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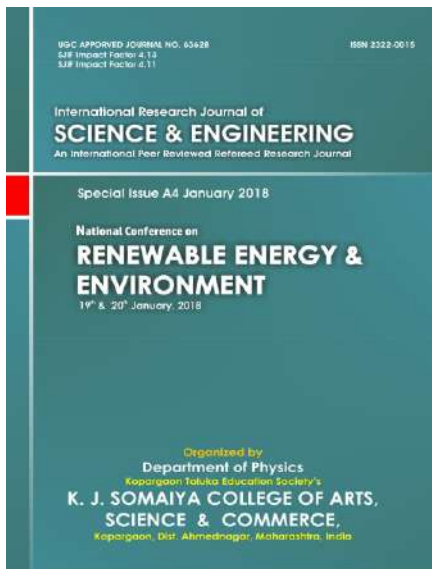
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Renewable Energy Technology: A Case Study of Solar Steam Cooking System at Shri Saibaba Sansthan Trust, Shirdi, MS, India

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ABSTRACT

Many scientists have pointed out the relevance of alternate renewable sources of energy to overcome 'Energy Crisis'. Among the renewable sources of energy, solar energy offers a practical solution for the energy problem which is clouding the prospects of mankind. Much of solar energy research in India is concentrated towards developing solar cookers for domestic use. In this context we should concentrate our thoughts on utilizing solar energy for the cooking requirements at the large scale establishments for better future and energy security. For facilitating the quantity cookery in large establishments, Sheffler's reflectors are among the convenient, cost effective and operationally viable devices. In order to iron out all the queries such as the availability, cost benefit ratio, the mode of installation, and the financial support given by the Government for installation, an explorative research study has been undertaken at Prasadalya of Shri Saibaba Sansthan Trust, Shirdi, Maharashtra where the world's largest Solar heating steam cooking system have been installed. The findings of this study bring forth the importance of the Sheffler's reflectors for quantity cookery that could be one of the emerging ventures for meeting the energy demands of the country.

Keywords: Energy crisis, Fossil fuels, Renewable energy, Solar energy, Thermosyphon principle, Sheffler reflector Solar heating steam cooking for Quantity cookery

INTRODUCTION

"Solar energy is the energy of the future, not just an alternative" was the message of the Second World Conference on Solar Cookers. It further stated that this energy will soon achieve great economic importance, not only in countries which lack primary energy resources such as coal, gas and oil but also in the industrialized countries. Solar energy would be the best and ready alternative to conventional fuels if harnessed through solar cooking devices. The rapid rise in population has resulted in constantly increasing energy needs. In order to cope with the increasing needs of the people, it put more stress and evokes higher demand on available energy.

This case study aims to understand Solar Heating steam Cooking System installed at Prasadalya of Shri Saibaba Sansthan Trust, Shirdi to see that how conventional energy and expenses incurred on it could be saved by using the solar energy. Nowadays, solar heating cooking system is becoming more popular as the concerned organization can save lakhs of rupees by saving the conventional energy sources. It also aims that natural resources of energy have the limitations. However, it can be saved if we emphasize the use of non-conventional energy sources. It is also required to come to a particular conclusion that after installing this type of project, to find out the efficiency of steam generation system by using Scheffler's reflector and its payback period. A Scheffler type concentrating solar steam cooking system was commissioned at Shri Saibaba Sansthan, Shirdi on 30th July, 2009. This is the first of its kind in Maharashtra. It cooks food for about 3000 devotees. The 73 nos. of solar Scheffler concentrators raise the water temperature to 550°C to 650°C and convert it into steam for cooking purposes. This system is integrated with the existing boiler to ensure continued cooking even at night and during rainy or cloudy weather. The solar cooking system installed at Shirdi follows the thermosyphon principle and so does not need electrical power or pump.

SYSTEM DEVELOPMENT

German scientist Wolfgang Scheffler has devised a

parabolic reflector set-up to harness solar energy using low cost set-up which can be used in rural areas in India. A concentrating primary reflector tracks the movement of the Sun, focusing sunlight on a fixed place. The focused light heats a very large pot, which can be used for heating, steam generation, cooking, baking breads, and water heating.

The solar steam cooking system installed at Shirdi has 73 parabolic concentrators / dishes (called Scheffler dishes after its inventor) placed on the terrace of Sai Prasad Building No.2.

The use of Scheffler reflectors can result in effective water heating by using the non-uniform distribution of solar radiation on the cylindrical absorber surface. In most of this system the part of the cylindrical absorber is thermally insulated in order to reduce storage tank thermal losses [5].

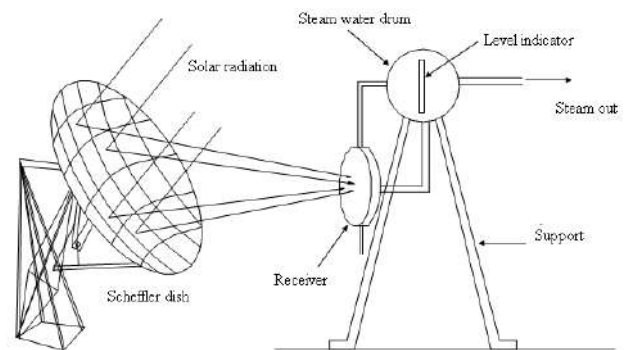


Fig 1. Schematic view of system installed at Sai Baba Sansthan's Prasadalya, Shirdi

They reflect and concentrate the solar rays on the 40 receivers placed in focus. Water coming from the steam headers placed above the header centers is received from bottom of the receiver, gets heated up to due to heat generated (about 550⁰ C) due to concentration of solar rays on the receivers and get pushed up via top pipe of receiver into the header. The principle of anything that gets heated is pushed up is called thermosyphon principle. The advantage of thermosyphon principle is no pumping (thus no electricity) is needed to create circulation since the heated water is pushed into the header and water from the same headers come into the receivers for heating. The cycle continues till it reaches 100 °C and gets converted into steam.

