Do not place machine on or near to any heat source .
- Do not place machine in a damp environment.
- Do not splash any fluid on the machine.
- Do not open the case for self-repair to prevent electrical shock or other danger.
- Please make sure power supply comply with operation requirement of this machine before use.
- If the supply cord is damage it must be replaced by the manufacturer its service agent or similarly qualified person in order to avoid a hazard.
- Do not use the appliance in a dusty environment or in a explosive atmosphere.
- The machine will not be started until the dust door is opened.
- When the paper is inserted, the machine will start automatically. After cutting paper, the machine will stop automatically.

OPERATIONS

- First put the plug in the circuit board for power supply.
- There are 3 modes present in the adreno board . 1st is AUTO MODE, 2nd is REV. MODE & 3rd is OFF MODE.
- Then put the paper or card in the centre of the entry, shredding will start automatically.
- If paper of small size is not inserting in the middle of the entry, the unit won't work.
- To keep the unit in order doesn't shred more than 8 sheets of paper or 1 piece of card at a time.
- If inserting too much paper into the entry at one time, the until will be locked. in this case, switch the button to REV. position to reverse the paper.
- If the paper is stuck too tightly to be reversed you can pull out the paper by hand, then put less paper into the entry again with the unshredded end of the paper down the shredding will resume automatically.
- Insert the CD into the entry evenly destroying will start automatically.
- The shredder tool will stop automatically after finishing CD destroying.
- To ensure smooth operation of the unit no more than 1 CD should be destroyed at a time and do not destroy CD continuously more than 50.
- If the CD stuck ,switch the button to REV. the CD will be reverse.

RESULT AND DISCUSSION

- The machine can cut up to 1.2mm thickness in a single pass
- For one pass it will take 8.34 sec.
- It need only 230 volt voltage with 50HZ frequency.
- It cut papers of same sizes.
- Cross-cut paper size 40*4 mm

Cost Estimation

- SERVO MOTOR (230V ,50 Hz)- Rs.700/-
- TUNGSTEN BLADES (1.35Kg)- Rs.2150/-
- SHAFT (CAST IRON)-1.5Kg- Rs.20/-
- SHEET METAL (MILD STEEL) -6Kg- Rs.300/-
- L-SHAPED ROD (MILD STEEL)- 9Kg- Rs.450/-
- BEARINGS- Rs.30 x 4 =Rs. 120/-
- GEARS (HELICAL & SPUR) – Rs.150/-
- TRANSPORTATION- Rs.200/-
- GRAND TOTAL- Rs. 4090/-

CONCLUSION

From the above project we found the following conclusions-

- The performance of the machine could increase by increasing the number of blades.
- As the cutting blades are too small that's why we can't shred plastics and metals.
- After complication of our project we came to a conclusion that we can't shred more than 8 papers at one time.
- Here in this project we can also control the feed rate by changing the spur gears.
- All the things considered, the cost for this solution was about right, and we less than the out of the box solution. We build something useful that's operating quite all, we have fun in the process having budget price.
- This paper shredder machine takes only 8.34 sec. for a single pass.
- About 8-12 sheet of thickness 0.1mm each can be shred in a single pass.

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RESEARCH ARTICLE

Fabrication of Solar Vertex Engine

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ABSTRACT

Due to increase in population, energy demand increases. Most of the countries depend on fossil fuel to meet the energy demand. But fossil fuels are left with limited quantities which lead to high price of fuel. Fossil fuel also contributes to rise in global warming. Therefore renewable energies are gaining popularity. Solar energy is one of the most promising solutions. In this article, solar updraft tower with less material cost which can results in high efficiency among its other variants is created. Solar evacuated tube flat plate collector is designed to increase the efficiency of the upgraded solar updraft tower that is solar vortex engine. Evacuated tube flat plate collector for heating the base plate of the solar vortex is used. Thus conversion of solar energy into electrical energy by using solar vortex is possible.

Keywords: Solar Thermal Collector, Solar Vertex Engine..

INTRODUCTION

Tan et al presented solar chimney power technology, which represented solar thermal energy system. This system was an energy transformation system in which solar energy and wind energy were utilised together. Air was heated with solar energy. Electric energy was produced by upward movement of air which was responsible to rotate the turbine that was placed inside the chimney [1]. Zou et al showed hybrid cooling-tower-solar-chimney system (HCTSC), combining solar chimney with natural draft dry cooling tower [2]. Chen et al proposed a low-temperature waste heat recovery system based on the concept of solar chimney. [3]. Zhou et al reviewed experimental studies, main important factors of theoretical modelings, and cost studies of the solar updraft tower power plant technology [4]. Simpson et al investigated columnar vortex formation, evolution and dynamics using PIV with particular emphasis on scaling and assessment of the available mechanical power [5]. Michaud et al used an atmospheric vortex engine (AVE) artificially created tornado like vortex to capture the mechanical energy produced during upward heat convection [6]. Mohiuddin et al studied a computational analysis of a device that created dust devils in

a controlled environment in order to explore its capacity as an energy conversion apparatus in solar energy applications [7].

Procedure for Fabrication of Solar Vertex Engine

In below figures a prototype of solar vortex base plate is made by taking 1 meter diameter and inner circle of 40cm dia where vortex is created. Fins attached outside the inner circle are used to regulate air for air vortex. Fins are connected by the help of revets. A copper tube coil is placed below the region where vortex is created. The inner circle is paint to black colour for better radiation effect and outer part is of white colour.

CONCLUSION

We created an efficient solar updraft tower with less material cost which can results in high efficiency among its other variants. We design a solar evacuated tube flat plate collector which increases our efficiency of the upgraded solar updraft tower that is solar vortex engine. Solar vortex engine can be used for generation of electrical energy in future by reducing cost of solar chimney. Due to easy construction and cost effective property it is beneficial for future uses.

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Fig.1. BENDING OF PLATES BY BENDING MACHINE

Fig.2. MARKING OF MILD STEEL PLATE FOR PREPARATION OF COLLECTOR BASE

Fig. 3. PLACING OF COPPER TUBES ABOVE THE PLATE

Fig. 4. BASE PLATE OF SOLAR COLLECTOR

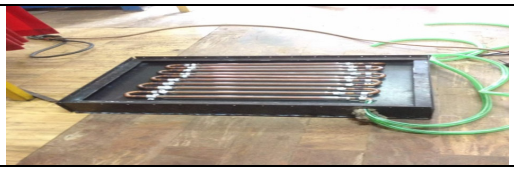

Fig. 5. SOLAR COLLECTOR WITH COPPER TUBES ATTACHED

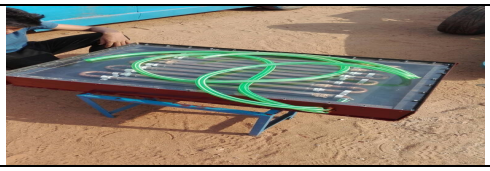

Fig. 6. SOLAR TUBE COLLECTOR

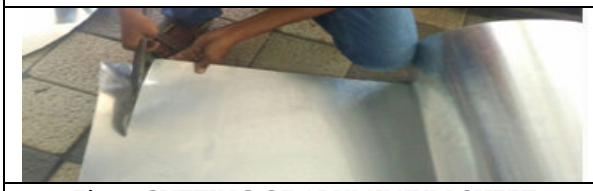

Fig. 7. CUTTING OF ALUMINIUM SHEET

Fig. 8. MARKING OF SOLAR VORTEX PLATE

Fig. 9. PROTOTUPE OF SOLAR VORTEX ENGINE

Fig. 10. BASE PLATE OF SOLAR VORTEX ENGINE

Fig.10.The final fabricated model

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RESEARCH ARTICLE

Emission Study in CI Engine Incorporating Producer Gas in Absence and Presence of Turbocharger

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ABSTRACT

Renewable sources are important in meeting energy demand. This is true during the last decade with changes in the energy distribution system. The present work is based on the effect of producer gas flow rates and adding turbocharger on the emissions of a twin cylinder dual fuel diesel engine fuelled with diesel and producer gas. Experiments are done at 10 kW at various gas flow rates. From study it is found that the maximum thermal efficiency increases with reduced specific energy consumption. Except nitrogen oxide and carbon dioxide emissions, a notable alleviation of hydrocarbon, carbon monoxide and smoke are observed under turbocharged mode compared to its normal mode at various test conditions. More the gas flow rates, lesser is the emission of nitrogen oxide and smoke substantially.

Keywords: Turbocharger, Producer Gas, Gasifier, Emission.

INTRODUCTION

The amalgamation of going up oil consumption and less production has made India dependent on the imports to satisfy its petroleum need. To meet the energy demand, non conventional energy sources should be encouraged [1,2]. Sahoo et al. have studied the effect of H2: CO ratio in syngas on the performance of a dual fuel diesel engine operation engine under dual fuel modes. [3]. Deshmukh et al. have worked on a single cylinder, CI engine attached with a down draft gasifier. They found an increased HC and CO emission with increase in load, because with increase in load the mixture becomes richer and the inducted producer gas reduces the oxygen content in the cylinder resulting incomplete combustion. [4].

Shirk et al. managed two sets of experiments to explore the effects of adjoining gaseous hydrogen to use (CI) engines fueled with 20% bio-derived and 80% petroleum-derived diesel fuel [5]. Rakopoulos et al. studied the emissions on a bus/truck, turbocharged diesel engine to obtain the NO, smoke, and combustion noise in hot starting for various fuel blends [6]. Chandra et al. obtained the performance of a stationary diesel engine modified into SI mode. The modified engine uses CNG, Bio-CNG. From bio methanation of jatropha and pongamia oil seed cakes, biogas was produced and this bio gas was used to study the performance of modified engine [7].

Korakianitis et al. studied the use of natural gas in SI and CI engines. SI engines using natural gas produce high NOx emission and low CO_2, unburned HC emission and CO emission [8]. Mun et al. have studied the effect of reaction conditions and additives on the constituents of producer gas and tar available in producer gas [9]. This article concentrates on examining experimentally the performance and emission behaviour of a 2 cylinder 4 stroke diesel engine in presence and absence of turbocharged techniques applying Babul wood producer gas with fossil diesel.

EXPERIMENTAL METHODOLOGY

A twin cylinder 14 hp, 1500 rpm, water cooled diesel engine was selected for the study. The instruments fitted to the test bed were properly calibrated to minimize the possible errors during experimentation. The results of this study can throw ample guidelines to utilize producer gas from a downdraft gasifier with & without turbocharger in dual fuel mode with diesel to study different engine performance parameters & emissions.

Producer gas along with Diesel without Turbocharger

Gasifier was fired for the production of producer gas. So Diesel with producer gas was injected into the specified engine. Air head reading on the air box was taken with help of a U-tube manometer in terms of water head. Producer gas head reading was taken in a U-tube manometer in terms of water head & its flow to the engine in normally controlled by a manual register. The amount of producer gas flow was regulated for changing the percentage of substitution of producer gas with diesel & observations were taken in specified loads. The consumption time for 10cc consumption of fuel was measured with help of graduated scale & stop watch. The exhaust gas temperature, inlet gas temp to turbo & producer gas temperature was recorded with help of thermocouple. A gas analyzer & smoke meter was utilized for emission reading and exhaust gas smoke opacity respectively. Load to the engine was provided with help of load cell.

Producer gas along with diesel with Turbocharger observation procedure

Gasifier was fired for the production of producer gas. So Diesel with producer gas was injected into the specified engine with turbocharger integration. Air head reading on the air box was taken with help of a U-tube manometer in terms of water head. Producer gas head reading was taken in a U-tube manometer & its flow to the engine in normally controlled by a manual register. The amount of producer gas flow was regulated for changing the percentage of substitution of producer gas with diesel & observations were taken in specified loads. The consumption time for 10cc consumption of fuel was measured with help of graduated scale & stop watch. The exhaust gas temperature, inlet gas temp to turbo & producer gas temperature was noted down with help of thermocouple. A gas analyzer & smoke meter was used for emission & smoke opacity reading respectively. Load to the engine was provided with help of load cell.

RESULTS AND DISCUSSION

CO EMISSION

CO emission increases gradually with increase in gas flow rates. Producer gas contains carbon monoxide in its composition and decrease in fresh air % is responsible to increase CO emission.

HC EMISSION

HC emission increases due to incomplete combustion. Slow burning velocity of producer gas and decrease in oxygen percentage in the mixture are mainly accountable for incomplete combustion.

CO_2 EMISSION

Since CO_2 is a part of producer gas composition, its increment during combustion increases the % of CO_2 emission.

NO_x EMISSION

The peak combustion temperature reduces due to the absence of organic nitrogen, higher delay period and lower adiabatic flame temperature of producer gas compared to pilot fuel. NO_x emission is reduced. When the gas flow rate increases, the decrease in NO_x emissions are observed.