Table 1: Details of system development.

Sr. No	Particular	Remark
01	Cost of Project	Rs. 1.33/- Crores
02	Financial aid Ministry of Renewable Energy, New Delhi	Rs. 58.40/- Crores
03	Project Completion period	150 days
04	Area of Project	2500 Sq. mtr
05	Total solar dishes	73 Nos.
06	Area of each dish	16 Sq. mtr
07	Total dish collection area	1168 Sq. mtr
08	Energy creates by one dish during 8 Hr period.	37,840 kcal
09	Total energy created from all dishes per day	2762320 kcal
10	Steam generation capacity per day	3500 kg/day
11	Fuel used at present	L.P.G.
12	Calorific value	10,500 kcal
13	Total calories generated from solar project	2762320 kcal (10500 calorific value of gas)
14	Saving of gas	263.08 Kg/day
15	Commercial gas rate	Rs. 40.27
16	Saving per day	Rs. 10,594/-
17	Saving per month	Rs. 3,17,825/-
18	Carbon credit from project = 1956.1 MT CO ₂ × 150	Rs. 2,93,425/-
19	Subsidy of carbon credit from International organization	Rs. 2,93,415/-

The header is only filled and thus steam generated gets accumulated in the upper half of the steam header. The temperature and pressure of steam generated keeps on increasing and heat is stored till the steam is drawn for cooking into the kitchen.

All the 73 dishes rotate continuously along with the movement of the sun, always concentrating the solar rays on the receivers. This movement of concentrators is called tracking, which is continuous and is controlled by the fully automatic timer mechanism.

Only once during the day i.e. in the early morning the dishes have to be turned manually onto the morning position, subsequently the automatic tracking takes over.

WORKING OF SOLAR STEAM HEATING COOKING SYSTEM

In the focus of each pair of Scheffler Concentrator (dishes), the sleeping dish and standing dish, are placed heat exchangers called receivers.

The Solar rays falling onto the dish are reflected and concentrated on the receivers placed in its focus. Due to concentration the temperature achieved is very high (between 450-650°C) and thus the water in receivers comes to boiling and becomes steam.

Above the receiver is an insulated header pipe filled half with water. The cold water enters the receiver through inner pipe, gets heated due to the high temperature of the concentrated rays and the heated

water goes up. The cold water again enters through inner pipe and the cycle continues till steam is generated. The steam gets stored in the upper half empty portion of the header pipe and pressure keeps on rising. The steam is then drawn / or sent to kitchen through insulated pipe line.

TESTING PROCEDURE AND EXPERIMENTATION

The Scheffler reflector used here has an area of 16 m². The sunlight that falls onto this reflector is reflected sideways to the focal point away from the reflector. The axis of daily rotation is located exactly in north-south direction, parallel to earth axis and runs through the centre of gravity of the reflector. Thus the reflector always maintains its gravitational equilibrium and the mechanical tracking device (clockwork) can be moved easily in position with the sun. The

focus is located on the axis of rotation to prevent it from moving when the reflector rotates.

During the day, the concentrated light is rotated around its own center but not in sideways. Thus, the focus stays fixed. At the focus it has a receiver to hold 20 liter water. The parameters measured were: ambient temperature, water temperature, solar radiation and wind speed. The built in thermometer is used to measure water temperature which has a range of - 200°C to 1250°C. Wind speed is measured by battery operated digital Anemometer with a range 0.3 to 30 m/s and with a facility to show ambient temperature. A pyranometer is used to measure the radiation. The experimentation was carried in the month of October, November and December 2017. The readings were taken between 9 AM to 10:35AM for 21 Dec, 2017. All readings were taken at the interval of 5 minutes. The sample observations are shown in Table II.

Table 2: Readings of various parameters in solar steam generation system.

Date	Serial Number	Time [hour]	Generated water Temperature [°C]	Wind speed [kmh ⁻¹]	Ambient Temperature [°C]	Radiation falling [Wm ⁻²]
21 Dec. 2017	1	9	25	16	28	700
	2	9.05	28	16	28	750
	3	9.1	34	16	28	750
	4	9.15	40	15	28.5	750
	5	9.2	45	16	28.5	750
	6	9.25	52	15	29	750
	7	9.3	58	15	29	750
	8	9.35	66	17	29	750
	9	9.4	73	17	30	750
	10	9.45	80	17	30	750
	11	9.5	86	17	30	750
	12	9.55	87	15	30	750
	13	10	90	15	31	775
	14	10.05	91	15	31	775
	15	10.1	93	14	31	775
	16	10.15	94	15	31	775
	17	10.2	96	15	31	775
	18	10.25	97	16	31	775
	19	10.3	98	16	31	775
	20	10.35	98	16	31	775

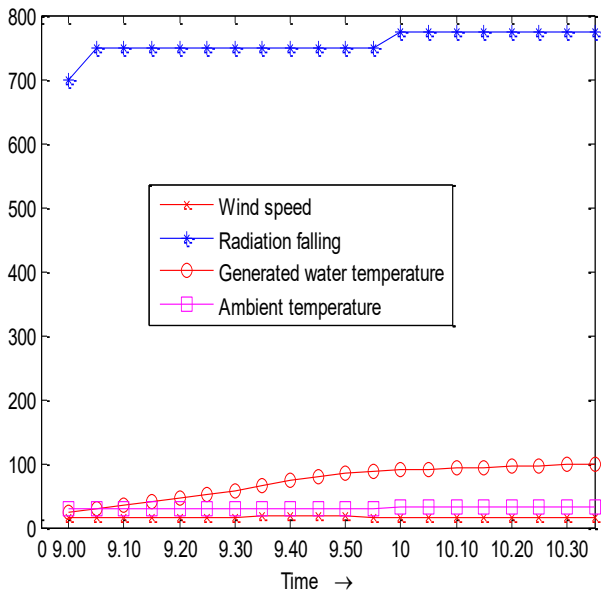


Fig 2: Variation of different parameter depending on time hours.