SMOKE OPACITY

The figure reveals that smoke opacity in case of turbocharged mode is lower than without turbocharger due to better combustion of diesel. Turbocharger provides sufficient fresh air which results in better combustion.

CONCLUSION

This study signifies that the diesel engines can operate with producer gas. The brake thermal efficiency in single fuel mode & dual fuel mode with turbocharger is higher than without turbocharger engine with a reduction in Brake specific energy consumption. The effect of turbo charger indicates a increase in CO_2 CO, HC emission and decrease in smoke opacity and NO_x, in dual fuel operation compared to without turbocharger.

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Fig.1. Gasifier coupled with engine

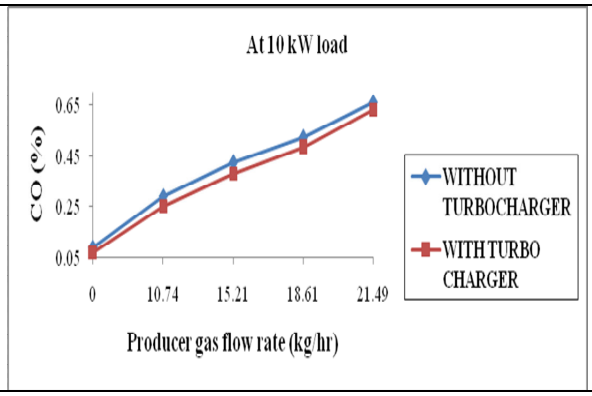

Fig.2. CO Vs Gas Flow

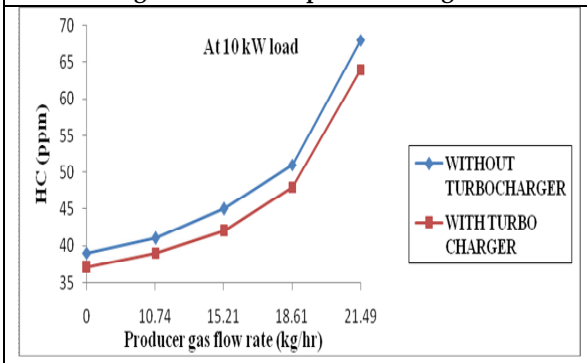

Fig.3. HC Vs Gas Flow

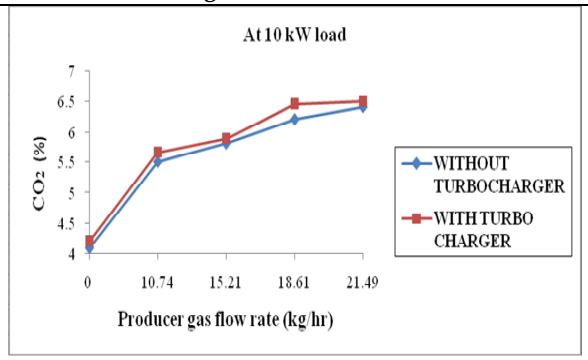

Fig.4. CO2 Vs Gas Flow

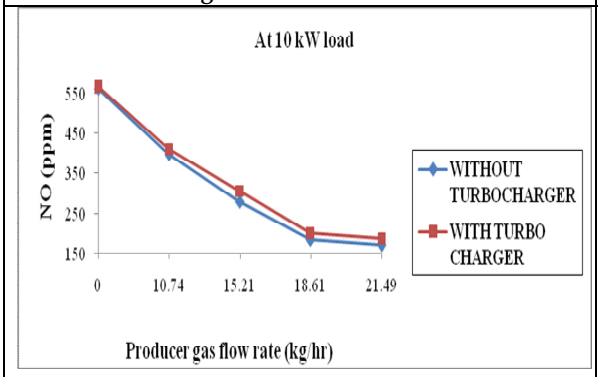

Fig.5. NOx Vs Gas Flow

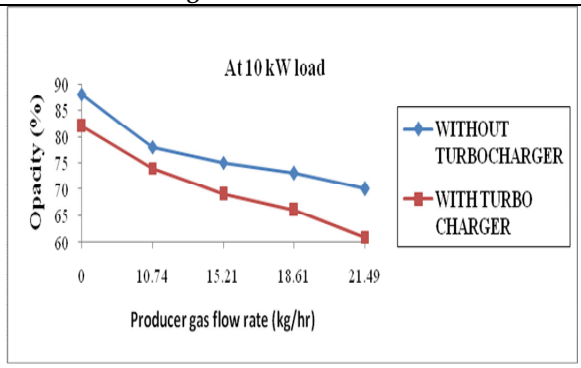

Fig.6. Smoke Opacity Vs Gas Flow

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RESEARCH ARTICLE

Numerical Simulation of Breaking Jet Effect of Water across the Beach

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ABSTRACT

This paper deals with the numerical simulation of breaking jet of water across the beach. The effect of distribution of different physical quantities are studied. This study is important for knowing the nature of the waves generated during the breaking of jet.

Keywords: Flow of breaking jet, laminar flow, simulation of flow, CFD of breaking jet.

INTRODUCTION

Set the gravity as an external acceleration laws or as an external body force derived from a potential function Set porous regions. Engine settings In Project Tree > Environment> Engine set the following parameters: (a) Kernel: 2d (b) Turbulence settings > Turbulent model: Automatic (d) In Project Tree > Environment> Environment set the following parameters: (a) Leave the Gravitational potential Off to include the gravity (b) conditions: Water channel default (c) With the help of the wizard (Main menu > Options > Setup progressive wave boundary conditions and the inlet wave function according to a linear wave given by the following parameters: (d) Set the ground wall to automatic type with zero velocity in X-direction.Material settings In Project Tree > Materials leave the default liquid properties, since these are the water properties.Geometry settings In Project Tree > Geometry > Geometries > Shape.

Problem set-up

Simulation settings In Project Tree > Simulation:

a) Show its local axes: right click on the Graphic View window to show the Graphic View Menu> Show > Local axes. The origin of the local axes is the center of gravity and the center of rotation of the object.
b) Set the Geometry > Shape: Box > Behaviour to Rigid body dynamics, with a Density of 250 kg/m3 (i.e. mass = 2000 kg) and leave free the three degrees-of-freedom: displacements in X and Y and rotation around Z in 2D. Thus, set both Constraints >Translation and Constraints > Rotation to Free.

Post processing technique

Create a cutting plane to visualise the velocity field, to do so please go to Project Tree > Postprocessing and do:

a) Right click on the Function Viewer window, a drop-down menu appears then select Shapes > Box > Py
b) Right click on the Function Viewer window, a drop-down menu appears then select Shapes > Box > Euz
c) Switch on the Gravitational potential in Environment > Environment > Global attributes. It should appear a pop-up window like the one shown in the figure below: This message indicates that the setup contains a non-zero External acceleration law together with the Gravitational potential, which accounts for the gravity. In this case, the Ext. acceleration laws represent the gravity [(0, -10) m s-2] introduced by hand in Step 1. Since the user only wants to consider the gravity effects once, press Yes to reset the Ext. acceleration law to zero.
d) Leave the Gravitational potential > Potential origin: Automatic, which by default sets the potential origin at the free surface.
e) Visualize the initial static pressure field. Activate the markers v visualization in Post-processing > General > Show > Markers by ticking the box.
f) Set Markers> From: All, to see all the markers in the domain, and select the Static pressure in Markers >Color by field.

RESULTS AND DISCUSSION

The velocity distribution of water jet can be seen from the Fig. 1. It can be depicted from the Fig. 1 that the velocity of breaking jet of water is about 3.651 m/s. The pressure distribution of water jet can be seen from the Fig.2. It can be depicted that the pressure will be maximum at the base of the beach and it decreases with going upwards to the surface. Fig.3 shows the streamlines distribution of breaking jet in water. It can be depicted that the streamlines form vortices during its travel towards the slope of the beach.

CONCLUSION

It can be concluded that the breaking jet forms vortices at the top of the surface of the breaking jet, whereas high velocity occurs at the base of the bed of the beach. Therefore, it will be better to remain at the middle surface of the water breaking jet for keeping the body to be in safe condition.

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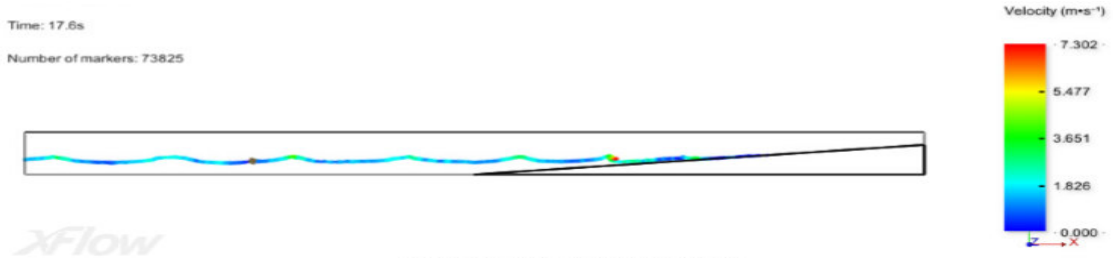
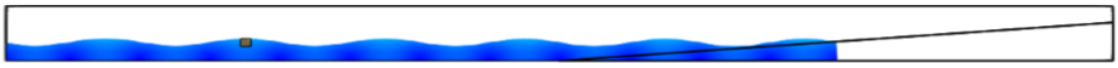


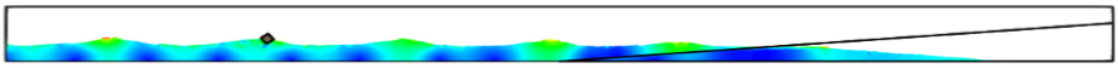
Free surface represented by markers

(a) Select the beach and display it in wireframe visualisation mode. Observe the different initial configurations in both cases (1)impervious beach, and (2) porous beach.



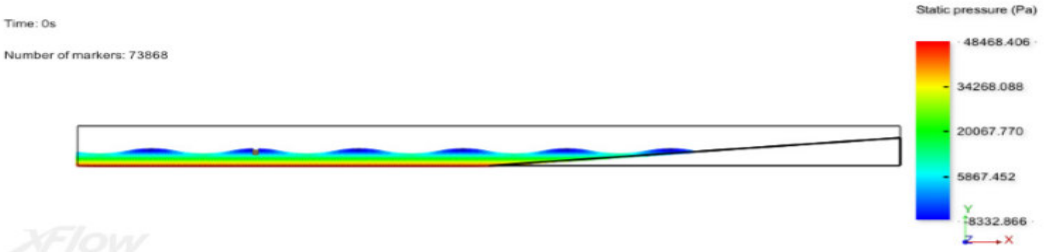
Markers at time = 0 s (coloured by velocity)

(b) Play forward the results and observe how the flow evolves inside the porous region.



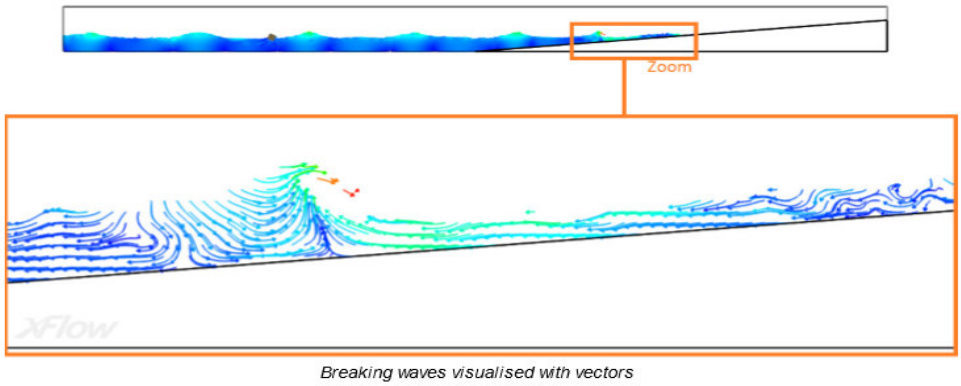
Markers at time = 15 s (coloured by velocity)

Fig.1. Velocity distribution of water breaking jet



Markers coloured by the initial static pressure field (time = 0).

Fig. 2. Pressure distribution of water breaking jet.



Breaking waves visualised with vectors

Fig. 3. Streamlines distribution around the water breaking jet

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RESEARCH ARTICLE

Simulation of Radiation Heat Exchange between Different Bodies

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ABSTRACT

This article deals with the simulation of exchange of radiation between different bodies. This helps in the prediction of temperature and energy exchange between bodies in space. Xflow is used for the numerical simulation of radiation exchange; also, temperature distribution on the surfaces are also discussed. The emphasis is given on the utilization of the software.