PERFORMANCE EVALUATION

A. Model formulation for performance analysis

The efficiency was calculated with the following equations:

$$\eta = \frac{10^5 * Ep}{\int_{t=0}^{tp} [Gbave * As] dt} * 100 \quad (1)$$

Where,

- Ep : The total heat energy,
- t : The time;
- $Gbave$: The beam radiation at time t ,
- As : The aperture area of the Scheffler reflector which is also a variable function whose value can be determined for any day of the year by the following formula.

$$Aperture\ area = Reflector\ Area \times \cos (43.23^\circ - seasonal\ angle\ deviation\ of\ the\ sun / 2) \quad (2)$$

Funk [18], described the procedure for evaluating different types of solar cookers and his research was focused on the influence of test conditions on results minimization if uncontrolled variables are held to certain ranges. He has used water for the evaluation of

the cookers in terms of power. For the performance test with water only, the following equation was used:

$$Ep = m_w * c_w * \Delta T / 3600 \quad (3)$$

Where,

- m_w is the mass of water used,
- c_w is the specific heat at constant pressure (for water 4.187 [kJ kg⁻¹ K⁻¹]) and
- ΔT [K] is the change in temperature for a specific time.

The average power available, P_{ave} , during the experiment is given as

$$P_{ave} = \frac{Ep}{tp} \quad (4)$$

Where,

- tp is the total process time.

In between the beam radiation range of 700 to 800[Wm⁻²], Scheffler reflector showed that about half of the solar power collected by the reflector becomes finally available in the cooking vessel.

B. Calculation:

Here,

- Number of solar reflectors=73
- Solar reflector area= 16 m²
- Total reflector area=73*16 m²
- $\Delta T=(98-25)+273=346$ °K
- $Ep=(73*20)*4.187*346/3600$
- $Ep= 587.53$ KW
- Aperture area= (73*16) × cos (43.23° - 1.5° / 2)
- Aperture area= (73*16) × cos (42.48°)
- Aperture area=861.71 m²

$$\eta = \frac{10^5 * 587.33}{\int_0^{1.35} [757.50 * 861.71] dt} * 100$$

$$\eta = 66.67\%$$

C. Cost benefit ratio

Total cost spent on the installation of the system (Rs) = 1.33 cores.

Cost of L.P.G fuel saved per year (Rs) = 38, 13, 900.

Carbon credit (Rs) = 2, 93, 425.

Subsidy (Rs) = 50 %

Net saving (Rs) = 41, 07, 325.

Payback period = Total cost / Net saving per year
 = 6650000 / 4107325
 = Approximately 2 years

USEFULLNESS OF SYSTEM

The Sansthan has a Prasadalya where it offers food (prasad) to the devotees at subsidized rates. Thousands of devotees partake food at a nominal rate of Rs.4/- per meal for grownups and Rs.2/- per meal for children. The Sansthan is always on the lookout for innovative ways to reduce its overhead costs. They have installed hot- water- systems at its dharmashalas / dormitories, providing staying facilities for devotees. The Sansthan have also installed solar streetlights in its pumping complex. Thus, it was found to be the ideal place to introduce the new solar steam cooking technology for its proper take-off in Maharashtra state. Before the installation of the solar cooking system, the steam for cooking at Sansthan was being generated by LPG gas firing in the boiler.

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CONCLUSION

The main goal of the system was to reduce LPG gas consumption by 50 %. Another important goal beside financial benefits due to saving LPG gas was to use as much natural energy as possible to promote environment protection, its conservation and rejuvenation by using renewable and clean energy. To promote and popularize use of solar energy. MNES and MEDA have supported this project towards realizing this objective.

Conflicts of interest: The authors stated that no conflicts of interest.

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Synthesis and Characterization of CdS nanoparticles for solar cell Application

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ABSTRACT

Nanocrystalline semiconductor materials have attracted considerable attention due to their particle size dependent physical properties and very large specific surface area which are not present in bulk materials. Usually they are synthesized with organic ligands to disperse them from agglomeration. However, these ligands can act as series resistance in the active layer of solar cells. In this work cadmium sulfide (CdS) precipitates were prepared from cadmium and sulfide ion solutions without any ligands at different solution temperature and synthesis time. The obtained CdS precipitates were washed by rinsing with methanol and by centrifugation with water and methanol. By using Fourier transform infrared spectroscopy (FTIR) impurities were observed on the surface of rinsed CdS samples and they had been eliminated after washing by centrifugation (not shown here). X-ray diffraction (XRD) patterns indicate that the obtained products were of hexagonal structure. The average size of the CdS crystallites found by Scherrer formula 12 nm before centrifugal washing and 6 nm after washing. The best cell prepared with CdS nanoparticles showed a photocurrent (J_{sc}) of 2.2 mA/cm² and a photovoltage (V_{oc}) of 0.84 V, measured in air at room temperature under 100 mW/cm² illumination in a solar simulator.

Keywords:

Keywords: Cadmium acetate, Methanol, CdS, Nanoparticles, XRD.

INTRODUCTION

Solar energy conversion is a highly attractive process for clean and renewable power for the future. Solar Energy is an only way to rise out of global poverty. We always intend to make our lives comfortable, energizing and productive. Mankind is using energy in many ways to improve living standard. We depend on energy for almost everything in our life. Due to the enormous amount of energy consumption, the world is facing an energy crisis. We have very limited sources of energy like coal, petroleum and natural gases. Nowadays, most of the energy is produced by fossil fuel and coal. Coal is the main source of carbon dioxide emissions in the world resulting global warming. From environmental point of view, a burning of fossil fuel depletes our non-renewable energy source and produce pollution. More combustion of fossil fuel can deplete the non-renewable energy sources. In nature, cost effective and pollution free. Solar energy is abundant and easily available, renewable energy source in world, especially in India.