Keywords: Radiation heat exchange, temperature distribution, Monte Carlo radiation, thermal simulation.

INTRODUCTION

Problem set-up

Simulation settings

a) Store data > Folder: Radiation
b) Set the Frames frequency to 10000 frames per second and leave the Numerical data frequency by default.
c) Global attributes > Ext. acceleration laws: (0, -9.81, 0) m/s2, to consider the gravity.
d) Leave the Initial conditions as User defined.
e) In Project Tree > Materials leave the default liquid properties, since these are the water properties.
f) In Project Tree > Geometry > Geometries > Shape: tank set the following parameters: (a) Behaviour: Fixed (b) Boundary conditions: Wall, with Wall model: Free slip.
g) In Project Tree > Simulation set the following parameters: (a) Simulation time (b) Resolution > Resolved scale: 0.03 metres, with the Refinement algorithm: Disabled (c) Resolution > Seed point: Automatic (d) Store data > Folder: radiation (e) Store data > Frames frequency: 50 frames per second (Hz) (f) Leave off Save averaged fields (g) Enable Compute markers.

Post-processing

a) To show only the particles at the free surface, select Makers > From: Surface; otherwise, select All to show the whole domain of fluid.
b) To represent the particles with different shapes, select Arrows and Sphere in Representation.Tick the checkbox at Post processing > General > Show > Markers.Leave the Gravitational potential > Potential origin: Automatic, which by default sets the potential origin at the free surface.
c) Visualize the initial static pressure field. Activate the markers v visualization in Post-processing > General > Show > Markers by ticking the box.
d) Set Markers > From: All, to see all the markers in the domain, and select the Static pressure in Markers >Color by field

It can be seen from the Fig. 1 that the temperature contour of the cylindrical element is the highest with a value of 250 K as compared to other bodies. Whereas the lowest temperature of about 249.9 K is shown by the walls surrounding the bodies. Fig. 2 shows that the highest heat flux occurs at the bottom surface of the surround walls with a value of 60 W/m^2 Also, the minimum value of heat flux is shown by the rectangular block.

CONCLUSION

The body with maximum heat flux shows the least temperature because of the maximum transfer of energy to the other body.

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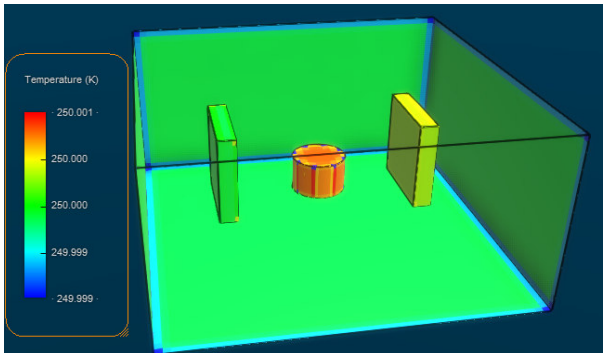

Fig.1. Temperature contour of the bodies.

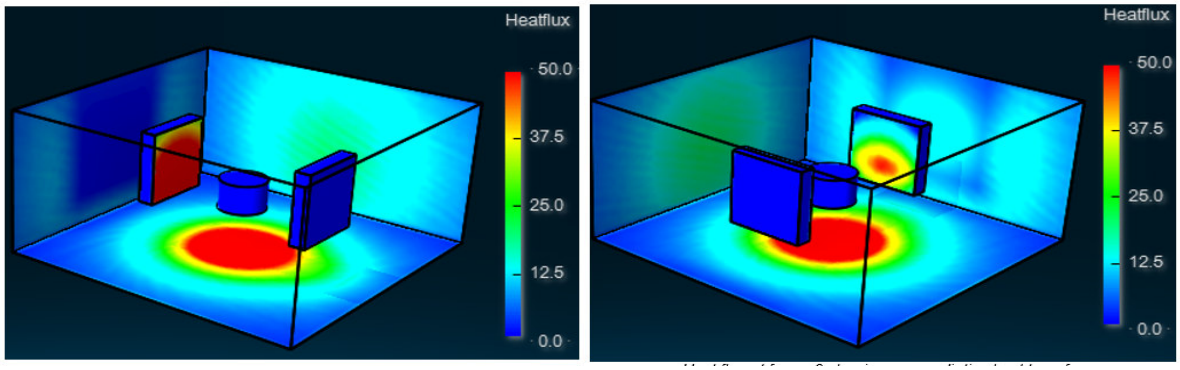

Fig.2. Heat flux contour of bodies

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RESEARCH ARTICLE

Numerical Simulation of the Process of a Breaking Dam

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ABSTRACT

This article discusses the process of a breaking dam and its effect on the obstacle in the path of flowing water. The velocity and pressure distribution around the flow pattern are discussed with the steps to be followed for the X-Flow analysis. It is a matter of concern to know the effect of dam breaking in real situation, so that enough and necessary steps should be taken during its failure.

Keywords: Dam breaking, laminar flow, simulation of flow, CFD of water flow.

INTRODUCTION

The setup and solution process of a dam break flow. The problem consists of a rectangular tank with an obstacle. In the right part of the tank there is a water column that will flow through the tank because of gravity and impact against the obstacle. This article shows how to: Set a free surface problem Define liquid regions Visualise the fluid particles Create arbitrary cutting planes Create clipping planes. XFlow can also be applied to problems that involve a free surface between a liquid and a gas. Examples of this type of problem include simulating the waves produced by a ship or the forces exerted by waves that break against an oil platform.

Problem set-up

In Project Tree > Environment> Engine set the following parameters: (a) Kernel: 3d (b) Flow model.
Environment settings In Project Tree > Environment> Environment set the following parameters:

a) Global attributes > Ext. acceleration laws: (0, -9.81, 0) m/s2, to consider the gravity.
b) Leave the Initial conditions as User defined.
c) In Project Tree > Materials leave the default liquid properties, since these are the water properties.

d) In Project Tree > Geometry > Geometries > Shape: tank set the following parameters: (a) Behaviour: Fixed (b) Boundary conditions: Wall, with Wall model: Free slip.
e) In Project Tree > Simulation set the following parameters: (a) Simulation time (b) Resolution > Resolved scale: 0.03 metres, with the Refinement algorithm: Disabled (c) Resolution > Seed point: Automatic (d) Store data > Folder: DamBreak (e) Store data > Frames frequency: 50 frames per second (Hz) (f) Leave off Save averaged fields (g) Enable Compute markers.

Post-processing

a) To show only the particles at the free surface, select Makers > From: Surface; otherwise, select All to show the whole domain of fluid.
b) To represent the particles with different shapes, select Arrows and Sphere in Representation.
c) Tick the checkbox at Post processing > General > Show > Markers.

RESULTS AND DISCUSSION

The velocity distribution can be seen around the obstacle within the dam in Fig.1. It can be seen from the Fig.1, that the velocity is maximum with a value of 1.739 m/s at the top of the obstacle and is minimum around other surfaces of the dam. Fig.2 shows the pressure distribution around the obstacle within the dam. It can be clearly seen that the pressure distribution is maximum with a value of 2770.648 Pa around the obstacle and is lowest around the other surfaces of the dam. The highest value is at the edge of the obstacle which faces head on collision with the breaking water jet with a value of 7625 Pa. It can be seen from the Fig.3 that the maximum vorticity with a value of 20 s^{-1} occurs at the faces of the dam in touch with the water rather than with the obstacle. Fig.4 shows the turbulence distribution around the obstacle; it can be seen that the turbulence is maximum at the walls of the dam with a value of 1048.008 %.

CONCLUSION

The different contours show that the most effective distribution of physical quantity occurs a at the edges of the obstacle and at the surfaces of the walls. Therefore, utmost care should be taken for the development of walls of the dam.

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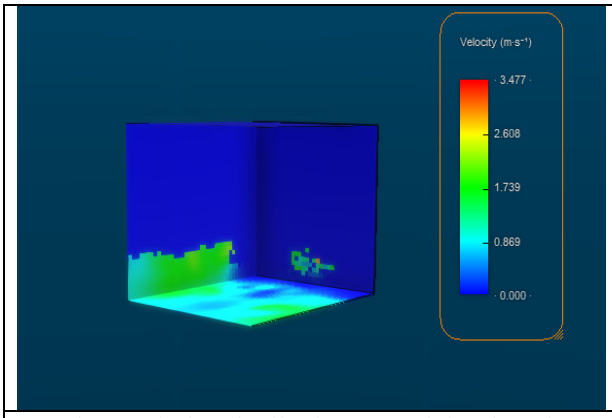

Fig.1. Velocity distribution around the obstacle

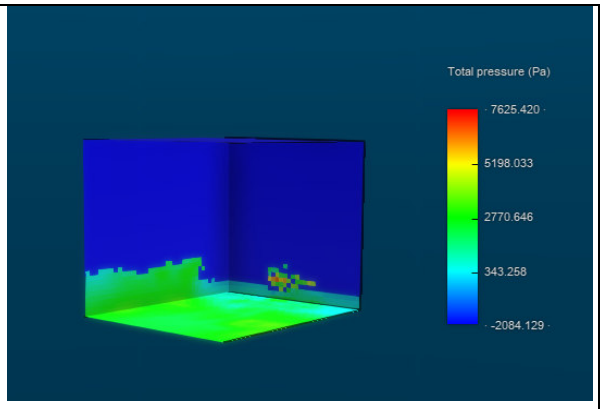

Fig.2. Pressure distribution around the obstacle

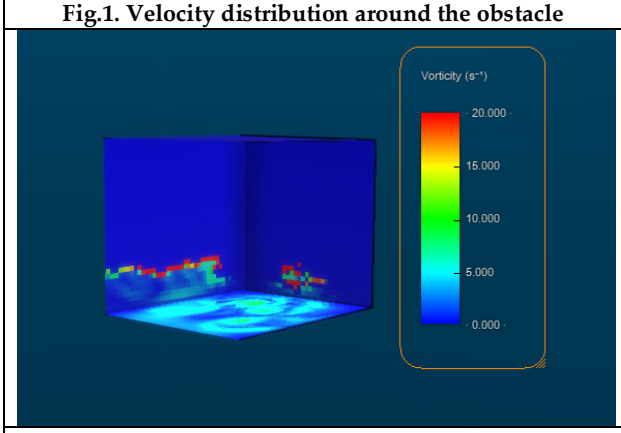

Fig.3. Vortex distribution around the obstacle

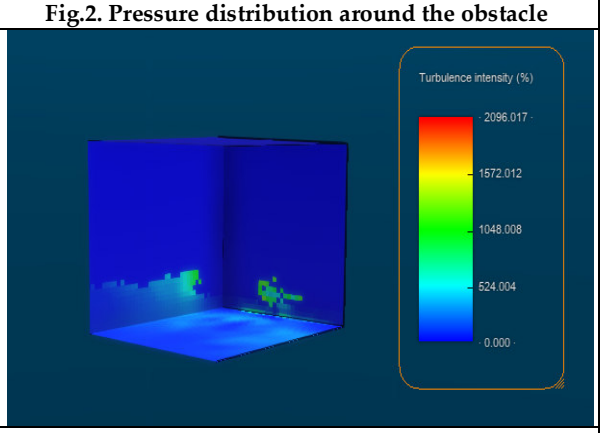

Fig.4. Turbulence distribution around the obstacle

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RESEARCH ARTICLE

Fabrication of Corn Separator

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ABSTRACT

Corn is considered as the third most produced crop after rice and wheat in India. Corn acts as an input to large number of industrial products. It is also utilised as human food and animal feed. Corn can grow across a range of agro-ecological zones. The demand for corn has been across the country for a long period of time which attracts a large number of users to get benefit from it, which includes industrialist to small businessman. Many of the small businessmen cannot afford big industrial equipment's for their day-to-day operations. It leads to lots of time consumption. A corn separator machine which costs less and has a low maintains cost can help them significantly to increase their productivity.

Keywords: Corn Separator, Catia, Ansys

INTRODUCTION

Ghadi *et al* and Nithin R *et al* presented corn dehusking in agriculture industry. Corn dehusking consisted of breaking the grains by hand or by using large machinery for deseeding. These methods were not effective as it consumed both effort and money. Therefore authors tried to find out innovative idea to design a product that is feasible, safe, cost effective and productive for the Indian farmer [1,8]. K P *et al* showed the demerits of conventional methods to deseed the corn which was time taking. The machines available in the market to solve this problem are very costly. In order to address the above problems, the authors designed and fabricated low cost corn de-seeding machine for de-seeding of corn without any damage to the seeds. The concept model of the machine was made by using AutoCAD software and required calculations were made [2]. Uttam *et al* constructed to shell maize and separate the cob from the grains [3].CHITODA *et al.* described about the design of various components of Maize Sheller which operated continuously for a comparatively long time with high shelling rate without causing damage to kernels[4]. Shridhar R *et al* presented machines which were automatic operated which can help farmers in getting

more benefit in less effort [5].Kale *et al* presented a new design which was made of electric motors, pulleys, v-belt and bearings and blower shaft impeller, inlet hopper. The machine was designed to deseed the corn and cleaning the corn seeds also [6]. Darudkar *et al* observed performance of corn deseeding machine which was made of hopper with a flow rate control device, shelling unit, separating unit and power system. [7] E.C *et al* performed experiment on corn at moisture content of 15.14% db .Results presented that for a total 20kg of sample tested, the average feed and threshing time were 2.37 and 2.95 , average feed and threshing rates were 2.06 and 1.65 kg/min with an average threshing efficiency of 78.93 %. With their designed about 1 tonne of maize per nine-hour shift could achieve the mentioned results[9].