However, we need to use it more economically. Solar cell is also called as photovoltaic cell, which converts solar energy into electrical energy. Today, silicon based solar cells are commercially produced because of the abundant supply of silicon raw material and its comparatively high efficiency. However, very pure Silicon is needed hence the price is very high compared to the power output [1].

For nanometer proportioned systems, their optical and electronic properties become size-dependent. Thus, chemical control over the growth and size of particles should allow a corresponding control over these properties [2]. In particular, considerable interest has centered on the synthesis of nanometer-size semiconductor particles [3]. The unique electronic and optical properties of semiconductor nanomaterials constitute the fundamental reason behind their technological importance. Cadmium sulfide (CdS) is one of the most important II-VI group semiconductors. It has been proved to be an excellent photoactive and charge transport material in optoelectronic devices [4], and its direct band-gap of 2.4 eV is appropriate to be an acceptor in hybrid

photovoltaic (HPV) devices [5-7]. CdS nanoparticles exhibit structural, optical and photo-conducting properties that are very different from their bulk properties that make them attractive for their possible application in solar cell, photo detector, laser, LED etc. [4]. Nanoparticles of CdS are usually synthesized in presence of ligands. These are lineal organic compounds that one of their two (head or tail) terminals is attached onto the surface of the nanoparticles and the other is solvated by the solvent molecules. In this way the nanoparticles were surrounded by these organic molecules and are separated one from each other under the electrostatic repulsion between the free terminals of the ligands. However, for solar cell applications, these ligands are obstacles to charge carrier transport, leading to a low photocurrent. The removal of the ligands in nanoparticles requires another chemical process [8-12].

METHODOLOGY

0.1M solution of Na₂S and 0.1 M solution of cadmium acetate [Cd(OOCCH₃)₂·2H₂O] were prepared in methanol. The temperature reaction was chosen as 0 or 25 °C (room temperature). The cadmium ion solution was added slowly into the sulfide one and the resulting solution turned from transparent to yellow color, which is indicative of the immediate formation of CdS product. The reaction time was stopped at 0.5 and 24 h at each temperature. The obtained CdS precipitates were washed in two ways: (a) rinsed by about 50 mL of methanol (called rinsed samples), and (b) washed by centrifugation for 10 times with 50 mL of deionized water each time and the last one with 50 mL of methanol (called washed sample). All the final products were dried at room temperature for 48 h.

Characterization

X-ray diffraction (XRD) patterns were recorded in a BRUKER D8 Advance (CuK α -radiation $\lambda = 0.154$ nm), with a scanning rate of 1°/min from 10° to 70° in 2θ range.

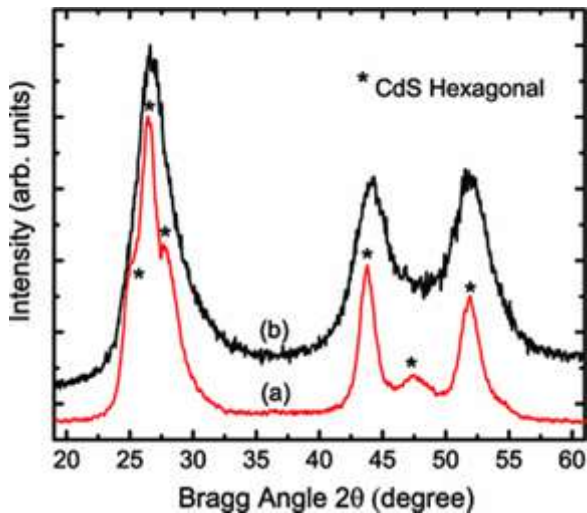


Fig. 1: XRD patterns of CdS nanoparticles synthesized at 25 °C for 24 h: (a) rinsed and (b) Centrifugally washed samples

The average crystallite sizes of CdS nanoparticles were estimated by Scherrer equation:

$$D = \frac{K\lambda}{\beta \cos \theta} \dots \dots \dots (1)$$

where D is the crystalline grain size, K is a Scherrer constant (shape factor) taken to be 0.94, λ is the wavelength of the X-ray radiation, β is the full width at half maximum (FWHM) of the diffraction peak, and θ is the angle of diffraction at that peak. It was found that the average crystallite size was about 12 nm for rinsed and 6 nm for washed samples. Although the discrepancy existed in size numbers provided by the two experimental methods, it is evident that the centrifugal washing process reduced the crystallite size in CdS nanoparticles from 6 to 12 nm down to 3–5 nm. The product yield was also estimated for different reaction temperature and time by adding 50 mL of 0.1 M $\text{Cd}(\text{OOCCH}_3)_2 \cdot 2\text{H}_2\text{O}$ into 50 mL of 0.1 M Na_2S solution. It seems that 30 min of reaction was enough to obtain more than 90 % of the final CdS product.

The build of the solar cells consisted in the following steps: 50 nm of CdS thin film was deposited on transparent conductive glass substrate (indium–tin–oxide coated glass slides with sheet resistance of 15 Ω per square, Lumtec) by chemical bath deposition [13] described as CdS-f in the hybrid structure. Subsequently, CdS nanoparticles were deposited on the CdS thin film by spin-coating. P3HT was

synthesized by a chemical oxidation method [14]. P3HT solution was prepared by dissolving the polymer product in 1,4-dichlorobenzene and dripped on top of the CdS nanoparticle layer. The P3HT film was formed after a fast drying process (70–80 °C). Carbon paint (CP) was spread on the polymer surface and dried in air. Then gold contacts of about 40 nm thickness were deposited by evaporation on top of CP. The use of CP was to improve the ohmic contact and avoid the gold atoms diffusion. The structure of the cells was: ITO/CdS-f/CdS-n/P3HT/CP/Au. Figure 2 illustrates the cross-section scheme of those CdS/P3HT solar cells. Except for metal contact, all the cell preparation process was carried out in air. The whole device was annealed in air at 120 °C for 30 min. Current–voltage (I–V) curves of solar cells was taken under illumination of one Sun with a solar simulator (Oriel) and the intensity of the Xenon lamp was adjusted to 100 mW/cm². The electrical characterizations of hybrid solar cells were carried out in air under ambient conditions.