DESIGN, FABRICATION AND TESTING

We have gone through many designs available in many journals regarding corn separator. We found the following design that we selected as a base design for our project.

Design

First we made the basic design giving the required dimension in CATIA. We made the different parts in CATIA and then assembled it in CATIA. Then we exported the CATIA files to ANSYS for analysis.

Fabrication

Step 1: The first step in fabrication is to do a sketch of the project with the dimensions the required to be manufactured.
Step 2: Now we have to cut the mild steel hollow rods according to the dimensions we need with the help of power hacksaw.
Step 3: A rectangular plate is fabricated to collect the corn seeds
Step 4: All rods are joined together to give a proper shape to the corn separator which is mentioned in the design
Step 5: The Blades are attached at the last to separate corn seeds from the corn.

CONCLUSION

The corn separator is designed and fabricated considering the problems and requirements of farmers of India. The machine is designed to minimize the effort of Indian Farmers. This device can be used widely by corn selling street vendors .It has a great possibility that it can be used in household .Small popcorn sell can be used it to increase their productivity .The scalability of the project can reduce its proposed cost upto 60% which will help to acquire new potential consume base.

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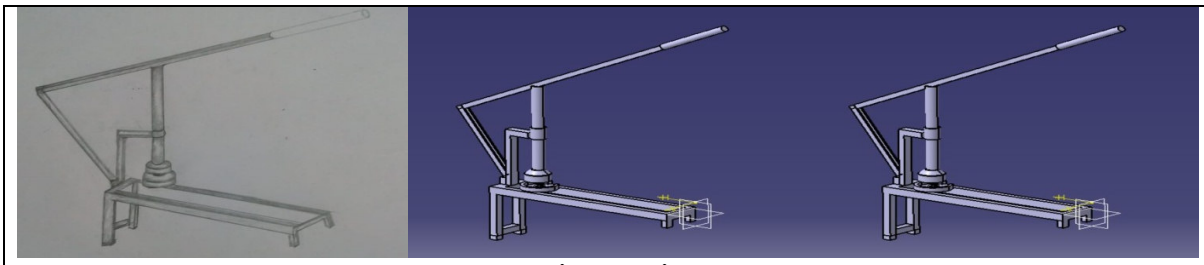

Fig.1. Design

Fig.2. Fabrication steps

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RESEARCH ARTICLE

Validation of High Lift Trapezoidal Wing

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ABSTRACT

This article deals with the validation of high lift trapezoidal wing. It is a matter of great concern that the flow fields should be visualized when it is required to be tested for aerodynamics of the wings. Validation of results for the high lift generation trapezoidal wings are presented and tested here with the use of grid independence test.

Keywords: aerodynamics, high lift, trapezoidal wings

INTRODUCTION

The NACA-0012 airfoil is a widely used wing section that has zero camber and a maximum thickness to chord ratio of 12 percent. As it is shown in Figure 2.1, the NACA-0012 is a symmetric two-dimensional profile with a very smooth aerodynamic shape. This validation case presents the XFlow results for the flow past a NACA-0012 at zero angle-of-attack and at a Reynolds number of 500. These results are further compared with reference data; the comparison is based on the CFL3D code from the National Aeronautics and Space Administration (NASA)1 [3, 4] due to the lack of experimental data for such a low Reynolds number. A two-dimensional single-phase external aerodynamics analysis has been performed using a virtual wind tunnel of dimensions 60×40 m and a NACA-0012 profile of chord length L = 1 m. In order to reach a Reynolds number based on the chord length equal to 500, the simulation parameters have been set according to Table 2.1.Free-stream velocity vref 50 m s−1 Density ϱ 1 kg m−3 Dynamic viscosity μ 0.1 Pa s Chord length L 1 m Reynolds number Re 500 Angle-of-attack α 0 degree. As shown in Figure 2.2, the spatial resolution is 2.56 m for the far field, and 0.005 m around the airfoil profile and within the wake area. The spatial discretization has been defined through a region of refinement instead of using an adaptive refinement in order to ensure that the symmetry of the NACA-0012 is respected. The discretization ended up with 1.3 million elements in 9 levels of refinement. Since the flow is laminar, no wall functions have been used to model the boundary layer.

Post-Processing

Experiments have been conducted at different Reynolds numbers based on the chord length, however this validation case will only treat the Reynolds number 2×106 since it has been used for most of the data provided by [5]. The Mach number is 0.1 and the experimentation has been done with transition free (smooth) and with transition fixed by roughness at specific locations. The objective of this case is to validate the pressure distribution and aerodynamic forces predicted by XFlow at low Mach number and different angles of attack (AoA). The calculations have been performed with XFlow for a range of angles of attack between -4 and 10 degrees every two degrees. All the calculations are transient due to the nature of the XFlow solver and use the Wall-Adapting Local-Eddy turbulence model, which belongs to the Large Eddy Simulation (LES) approach. Wall function models in XFlow assume that the boundary layer is fully turbulent, therefore it is not possible to model transition or prescribe a transition location.

RESULTS AND DISCUSSION

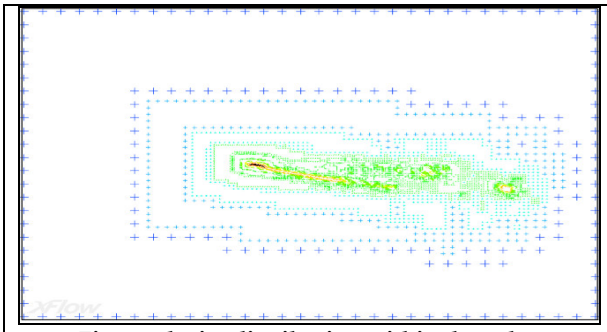

Fig.1. velocity distribution within the valve

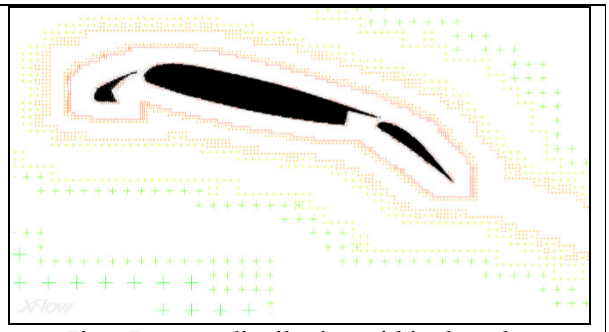

Fig.2. Pressure distribution within the valve

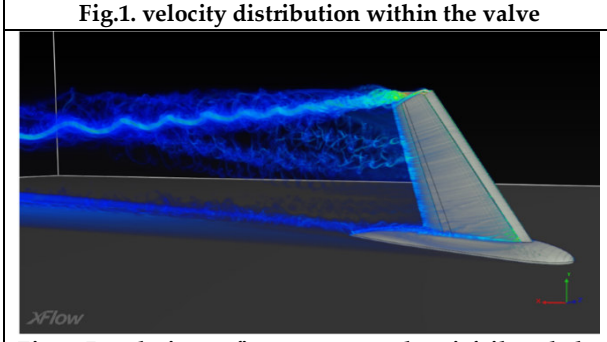

Fig.3. Resolution refinement near the airfoil and the wake.

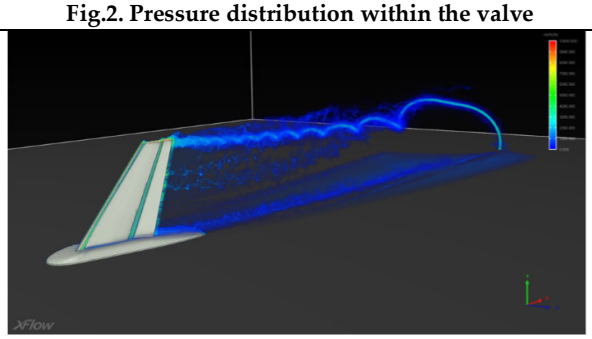

Fig. 4. Airfoil pressure coefficient distribution for different AoA: a) 0 degrees, b) 2 degrees, c) 4 degrees, d) 6 degrees.

CONCLUSION

The study shows that the trapezoidal aerofoil is used for generating high lift and can be used for high payload aircrafts. It can be seen that from pressure and velocity distribution, the lift generation can be tested. The lift generation is tested for different angle of attacks, that is for 0 degrees, 2 degrees, 4 degrees and 6 degrees.

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RESEARCH ARTICLE

Validation of NACA-0012 Aerofoil at Re = 500

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ABSTRACT

This article deals with the validation of NACA-0012 aerofoil. The results of XFlow are compared with the results of CFL3D. The validation of the aerofoils is very important for the numerical simulation of aerodynamic results. After the validation of the results only, the experimentation or the designing of propellers can be approached.

Keywords: aerodynamics, propeller design, NACA aerofoil. validation of results.

INTRODUCTION

The NACA-0012 airfoil is a widely-used wing section that has zero camber and a maximum thickness to chord ratio of 12 percent. As it is shown in Figure 2.1, the NACA-0012 is a symmetric two-dimensional profile with a very smooth aerodynamic shape. This validation case presents the XFlow results for the flow past a NACA-0012 at zero angle-of-attack and at a Reynolds number of 500. These results are further compared with reference data; the comparison is based on the CFL3D code from the National Aeronautics and Space Administration (NASA)1 [3, 4] due to the lack of experimental data for such a low Reynolds number.

A two-dimensional single-phase external aerodynamics analysis has been performed using a virtual wind tunnel of dimensions 60×40 m and a NACA-0012 profile of chord length L = 1 m. In order to reach a Reynolds number based on the chord length equal to 500, the simulation parameters have been set according to Table 2.1.Free-stream velocity vref 50 m s−1 Density ϱ 1 kg m−3 Dynamic viscosity μ 0.1 Pa s Chord length L 1 m Reynolds number Re 500 Angle-of-attack α 0 degree.

As shown in Figure 2.2, the spatial resolution is 2.56 m for the far field, and 0.005 m around the airfoil profile and within the wake area. The spatial discretization has been defined through a region of refinement instead of using an

adaptive refinement in order to ensure that the symmetry of the NACA-0012 is respected. The discretization ended up with 1.3 million elements in 9 levels of refinement. Since the flow is laminar, no wall functions have been used to model the boundary layer.

Regarding temporal discretization, the time step was set to 0.004 s, which corresponds to a Courant number of 1 with respect to the lattice size and the free stream velocity. Since X Flow solver is inherently transient and this case is steady, the analysis has been run until the aerodynamic co efficients stabilize in time. The values of these co efficients are given in Table 2.2; the ones predicted by XFlow are quite like those from CFL3D. The drag co efficient (Cd) has a relative error of -2.0678% with respect to CFL3D results, whereas the lift co efficient (Cl) is actually even more accurate as it should theoretically be theoretically equal to zero because of the NACA symmetry at zero angle-of-attack.XFlow profiles of normalized X and Y velocity components as well as pressure co efficients have been compared with CFL3D data at five vertical sections: x/L = 0, 0.25, 0.5, 0.75 and 1 (see Figure 2.3).Figure 2.4 shows the X-component of the velocity field normalized by the reference velocity v ref = 50 m s−1. The results of X Flow and CFL3D are perfectly matching for the five sections. The profiles are as expected in both codes: they tend to zero in the airfoil thickness and to one (or slightly more) on the sides where the boundary layer is fully developed. For the Y-component of the velocity field (normalized by vref), again XFlow results are almost perfectly matching with those of CFL3D, as shown in Figure 2.5. Nevertheless, one can observe some differences close to the airfoil wall, especially for section x/L = 0.5. This might be due to the size of the first element within the boundary layer which is not fine enough. However, the differences between the two codes are small.The pressure coefficient Cp is defined as Cp =pstatic 1 2 ϱ v2ref, where pstatic is the gaugestatic pressure. Figure 2.6 shows the pressure coefficient distribution at the five sections. More differences are now noticeable, especially at x/L = 0.5, 0.75 and 1.0. In general, the Cp tends to be slightly over-estimated.

S825 airfoil

The S825 airfoil has been designed for horizontal-axis wind turbine applications by the National Renewable Energy Laboratory (Colorado, USA). The report of the design and experimentation of the S825 airfoil [5] exposes the different objectives and constraints set for the design, as well as the methodology of measurements which have been conducted in the NASA Langley Low-Turbulence Pressure Tunnel (LTPT) [6]. As explained in [5], the main objectives were, first, to reach a maximum lift coefficient of at least 1.40 at a Reynolds number of 2×106. Second, a low profiledrag coefficients should be obtained between 0.40 and 1.20 of the lift coefficient. Two main constraints were to keep the zero-lift pitching-moment coefficient greater than -0.15, and also to have an airfoil thickness equal to 17% of the chord. The final two-dimensional design is as shown, with a chord length equal to 0.45715 m. Experiments have been conducted at different Reynolds numbers based on the chord length, however this validation case will only treat the Reynolds number 2×106 since it has been used for most of the data provided by [5]. The Mach number is 0.1 and the experimentation has been done with transition free (smooth) and with transition fixed by roughness at specific locations.

The objective of this case is to validate the pressure distribution and aerodynamic forces predicted by XFlow at low Mach number and different angles of attack (AoA). The calculations have been performed with XFlow for a range of angles of attack between -4 and 10 degrees every two degrees. All the calculations are transient due to the nature of the XFlow solver and use the Wall-Adapting Local-Eddy turbulence model, which belongs to the Large Eddy Simulation (LES) approach. Wall function models in XFlow assume that the boundary layer is fully turbulent, therefore it is not possible to model transition or prescribe a transition location. Two-dimensional single-phase analyses have been performed using a virtual wind tunnel of 60 m × 40 m and a velocity at the inlet of 43.7493 m s−1. The angle of attack is varying by rotating the geometry instead of projecting the inlet velocity vector, since XFlow allows easy manipulation of the geometry. The fluid has a density of 1 kg m−3 and a dynamic viscosity of 10−5 Pa s accordinglyto the Reynolds number based on the airfoil chord length (Re = 2 × 106). The simulations have been run for 1 second of physical time, with a time step of 0.002 s. The resolution scale at the far field is 1.28 m, using the refinement near walls and dynamically adapting to the wake available in XFlow. The walls and the wake are

resolved with a scale of 0.0025 m. The solution for the static pressure and velocity flow variables at final time for zero angle of attack can be observed. For each angle of attack, the curve of pressure coefficients (Cp) has been extracted in XFlow using a cutting plane field distribution which projects the selected field on the upper and lower sides of the airfoil. For the angles of attack -4, -2, 0, 2, 4, 6, 8 and 10 degrees, the pressure coefficient distribution along the airfoil has been compared with the transition free experimental data presented in [5]. The results for angle of attack between 0 and 6 degrees are in good agreement with the experiments. On the upper side of the airfoil, the pressure coefficients are slightly under-estimated when the angle increases but still match reasonably with the experimental data.

However, when angles are increased to 8 and 10 degrees of AoA then results are getting less accurate, as shown in Figure 2.11. The pressure coefficient tends to be more under-estimated near the leading edge of the upper part. This could beexplained by the lack of transition model or the LES model, which is not fully consistent for 2D simulations. Another last series of angles of attack have been studied, this time for negative incidence.Again, XFlow predicts with accuracy the pressure coefficient distribution for -2 and -4 degrees. Finally, compares the angle of attack vs. lift coefficient for theoretical [5], experimental [5] and XFlow results. For positive angles, the lift coefficient is slightly over-predicted by XFlow but in good agreement with the theoretical results.

RESULTS AND DISCUSSION

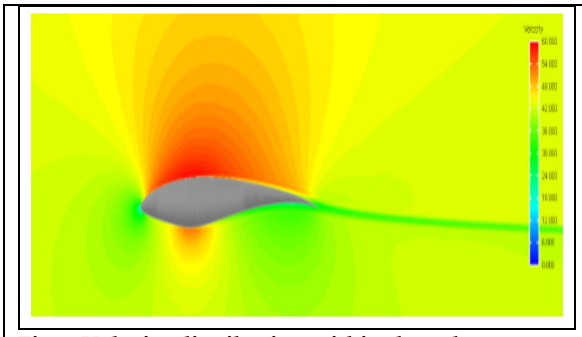

Fig.1. Velocity distribution within the valve.

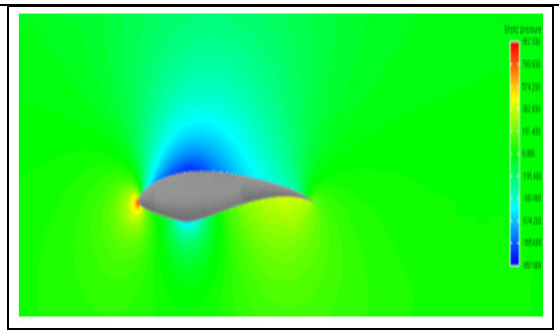

Fig.2. Pressure distribution within the valve

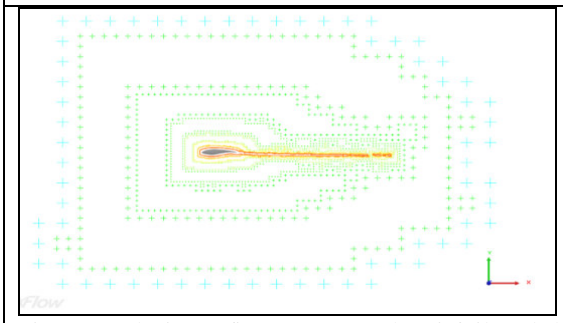

Fig.3. Resolution refinement near the airfoil and the wake.

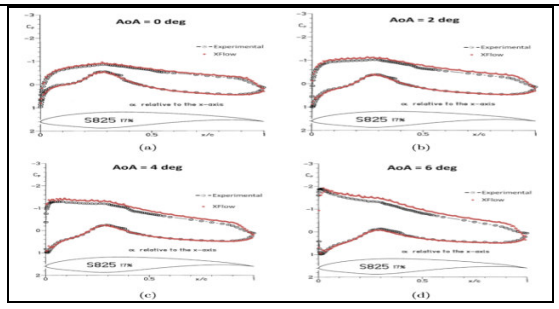

Fig.4. Airfoil pressure coefficient distribution for different AoA: a) 0 degrees, b) 2 degrees, c) 4 degrees, d) 6 degrees.

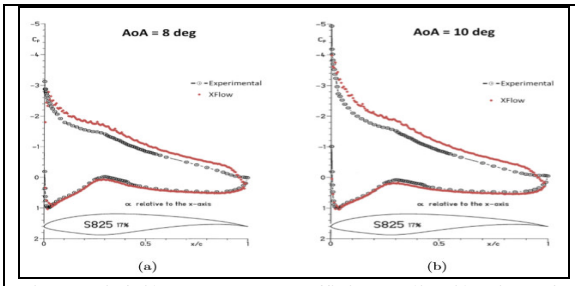

Fig.5 Airfoil pressure coefficient distribution for different AoA: a) 8 degrees, b) 10 degrees.

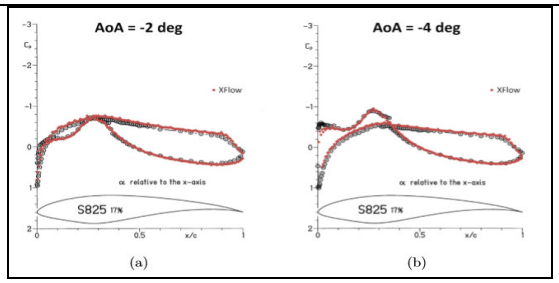

Fig.6. Airfoil pressure coefficient distribution for different AoA: a) -2 degrees, b) -4 degrees.

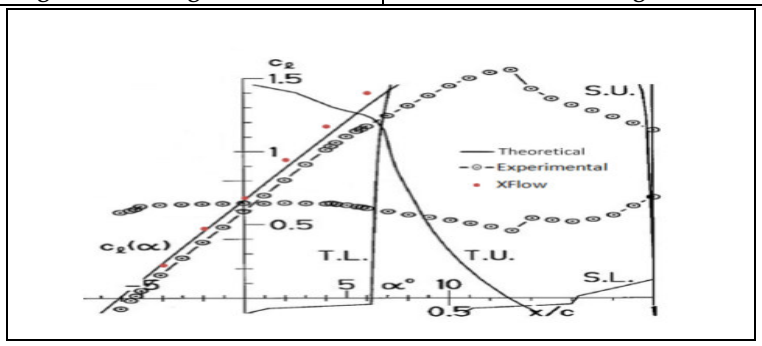

Fig.7. AoA (α) vs. lift coefficient (Cl) for theoretical, experimental and XFlow results.

CONCLUSION

It can be concluded that the flow disturbance occurs only at the top and bottom portion of the cyclone. It should be minimized, so that the vibration should be reduced, and its stability can be maintained.

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RESEARCH ARTICLE

Study of Laminar Flow inside the Ball Valve

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ABSTRACT

This paper deals with the distribution of flow field inside the ball valve. The study of velocity, pressure, turbulence and viscosity are studied for the design of turbulence free and noise reduction valves.

Keywords: convective heat transfer, convective heat transfer coefficient, heat exchange

INTRODUCTION

Import/Create the geometry Load and setup the valve geometry as indicated below:
(a) You can notice that the valve inlet and outlet surfaces are not defined. Create the inlet boundary surface: use the "Edge filter" button to select the circular inlet contours of the inlet cylinder as shown below.
(b) Now click on the "Create surface" button and a new circular surface will appear in the geometry tree: Geometry > Shape: Surface. (f) Repeat steps (d)-(e) at the valve outlet to get the outlet closing surface.
(c) It is suggested to call the surfaces "Inflow" and "Outflow": Geometry > Geometries > Shape: Inflow Geometry > Geometries > Shape: Outflow.

Create the ball: (a) Create a sphere of radius 0.008 m at the location (0,0,0). To do so, Main Menu > Geometry > Create Object > Create Sphere or press in Toolbar Object Creation. (d) In Geometry > Shape: Sphere > Behaviour>Position, move it to the initial position at rest: (0.014,0,0). In the Graphic View window, the wind tunnel disappears, and the user will have to provide the geometry that contains the fluid, the valve. Environment settings Leave the default configuration, this means: (i) no External acceleration laws (0,0,0); and (ii) user defined Initial conditions with zero initial values. However, in this tutorial the operating fluid is water. So, change the fluid properties to make the simulation with water: (a) Type: Water (b) Molecular weight: 18.01 units of atomic mass (c) Density: 998 kg m-3

Shape: Valve: Behaviour: Fixed, since this will be the fixed domain outline. The valve will remain fixed at the Position (0,0,0) with Orientation (0,180,0) (This has been set up previously).

(a) Inflow surface - Shape: Inflow: Behaviour: Fixed Position (0,0,0) and Orientation (0,180,0) should already be set up correctly. Define the Inflow surface as a mass flow boundary condition of 0.3 kg/s for t<0.3 s and 0 after. Boundary conditions: Inlet > Mass flow with Mass flow law: if (t<0.3,0.3,0).

(b) Outflow surface - Shape: Outflow: Behaviour: Fixed Position (0,0,0) and Orientation (0,180,0) should already be set up correctly. Set up the Outflow surface to be a pressure outlet condition at atmospheric pressure. Boundary conditions: Outlet> Gauge pressure outlet with Gauge pressure law: 0 Pa. Leave the Backflow disabled and Characteristic relaxation time equal to zero. Keep the default Interaction properties Let the sphere translate in X direction by setting the Translation (Global) option to Axis x. Don't let it rotate by setting Rotation (Local): Fixed. External force global (X): -150*(px-(-0.014)) (in Newtons), start computation. Load data If the user has not closed the GUI, the numerical data will be automatically loaded.

Post-processing: Vectors
Create a cutting plane by clicking on the icon on the Post-processing toolbar. A Cutting plane 1 will appear in the Post-processing tree. (b) Select Vectors as Visualisation mode of the Cutting plane 1. Adjust Arrows density to 1.000 and Arrow length to 0.8.(c) Change the velocity range to [0;4.5] by hitting.

Post-processing:
Sphere position with help of its checkbox (b) Plot the X-position of the Shape: Sphere by right-click on the Function Viewer, in the drop-down menu select Shapes Run the under-damping case Taking the "No damping" case as reference, modify the following settings: (a) In Geometry > Shape: Sphere > Behavior: Rigid body dynamics > Constraints > External forces replace External force global (X): -150*(px-(-0.014)) by -150*(px-(-0.014))-1.91*vx (in Newtons). The new term corresponds to the damping term and depends on the velocity. According to the equations and taking $\xi = 0.5$, the calculation leads to $2\xi(km)1/2 = 1.91$.