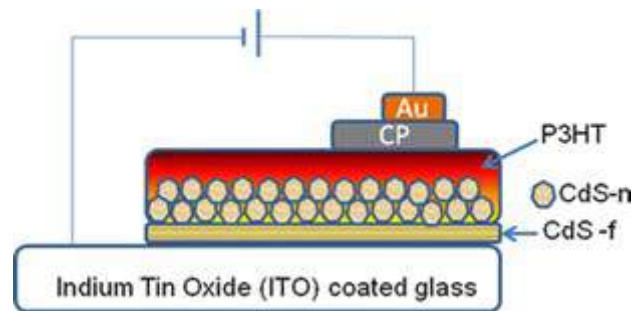


Fig. 2 Cross-section scheme of CdS-n/P3HT solar cells

RESULTS AND DISCUSSION

The centrifugal washed CdS powder was finer than the rinsed one, that is, the centrifugation process could break down CdS clusters into smaller ones. An indirect measurement of particle size is the BET method, which consists in determining the specific surface area of powder samples by physical absorption of an inert gas (N_2 , for example). The larger the specific area, the smaller the average particle size [15]. The BET surface area of rinsed CdS nanoparticles was of 66.55 m²/g, and for centrifugal washed samples that number was almost doubled: 127 m²/g, which is consistent with the physical appearance of the two types of CdS powders, it is

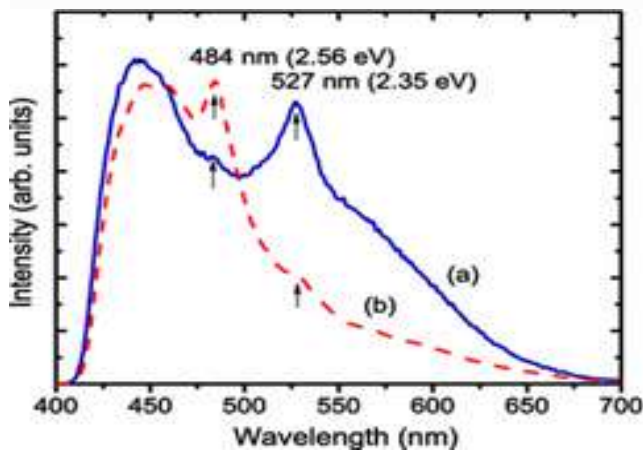


Fig. 3

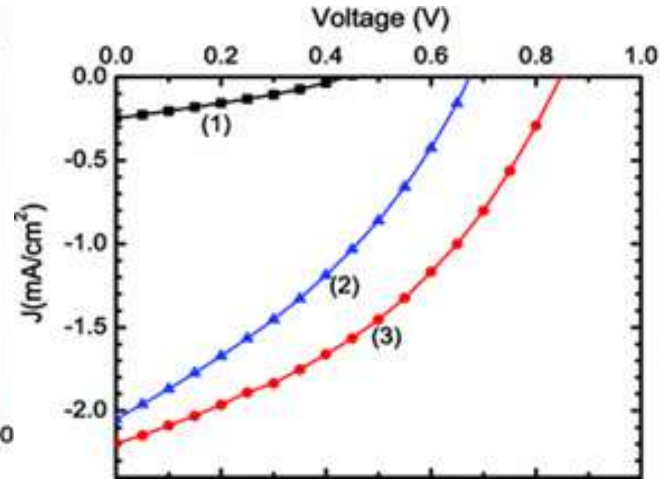


Fig. 4

Fig. 3 : Photoluminescence emission spectra of CdS precipitates synthesized at 0 °C for 24 h:

(a) centrifugally washed and (b) rinsed samples. Excitation wavelength: 390 nm, detector cut-off filter: 430 nm

Fig. 4 : J-V curves of hybrid solar cells: (1): ITO/CdS-f/P3HT/CP-Au, (2): ITO/CdS-f/CdS-n washed)/ P3HT /CP/ Au and (3) : ITO/CdS-f/CdS-n(rinsed)/P3HT/CP/ Au.

Table 1: ???

S.N.	Structure (CdS at 0°C for 24 hr)	J_{sc} (mA/cm ²)	V_{oc} (V)	FF	η (%)
1	ITO/CdS-f/P3HT/CP-Au	0.24	0.43	0.30	0.03
2	ITO/CdS-f/CdS-N-washed P3HT/CP-Au	2.05	0.67	0.34	0.47
3	ITO/CdS-f/CdS-n rinsed /P3HT/CP- Au	2.19	0.84	0.39	0.72

valid to assume that the washed CdS precipitates still kept the hexagonal structure but with smaller crystallites inside the particles.

Finally, the use of CdS nanoparticles in hybrid solar cells was experimented. The use of a solution deposited CdS thin film (CdS-f) on ITO surface served as a sealing layer to prevent short-circuit between ITO and the metal contact. Then CdS nanoparticles were deposited as a rough layer CdS-n, which allowed a posterior good permeation of P3HT macromolecules into the inorganic layer and enlarged the CdS-n/P3HT interface. Being the same semiconductor compound, the heterojunction of CdS thin film and P3HT (ITO/CdS-f/P3HT/CP-Au) also generated photovoltage (V_{oc}) and photocurrent (J_{sc}), as evidenced in Fig. 4, although with inferior photovoltaic performance. The use of CdS nanoparticles (CdS-n) between CdS-f and P3HT improves largely those parameters; Fig.4, shows the

J-V curves of the best CdS/P3HT hybrid cells with washed CdS nanoparticles (ITO/CdS-f/CdS-n-washed/P3HT/CP/Au) and rinsed CdS ones (ITO/CdS-f/CdS-n-rinsed/P3HT/CP/Au) where the CdS powders were synthesized at 25 °C for 24 h and the cells were fabricated under the same procedure.