RESULTS AND DISCUSSION

Fig.1 shows the velocity distribution within the valve. It can be seen that velocity with a value of 0.226 m/s will be highest at the centre of the middle section of the valve.
Fig.2 shows the pressure distribution within the valve of with a highest value of -4930.071 Pa at the inlet section of it.
The viscosity of the water within the valve is seen to be highest at the middle section of it with a value of 0.001 Pa-s.
Fig.4 shows the turbulence intensity within the valve. It can be seen that the turbulence will be highest at the outlet of the valve with a value of 60.016 %.
Fig.5 shows that the vorticity will be highest at the middle section of the valve with a value of 168.936 s^{-1}.

CONCLUSION

It can be concluded that the disturbances within the flow will be higher at the other side of the valve towards the outlet. Therefore, it is the reason why there occurs the sound of turbulence and flow variations towards the outlet of the valve.

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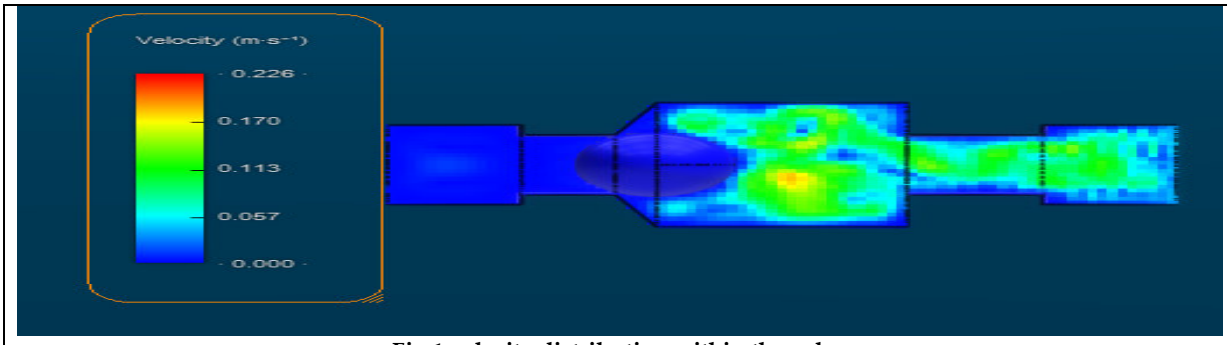

Fig.1 velocity distribution within the valve.

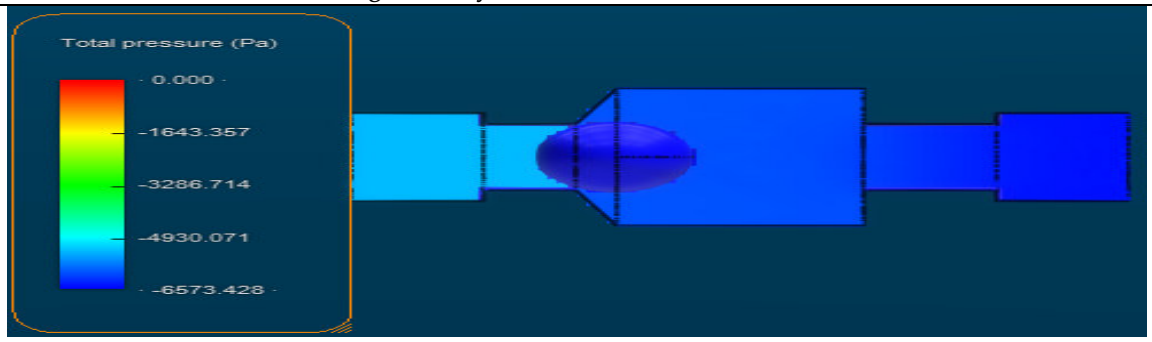

Fig.2 pressure distribution within the valve.

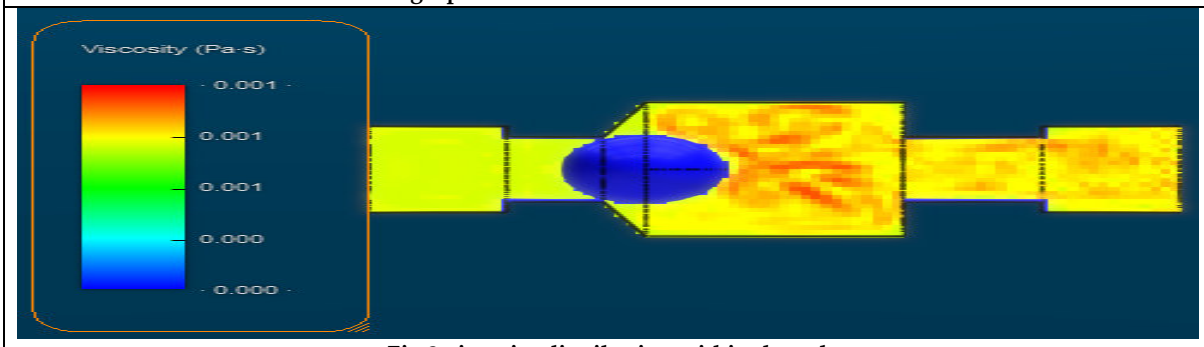

Fig.3 viscosity distribution within the valve.

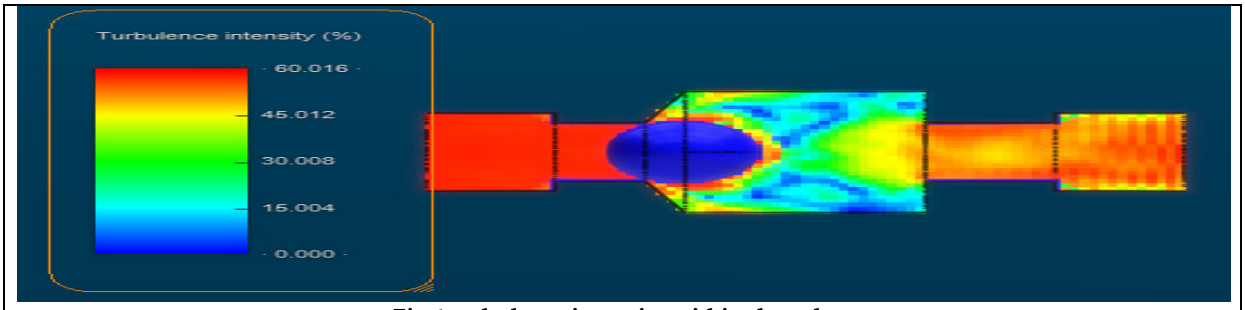

Fig.4 turbulence intensity within the valve.

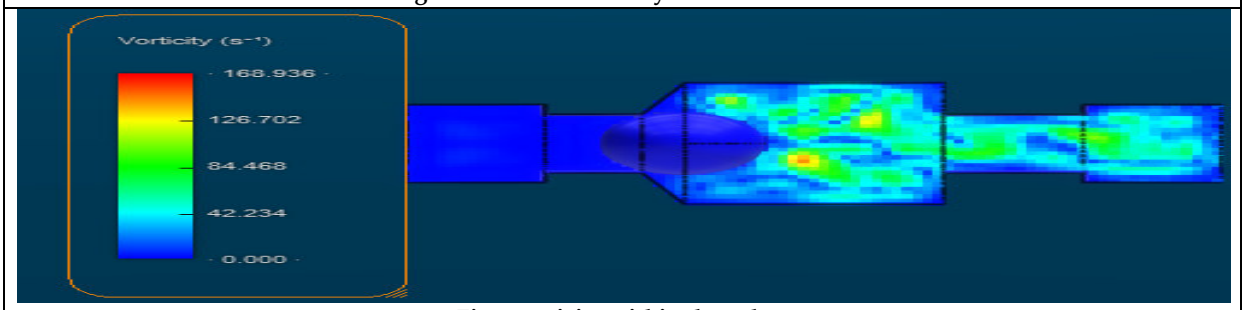

Fig.5 vorticity within the valve.

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RESEARCH ARTICLE

Study of Flow inside the Cyclone Separator

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ABSTRACT

This paper deals with the temperature distribution along the surfaces of the metal block in a closed boundary. The convective heat transfer has been considered; with a box filled with air and a solid metal box placed at the centre of the room. The Boussinesq approximation has been adopted in this scenario.

Keywords: convective heat transfer, convective heat transfer coefficient, heat exchange

INTRODUCTION

This article illustrates the setup and post-process of a cyclone flow. Cyclones are used in many industrial applications, especially in separation processes such as dust from a gas stream. Dust particles can be modelled in XFlow with the Discrete Phase Model (DPM), which represents solid spherical particles with physical properties (inertia, drag and gravity). The inflowing fluid rotates inside the chamber and is constrained to follow a swirling flow path. In cyclones of this type the larger suspended particles move outwards to the chamber wall where they travel in a downward spiral to the base. The smaller particles move slowly and therefore their distribution across the flow changes little. Those in the centre are captured in the upward flow and exit the chamber through the upper outlet. Cyclones are commonly used when the density of the inflowing fluid (the carrier phase) is less than that of the suspended phase.

Calculate Discrete Phase Model stream tracers Show the path lines Monitor the number of particles through the outlets. Import a new geometry or. Note that the vertical direction of the chamber is in the Z-axis and that the normal are pointing outwards. (b) Rotate the chamber so that the vertical direction is parallel to Y-axis: Geometry > Shape: Cyclone Chamber > Orientation: (-90,0,0). (c) Leave the Wall Boundary condition at the Cyclone Chamber (Automatic) (d) Set the Inlet > Mass flow Boundary condition to the inlet. It will be assumed that the air inflow rate is 0.08 m3/s. This is equivalent to a Mass flow law of (air density) *(volumetric flow rate) = 0.0964 kg/s (e) Set the Gauge

pressure outlet to the outlet, with Gauge pressure law = 0 Pa, and no Backflow allowed and Characteristic relaxation time = 0 s. (d) Set the Frequency to store data to 200 frames per second (e) Switch on Save averaged fields with an initial time for averaging of 0.3 s. This will filter out the phase of initialisation of the flow before starting the averaging.

Post-processing

Visualise the velocity field on a cutting plane In Post Processing > Cutting planes

(a) Create a cutting plane on the Z axis and adjust the position to 0.2 (Cutting plane 1) (b) Choose Visualisation mode: 3d field (c) Choose Field: Velocity (d) Set the General > Interpolation mode: Convolution (e) Select view from right (f) Choose General > Data: Averaged (g) Press play and note that there is no data before t = 0.3 s as we specified for the averaging initial time. (h) Change to Instantaneous data and play forward the results. Observe the differences with the averaged data. (i) Show also static pressure, vorticity, Vy, Vz and turbulence intensity fields. You may need to adjust the legend ranges.

Visualise the velocity vector field on a cutting plane In Post-Processing > Cutting planes > Cutting plane 1 (a) Go the last frame available (c) Choose Visualisation mode: Vectors with Uniform distribution: On and increase arrows density and arrows length (d) Choose Field: Velocity (e) Select view from right (f) Change between Instantaneous, Averaged and Standard deviation data and refresh the cutting plane with the icon.

Measure velocity field along a line (a) Create a plot line by right clicking Post-Processing > Plot lines and selecting Add data plot line (b) Line goes from Vertex 1: (-0.1, -0.3, 0) to Vertex 2: (0.1, -0.3, 0) (c) Set the Number of samples to 1000. This is the number of points used to draw the curve, therefore the higher the more accurate (d) Select the Velocity field and Averaged data, with interpolation on (e) Right click in Function Viewer > Plot lines > Line 1 to display the evolution of the visualisation field along the line: Visualise the vorticity volumetric field (a) Deactivate any cutting plane or plot line (b) Set the Interpolation mode to Off (d) Set the vorticity range to [0,2000] (Main menu > Simulation data > Analysis settings or) (e) Set Post-Processing > General > Data: Instantaneous (f) Enable the visualisation of the Volumetric field and visualise the vorticity field with a transference law: [a*a] (g) Press play (h) Change the Transference law to [a]

RESULTS AND DISCUSSION

Fig.1 shows that the velocity is maximum at the top portion of the cyclone with a velocity of 52.313 m/s. Whereas, the velocity of about 26.159 m/s occurs at the middle portion of the cyclone. Fig.2 shows that the vorticity distribution inside the cyclone separator. It can be seen that the maximum vorticity occurs at the top and bottom portion of the separator with a value of 2000 s^{-1}. Whereas, the lowest portion of the vorticity occurs at the edges of the cyclone separator.

CONCLUSION

It can be concluded that the flow disturbance occurs only at the top and bottom portion of the cyclone. It should be minimized, so that the vibration should be reduced, and its stability can be maintained.

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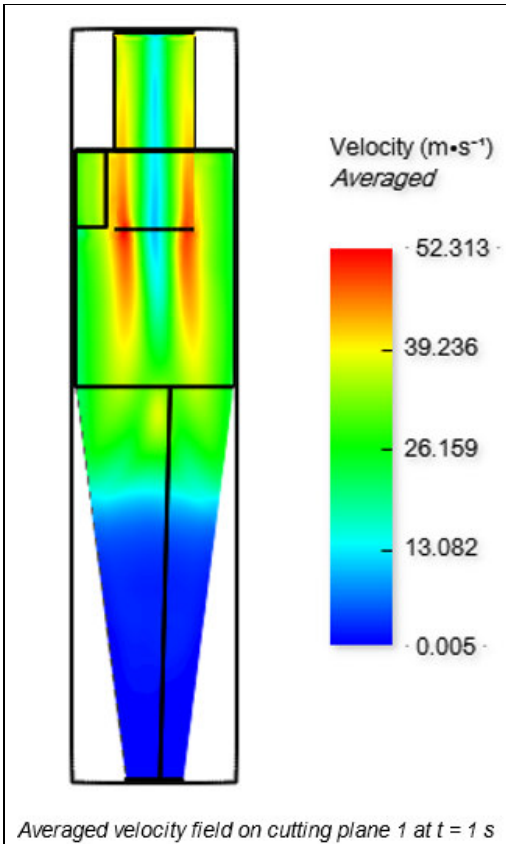
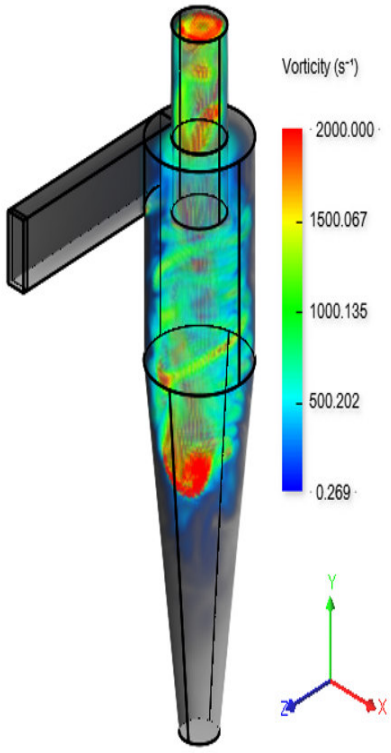


Averaged velocity field on cutting plane 1 at t = 1 s

Fig.1 velocity distribution within the valve.



Volumetric rendering of instantaneous vorticity at t = 1 s with a transference law

Fig.2 vorticity distribution within the valve.

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RESEARCH ARTICLE

Study of Laminar Flow around the Heat Block

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ABSTRACT

This paper deals with the temperature distribution along the surfaces of the metal block in a closed boundary. The convective heat transfer has been considered; with a box filled with air and a solid metal box placed at the centre of the room. The Boussinesq approximation has been adopted in this scenario.

Keywords: convective heat transfer, convective heat transfer coefficient, heat exchange

INTRODUCTION

Simulation settings

h) Store data > Folder: Radiation
i) Set the Frames frequency to 10000 frames per second and leave the Numerical data frequency by default.
j) Global attributes > Ext. acceleration laws: (0, -9.81, 0) m/s2, to consider the gravity.
k) Leave the Initial conditions as User defined.
l) In Project Tree > Materials leave the default liquid properties, since these are the water properties.
m) In Project Tree > Geometry > Geometries > Shape: tank set the following parameters: (a) Behaviour: Fixed (b) Boundary conditions: Wall, with Wall model: Free slip.
n) In Project Tree > Simulation set the following parameters: (a) Simulation time (b) Resolution > Resolved scale: 0.03 metres, with the Refinement algorithm: Disabled (c) Resolution > Seed point: Automatic (d) Store data > Folder: radiation (e) Store data > Frames frequency: 50 frames per second (Hz) (f) Leave off Save averaged fields (g) Enable Compute markers.

Post-processing

e) To show only the particles at the free surface, select Makers > From: Surface; otherwise, select All to show the whole domain of fluid.

f) To represent the particles with different shapes, select Arrows and Sphere in Representation. Tick the checkbox at Post processing > General > Show > Markers.Leave the Gravitational potential > Potential origin: Automatic, which by default sets the potential origin at the free surface.

g) Visualize the initial static pressure field. Activate the markers v visualization in Post-processing > General > Show > Markers by ticking the box.

h) Set Markers > From: All, to see all the markers in the domain, and select the Static pressure in Markers >Color by field

RESULTS AND DISCUSSION

Fig. 1 shows the temperature distribution around the block. It can be seen that thetemperature far from the block is higher with a value of 366.02 K as compared to other parts. Also, the temperature at the right face is the highest among them with a value of 392.364 K.

The pressure distribution around the air can be seen from the Fig.2. The highest pressure of about 111.367 Pa occurs at the top face of the cavity. Whereas, the lowest pressure of about -55552 Pa occurs at the base of the cavity.

The viscosity distribution around the block can be seen from the Fig.3. It can be seen that the highest viscosity occurs at the lower edges of the block.

CONCLUSION

The convective heat transfer occurs from solid to the gas and again to the solids. There is a combined effect of different boundary interactions needed for the convective heat transfer. Convective heat transfer is less effective as compared to the conductive heat transfer; whereas it is more effective a s compared to the radiation heat transfer.

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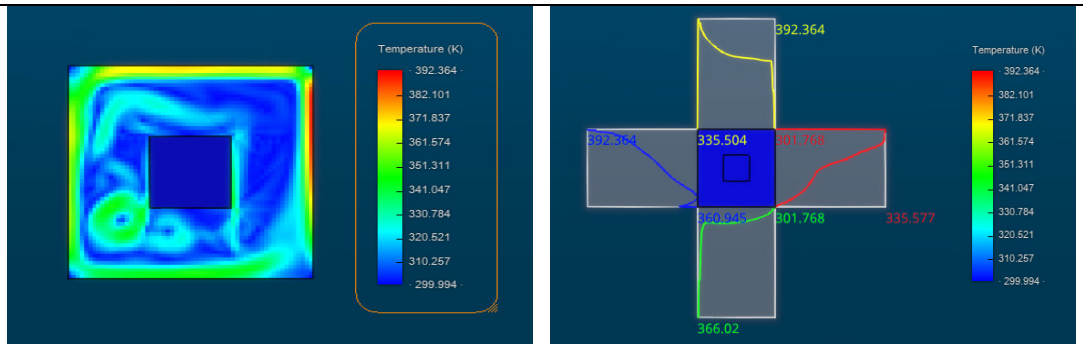

Fig.1 Temperature distribution around the block

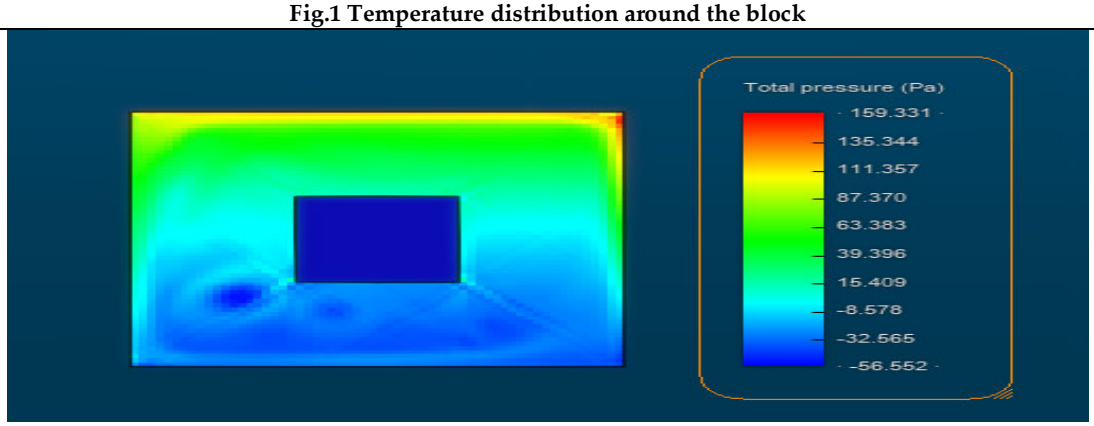

Fig.2 Pressure distribution around the block

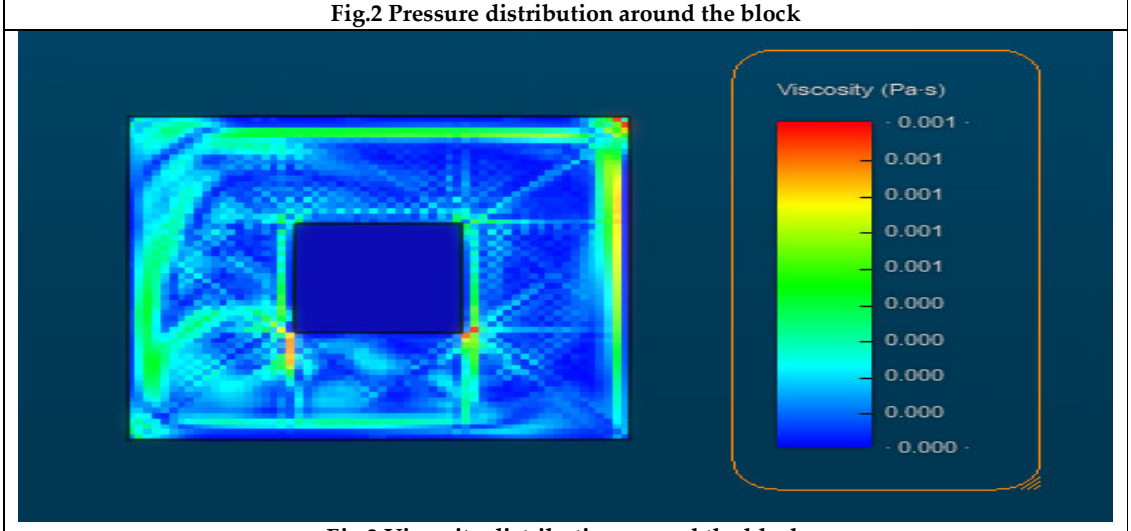

Fig.3 Viscosity distribution around the block

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RESEARCH ARTICLE

Performance and emission Analysis of Single Cylinder 4 stroke VCR Engine using Karanja biodiesel blend with diesel

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ABSTRACT

Keeping environment cleanliness into consideration, different alternatives to fossil fuel were gaining importance day by day. Biodiesel is an alternative to diesel. In this article, emphasis is given on the production of biodiesel from Karanja oil. Karanja Biodiesel is blended with Diesel fuel and its performance is tested in a 4 stroke single cylinder VCR engine. Its emission is also measured in emission gas analyser.

Keywords: Karanja Biodiesel, VCR engine, Emission gas Analyser**Keywords**: convective heat.

INTRODUCTION

Anjana et al presented the effect of CaO catalyst in the transesterification of Pongamia oil.The performance and emission characteristics of Pongamia Biodiesel blend with diesel was studied [1]. Patel et al reviewed the feasibility of Karanja oil as a feedstock to produce biodiesel, suitable method to extract oil from seeds, the optimised parameters to produce biodiesel and the effect of biodiesel emission as compared to diesel [2].Bobade et al pointed out the demerits of using edible oil as biodiesel feedstock. In order to overcome, the mentioned issue non edible oils were preferred [3]. Rathore et al investigated that Karanja biodiesel gave good performance and less emission value at optimised condition of diesel engine at 1500 rpm, 16:1 Compression Ratio and 200 bar [4].Balajee et al showed performance and emission parameters of VCR CI engine fuelled with blends of diesel with Jatropha and Pongamia pinnata methyl ester at different compression ratio 13,14, 15, 16, 17.5 [5].Imranet al presented different techniques to produce biodiesel from Karanja oil with the help of different catalyst [6]. Thennarasu et al obtained combustion parameters at Compression ration 16.5, 17.5 and 18.5 with B10, B20, B30, B50 in a VCR engine [7]. Harrehet al presented the optimised value of desel engine fuel with Karanja biodiesel from Sarawak, Malaysia [8]. EKNATH et al studied the effect of compression ration on a single cylinder VCR DI diesel engine [9] .

EQUIPMENTS USED IN PREPARATION OF BIODIESEL

The Karanja oil is first measured for 1 L and filtered to remove impurities. It is preheated at 45°C for 15 minutes to remove moisture.