Photovoltaic parameters of the J-V curves shown in Fig. 4 are listed in Table and the maximum power conversion efficiency was about 0.72 %.

It is seen that the two cells with CdS nanoparticles (rinsed and washed) gave a good J_{sc} (current density at voltage equal to zero) above 2 mA/cm². However, the rinsed CdS nanoparticles gave a higher V_{oc} (voltage at current equal to zero) than the washed ones. This phenomenon can be explained by the fact that a higher density of the surface states in washed CdS samples should lead to a higher probability of charge recombination at CdS-n/P3HT interface,

which in turn should reduce the V_{oc} of the heterojunction [16]. On the other hand, the CdS crystallite size should also play an important role in the photovoltaic behavior of the cells, which could not be clearly observed because of the surface states in washed CdS samples. In literature, similar CdS/P3HT heterojunctions have been reported and the obtained power conversion efficiency varied from 0.06 % [7] to 4.1 % as CdS is grafted in the highly ordered P3HT nanowires [17]. Further research effort should be addressed to improve the photovoltaic performance of hybrid solar cells.

CONCLUSION

Nanoparticles of cadmium sulfide were synthesized from cadmium and sulfide ion solution in methanol without any ligands or dispersants. The reaction temperature was chosen at 0 or 25 °C and the reaction time, for 0.5 or 24 h. Both types of samples showed a crystalline hexagonal structure, although the centrifugal washing reduced the crystallite size from 12 to 6 nm. Photoluminescence spectra also suggest the presence of impurities at the surface of rinsed samples. The photocurrent density of hybrid solar cells with CdS nanoparticles and poly(3-hexylthiophene) was higher than 2 mA/cm², and the photovoltage of the same cells reached to 0.84 eV, which will be lowered down to 0.67eV if the CdS nanoparticles were smaller.

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Quantum dot sensitized solar cells an effective material for photovoltaic applications

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ABSTRACT

Nanomaterials are effectively used for solar energy conversions. Out of which quantum dot (QD) solar cells have thermodynamic conversion efficiency of solar photon conversion above 60%. This was achieved by hot photogenerated carriers produced when electromagnetic radiation falls on solar cells. This produces photovoltages or photocurrents by photoelectric effect. The former effect is based on miniband transport and collection of hot carriers in QD array photoelectrodes before they relax to the band edges by phonon emissions. The latter effect is based on utilizing hot carriers in QD solar cells to generate and collect additional electron-hole pairs through enhanced impact ionization processes.

Keywords: Nanomaterials, quantum dot (QD) solar cells, photoelectrodes.

INTRODUCTION

Shockley and Queisser [1] calculated the maximum thermodynamic efficiency for the conversion of unconcentrated solar irradiance into electrical free energy in the radiative limit assuming detailed balance and a single threshold absorber found [1] to be about 31%, this is also valid for the conversion to chemical free energy [2,3]. Since conversion efficiency is important parameters to optimize for implementing photovoltaic and photochemical cells on a truly large scale [4], several schemes for exceeding the Shockley-Queisser (S-Q) limit have been proposed and are under active investigations.

Like tandem cells [5], hot carrier solar cells [6–8], Solar cells producing multiple electron–hole pairs per photon by impact ionization [9,10], multiband and impurity solar cells [4,11], and thermo-photonic cells using thermal and electromagnetic energy [4]. Here hot carrier and impact ionization solar cells, and the effects of size quantization on the carrier dynamics that control the probability of these processes is discussed. It is well known that solar spectrum is continuous one and have photons with energies between 0.5 to 3.5 eV. When such photon incident on semiconductor, then photons with energies below the semiconductor band gap are not absorbed, while those with energies above the band gap create electrons and holes with a total excess kinetic energy equal to the difference between the photon energy and the band gap this may be given by energy conservation equation 1.

$$h\nu = E_g + E_{kin.}$$

---(1)

where, $h\nu$ is energy of incident photon, E_g is energy gap of semiconductor and $E_{kin.}$ is total excess kinetic energy in above equation. This excess kinetic energy creates an effective temperature for the carriers which are much higher than the lattice temperature, such carriers are called “hot electrons and hot holes”, and their initial temperature upon photon absorption can be as high as 3000 K with the lattice temperature at 300 K. The distribution of this kinetic energy between electrons and holes is decided by effective masses, with the carrier having the lower effective mass receiving more of the excess energy [6]. A major factor limiting the conversion efficiency in single band gap cells to 31% is that the absorbed photon energy above the semiconductor band gap is lost as heat through electron phonon scattering and subsequent phonon emission, as the carriers relax to their respective band edges means bottom of conduction band for electrons and top of valence for holes. To reduce this loss in efficiency has been to use a stack of cascaded multiple p–n junctions with band gaps better matched to the solar spectrum, in this way higher-energy photons are absorbed in the higher-band-gap semiconductors and lower-energy photons in the lower-band-gap semiconductors, thus reducing the overall heat loss due to carrier relaxation by phonon emission. In the limit of an infinite stack of band gaps perfectly matched to the solar spectrum, the ultimate