The following are the major components used in production of biodiesel:-

- Biodiesel reactor
- Stirring system
- Heating system
- Cooling Unit
- Settling (Separation) vessels

BIODIESEL REACTOR

2L capacity biodiesel reactor was used in the below diagram. This reactor is used to heat 1L Karanja oil with 200 ml methanol and 10 gm concentrated H_2SO_4 for esterification process. 200 ml ethanol and 10gm KOH is also used in transesterification process.

Stirring system

For proper mixing and improve the reaction a stirrer is needed which comes along with the setup the speed at which the stirring should be done in between 150 r.p.m to 700 r.p.m.

Heating System

The conversion of Karanja oil to Karanja Biodiesel needs temperature range of 50 °C to 60°C.A constant temperature need to be used for this purpose. An insulating system is also used for this purpose.The system was designed with an electric heating coil, a temperature controller and a sensor.

Cooling System

Cooling system is also a vital part of the whole reactor because a water cooling arrangement is needed to handle the temperature within the range .The cooler is a recycle type water cooler.

Separating and Washing funnel

Separating funnel of 1L is used to separate Karanja methyl ester. In this funnel, the product of esterification and transesterification is settled for 12 hours to separate the biproducts.

PROCEDURE FOR PRODUCTION AND TESTING OF BIODIESEL

Acid value test of Crude Karanja Oil

- Weightout 0.5gm of the given oil into a clean and dry conical flask.Add 10 ml of ethyl alcohol into it .Shake it for 5 minutes to prepare a homogeneous mixture.
- Add 10 drops of phenolphthalein indicator to it.Then titrate it against standard solution of potassium hydroxide of strength N/100.
- Note the initial burette reading and titrate it until pink colour first appears in the flask.Note the final burette reading.
- Let V_1=Vol. of N/100 KOH required for blank titration.
  V_2=Vol. of N/100 KOH required for in presence of oil.
  Volume of N/100 KOH equivalent to acid content of oil=($V_2 - V_1$) ml. of N/100 KOH.
  Now, 1000ml of 1N(KOH)=56 gm of KOH
  (V_2-V_1)ml of 1N(KOH)={56*(V_2-V_1)/1000}gm of KOH
  (V_2-V_1)ml of (N/100)KOH={56*(V_2-V_1)/1000*100 }gm of KOH

= A mg of KOH
0.5 gm of oil requires A mg of KOH
1gm of oil requires 2A mg of KOH

Esterification Process

- Take 1 litreof crude karanja oil in the reaction and preheat it upto 50°C for 15 min with streering. Take 10gm of H_2SO_4 and add 200ml of Methanol and mix it properly then add the solution in the reactor.
- Heating will be done for 4 hours at (50°-55°)C .Then leave the product in the separating flask for 12 hours.
- Then extract the required output preheat for transesterification.

Transesterification Process

- Take 10 gm of KOH pallets and add it with 200 ml of Methanol and mix it properly .Then add it to the product of esterification.
- Continue step-3,4 of esterification.
- Then the extracted output product will be water washed to remove unreacted alcohol from the biodiesel.
- Then heat the biodiesel at 60°C to remove the partial water content with in it.

Instruments used for measuring properties

Kinematic viscometer bath apparatus
The kinematic viscosity of the diesel is measured with the help of KINEMATIC VISCOMETER BATH APPARATUS (Fig.3) whose manufacturer is PETRO-DIESEL INSTRUMENTS COMPANY and its bath capacity is 20 litres. Its temperature range varies from ambient temperature to 100°C. Six no. of test provisions are there in this apparatus

Flash point tester
The flash point and fire point of the diesel can be found out with the help of PENSKY MARTENS FLASH POINT TESTER APPARATUS (fig. 4) whose manufacturer is PETRO-DIESEL INSTRUMENTS COMPANY.

Cloud point & pour point apparatus
The cloud point & pour point of the diesel is measured by CLOUD POINT & POUR POINT APPARATUS (fig.5) whose manufacturer is PETRO-DIESEL INSTRUMENTS COMPANY. Its temperature range varies from ambient to -40°C. There are 4 number of test provision in the apparatus

Density bath with hydrometer apparatus
The density of the diesel can be determined by DENSITY BATH WITH HYDROMETER APPARATUS (fig.6). Its manufacturer is PETRO-DIESEL INSTRUMENTS COMPANY. Its bath capacity is 15 litres. Its temperature range varies from ambient temperature to 100°C.

Exhaust gas analyzer
Multi - Gas Analyzer capable of measuring CO, HC, CO_2, O_2 & NOx contents in the exhaust. The AVL-444 analyzer provides optimized analysis methods for different applications

RESULTS AND DISCUSSIONS

Karanja oil used in our research work was having acid value more than 12. We used both esterification and transesterification methods. In eserification process, we heated the oil at 55 to 60 degree centigrade for 4 hours with

catalyst to bring down the acid value to less than 1. Then transesterification process was carried out with same time interval at 60 degree centigrade to produce biodiesel. The biodiesel was tested and found it was having density nearly equal to diesel. The biodiesel was tested in VCR engine at different compression ratio (CR) varying from 12 to 18 at interval of 1 CR. Biodiesel blends from B0 to B100 was tested in engine**.** It was found that B30 gave good result at CR 18 in comparison to other blends of biodiesel. Brake thermal efficiency of biodiesel was found lower than diesel. As a result of which Brake specific fuel consumption increases with increase in load for biodiesel. NOx, CO and HC emissions were measured for diesel and Karanja methyl ester blends. NOx was found to increase whereas CO and HC emission decreases with increase in blend proportion.

CONCLUSION

In this article, effort was made to optimize the production of karanja biodiesel from karanja oil with high acid value. It was observed that 980 ml of biodiesel was produced when the karanja oil was heated in the biodiesel reactor for more than 3 hours. Different blends of diesel and karanja biodiesel was made and used in a single cylinder 4 stroke VCR engine. Its performance and emission parameters were also studied. In Odisha context, Karanja biodiesel is a potential alternative for diesel without bringing any modification in the diesel engine.

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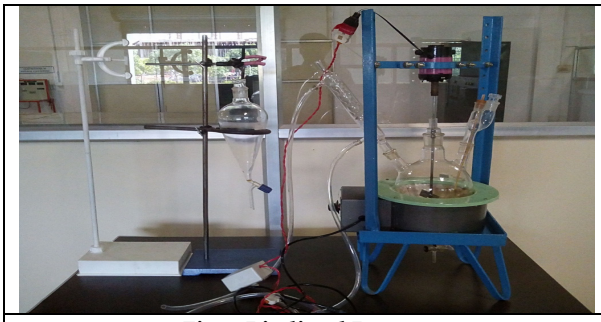

Fig. 1.Biodiesel Reactor

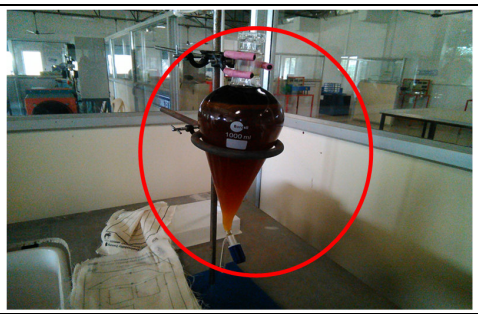

Fig. 2.Separating and Washing Vessel

Fig.3. Kinematic viscometer bath apparatus

Fig.4. Flash point tester

Fig.5.Cloud point & pour point apparatus

Fig.6.Density bath with hydrometer apparatus

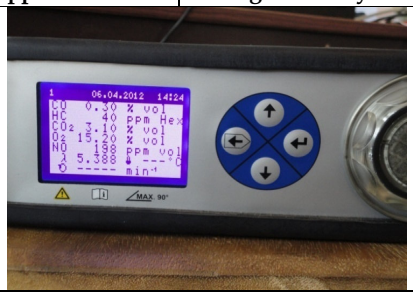

Fig 7. Exhaust gas analyser

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RESEARCH ARTICLE

Fabrication of Solar Still

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ABSTRACT

Water is the most important parameter for human being for their livelihood. It is not only required to make them alive but also required in power plants, hospitals, offices etc. Very less amount of water can be used for drinking purpose. In many areas human being struggle to get clean drinking water. To eliminate these issues, solar still is found to be very effective. This device uses the solar energy to generate clean drinking water. In this article, effort has been made to design a solar still which is easy to use and less costly. The purpose of this project is to fabricate a solar still system that can purify the water. It will be useful in rural areas where there is lack of availability of pure water. This system can also be used in the night as Phase change material is utilised to store the heat of sunlight for a long amount of time.

Keywords: Solar Still, Solar Collector, PCM.

INTRODUCTION

Kumar et al. reviewed different type of solar distillation system and proposed different techniques to improve the design [1]. Gangadhar et al. described use of wick as insulators. They also used sand to make the distillation possible at night time [2]. Dashtban et al designed a weir type cascade solar still with paraffin wax. With the paraffin wax, efficiency increased upto 31% [3]. Fayadh M. Abed explained the design and manufacturing of a multilayer solar distiller at a minimum cost [4]. Obayemi et al presented two designs on two single slope solar stills: a modified solar still with variable collector/inclination angle (still A), and a conventional solar still with rigid angle of collector/inclination (still B) [5]. Karthickmunisamy et al investigated performance of conventional solar still with modified solar still in which metal matrix structures were used as sensible heat storage media. This was used in day time and night time also [6].

FABRICATION

The absorber plate of the solar still was designed and fabricated. Aluminium sheets were used. Aluminium rivets were used for joining different pieces of the absorber together. The sheets were bended with bending machines and were riveted with the main structure to give it a shape of a stair-case like structure. A box was put below the absorber plate to incorporate PCM (phase change material) .A glass plate was used at the top of the absorber plate. 16 stair steps were made. Side walls were also made by riveting. We also fabricated the tilted part which made an angle of 30 degree with the absorber plate.

RESULTS AND DISCUSSION

Table: 1. Readings taken form still
Experiment is performed from 12:00am to 04:00pm in summer season.

TIME (am)	Inlet water Temp˚C	Outlet water Temp˚C	Glass Surface Temp˚C	Intensity of radiation(lux)
12.00	35.3	37.8	29.8	1098
12.30	37.4	39.1	32.5	1010
01.00	40.6	43.5	34.5	998
01.30	42.5	44.6	33.4	987
02.00	44.1	45.7	37.2	946
02.30	46.0	46.5	34.8	893
03.00	45.3	47.4	41.0	810
03.30	46.1	46	34.3	718
04.00	43.9	43.1	32.3	620

COST ESTIMATION

Item no	Description of item	Unit	Quantity	Total	Total weight	Rate/Kg	Total Cost
1.	Pump	PC	1	NA	NA	1806	1806/
2.	Paraffin Wax (P.C.M)	Kg	12	NA	6 Kg	800/- for 500gm	9600/-
3.	Aluminium Sheet of **10m x 15m** and thickness **1mm**	mt x mt	1	NA	NA	231/- per Kg	2541/-
4.	Glass of 3mm	mm	1	NA	NA	NA	350/-
5.	Storage Tank	PC	3	NA	NA	NA	2774/-
6.	Pipe (Insulated-Flexible)& Clamp	L	10 Mtr.	NA	NA	NA	777/-
7.	M.Seal	250 gm	9	NA	NA	NA	540/-
8.	Brown Tape	PC	2	NA	NA	50	100/-
9.	Rivet,Nut& Bolt	PC	NA	NA	NA	NA	300/

10	**Teflon Tape**	**15**	**20**	**300**
11	Electric Wire	16×2mtr.	NA	420
12	Paint	2	130	260
13	Stand	2	1500	6000
14	Hose Camp & Hard Pipe	NA	NA	555
15	Plug and Pin	NA	NA	150
			TOTAL	RS.26500/-

CONCLUSION

In this article, effort has been made to design a pocket friendly solar still which can not only be used in the presence of sunlight but in absence of sun light also. Phase change material, Wax is used to store the heat up to 18 hours so that the heat can be used to purify the water in night time also. Modified collector design is used to increase the efficiency of the solar collector so that purification rate can be faster.

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Fig.1. Cutting of Sheets

Fig.2. Bending of foil into stairs

Fig.3. Making Collector Cover and Riveting the stairs

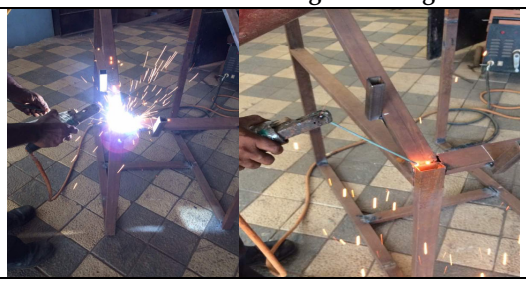

Fig.4. Making of Stand

Fig.5. Drilling of Holes & Installation of Valve

Fig.6. Painting

Fig.7. Assembling

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