conversion efficiency at one sun intensity can increase to about 66%. Another approach to increasing the conversion efficiency of photovoltaic cells by reducing the loss caused by the thermal relaxation of photo generated hot electrons and holes is to utilize the hot carriers before they relax to the band edge by phonon emission [6]. There are two fundamental ways to utilize the hot carriers for enhancing the efficiency of photon conversion. One way produces an enhanced photo-voltage, and the other way produces an enhanced photocurrent. The former requires that the carriers be extracted from the photo converter before they cool [7,8], while the latter requires the energetic hot carriers to produce a second (or more) electron–hole pair through impact ionization [9,10]—a process that is the inverse of an Auger process where by two electrons–hole pairs recombine to produce a single highly-energetic electron–hole pair. In order to achieve the former, the rates of photo generated carrier separation, transport, and interfacial transfer across the contacts to the semiconductor must all be fast compared to the rate of carrier cooling [8,12–14]. The latter requires that the rate of impact ionization (i.e. inverse Auger effect) be greater than the rate of carrier cooling and other relaxation processes for hot carriers. Hot electrons and hot holes generally cool at different rates because they generally have different effective masses; for most inorganic semiconductors, electrons have effective masses that are significantly lighter than holes and consequently cool more slowly. One more important factor is hot carrier cooling rates are dependent upon the density of the photo generated hot carriers (viz., the absorbed light intensity) [15–17]. Here, most of the dynamical effects will be discuss are dominated by electrons rather than holes; therefore, discussion is restricted on primarily to the relaxation dynamics of photo generated electrons. Finally, in recent years it has been proposed [8,12,13,18–21], and experimentally verified in some cases [6], that the relaxation dynamics of photo generated carriers may be marked by quantized effects in the semiconductor known as semiconductor quantum wells, quantum wires, QDs, super lattices, and nanostructures. That is, when the carriers in the semiconductor are confined by potential barriers to regions of space that are smaller than or comparable to their deBroglie wavelength or to the Bohr radius of excitons in the semiconductor bulk, the relaxation

dynamics can be dramatically altered; specifically, the hot carrier cooling rates may be dramatically reduced, and the rate of impact ionization could become competitive with the rate of carrier cooling [6] shown in Fig1.

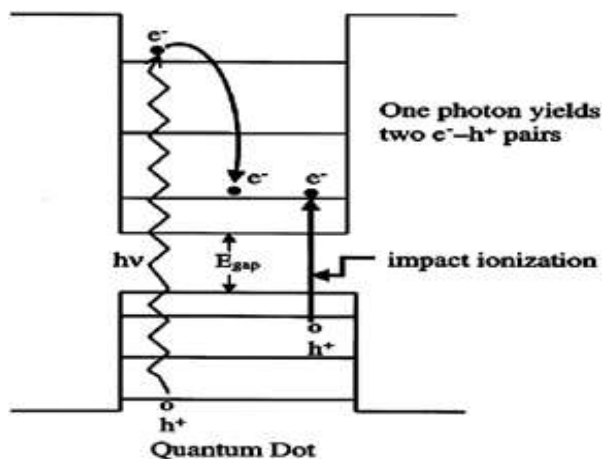


Fig1. Enhanced photovoltaic efficiency in QD solar cells by impact ionization (inverse Auger effect).

Greatly, slowed hot electron cooling in InP, CdS, CdSe and CdTe QDs has been observed by the different research group[22]. For QDs, one mechanism for breaking the phonon bottleneck that is predicted to slow carrier cooling in QDs and hence allow fast cooling is an Auger process. Here a hot electron can give its excess kinetic energy to a thermalized hole via an Auger process, and then the hole can then cool

quickly because of its higher effective mass and more closely spaced quantized states. However, if the hole is removed from the QD core by a fast hole trap at the surface, then the Auger process is blocked and the phonon bottleneck effect can occur, thus leading to slow electron cooling. This effect was first shown for CdSe QDs [23,24]; it has now also been shown for InP QDs, where a fast hole trapping species (Na biphenyl) was found to slow the electron cooling to about 7 ps [22]. This is to be compared to the electron cooling time of 0-3 ps for passivated InP QDs without a hole trap present and thus where the holes are in the QD core and able to undergo an Auger process with the electrons [22]

QUANTUM DOT SOLAR CELL CONFIGURATIONS

The two fundamental pathways for enhancing the conversion efficiency (increased photovoltage [7,8] or increased photocurrent [9,10] can be accessed, in principle, in three different QD solar cell configurations, and are described below. However, it is emphasized that these potential high efficiency configurations are speculative and there is no experimental evidence yet that demonstrates actual enhanced conversion efficiencies in any of these systems. Absorption and photoluminescence spectra of such CdS quantum dots are shown in figure 2.

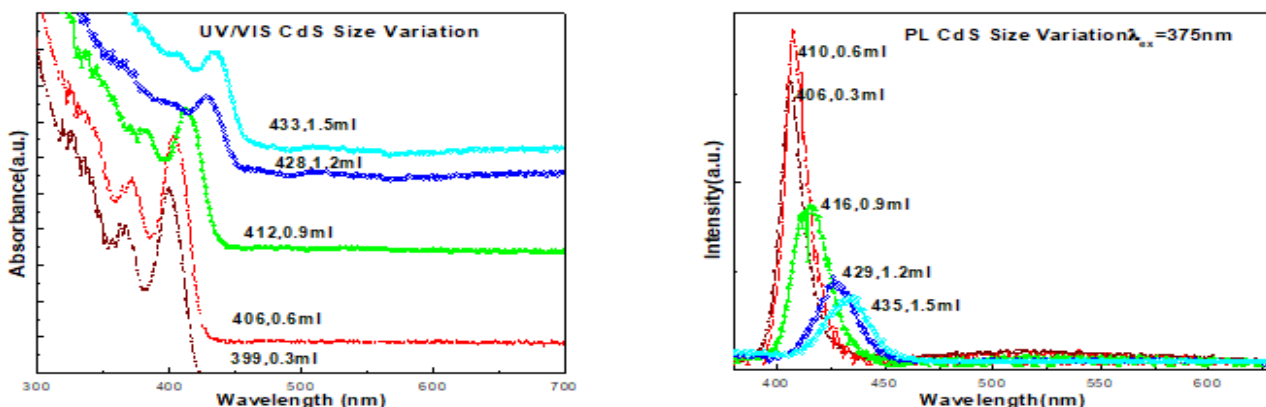


Fig.2. Absorption and photoluminescence spectrum of CdS quantum dots with varying size, absorption and photoluminescence peak positions shown in figure. The concentration oleic acid which acts as capping agent is also shown in inset. The sizes of CdS quantum dots (radius) are 2.3 nm, 2.5 nm, 2.8 nm, 3.1 nm and 3.3 nm.

1. Quantum dot arrays in p-i-n cells

In this configuration, the QDs are formed into an ordered 3-D array with inter-QD spacing sufficiently small such that strong electronic coupling occurs and mini bands are formed to allow long-range electron transport. The delocalized quantized 3D mini band states could be expected to slow the carrier cooling and permit the transport and collection of hot carriers at the respective p and n contacts to produce a higher photo potential in a PV cell or in a photo electrochemical cell where the 3-D QD array is the photo electrode [25].

Also, impact ionization might be expected to occur in the QD arrays, enhancing the photocurrent (see Fig. 1) The former have been formed via evaporation and crystallization of colloidal QD solutions containing a uniform QD size distribution; crystallization of QD solids from broader size distributions lead to close-packed QD solids, but with a high degree of disorder. Concerning the latter, arrays of epitaxial QDs have been formed by successive epitaxial deposition of epitaxial QD layers; after the first layer of epitaxial QDs is formed, successive layers tend to form with the QDs in each layer aligned on top of each other [27,28]. Theoretical and experimental studies of the properties of QD arrays are currently under way. Major issues are the nature of the electronic states as a function of inter-dot distance, array order vs. disorder, QD orientation and shape, surface states, surface structure passivation, and surface chemistry. Transport properties of QD arrays are also of critical importance, and they are under investigation.

2. Quantum dot-sensitized nanocrystalline

This configuration is a variation of a recent promising new type of photovoltaic cell that is based on dye-sensitization of nanocrystalline TiO₂ layers [29-31]. In this latter PV cell, dye molecules are chemisorbed onto the surface of 10-30 nm size TiO₂ particles that have been sintered into a highly porous nanocrystalline 10-20 nm TiO₂ film. Upon photoexcitation of the dye molecules, electrons are very efficiently injected from the excited state of the dye into the conduction band of the TiO₂, affecting charge separation and producing a photovoltaic effect. For the QD-sensitized cell, QDs are substituted for the dye molecules; they can be adsorbed from a colloidal QD solution [32] or

produced in situ [33-36]. Successful PV effects in such cells have been reported for several semiconductor QDs including InP, CdSe, CdS, and PbS [32-36]. Possible advantages of QDs over dye molecules are the tunability of optical properties with size and better heterojunction formation with solid hole conductors. Also, as discussed here, a unique potential capability of the QD-sensitized solar cell is the production of quantum yields.

CONCLUSION

Nanomaterials are effectively used in photovoltaic applications as solar energy converter. Quantum dot (QD) which have size less than Bohr exciton radius can be used in solar cells, and have thermodynamic conversion efficiency of solar photon conversion above 60% which is more than enough compared to other materials. This high efficiency achieved by a peculiar phenomenon, in which hot photogenerated carriers produced when electromagnetic radiation falls on solar cells. This produces photovoltages or photocurrents by photoelectric effect. The former effect is based on miniband transport and collection of hot carriers in QD array photoelectrodes before they relax to the band edges by phonon emissions. The latter effect is based on utilizing hot carriers in QD solar cells to generate and collect additional electron-hole pairs through enhanced impact ionization processes.

Conflicts of interest: The authors stated that no conflicts of interest.

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Wind energy a clean renewable energy: a scenario of Ahmednagar district

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ABSTRACT

For sustainable development of mankind renewable energy will become key for unlocked resources and sustainable development solution. Basic aim of this paper is to understand the current situation of the wind energy in Ahmednagar district. Wind energy is one of the best form energy which can easily harness from blowing wind and ecofriendly for environment. Today worldwide production of the wind electricity is 5,00,000. MW, India is the produces 40,000 MW and secure fifth rank in the world after the US, China, Spain, and Germany. Maharashtra with 1065 MW stood third position in exploring wind energy. In Ahmednagar District the leeward slope of these sub ranges are very favorable for wind power generation and wind power density is between 119 to 131 Watts per sq mt. with 413 windmills it produces 386.80 MW electricity. Geographical location of Ahmednagar is conducive for wind power harnessing. Its typical platue location gives more suitable situation for wind power generation.

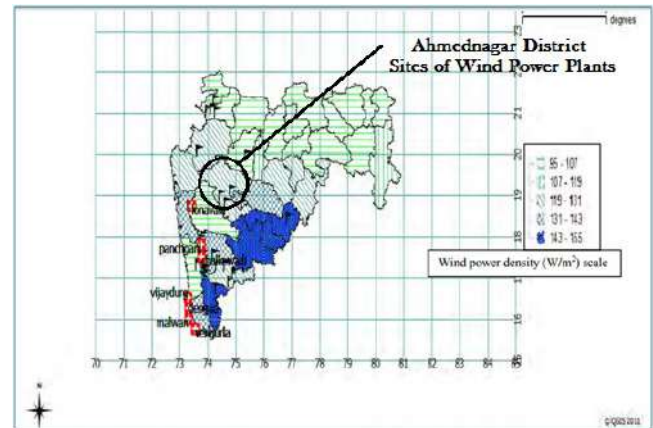
Keywords: Windmill, Wind Power Density, Sustainable Development, Renewable Energy.

INTRODUCTION

In simple language, Energy is a form of power which is necessary to perform work. The whole universe is abided with invisible form of energy. Energy is one of the most important forces for economic growth and human development. Stages of human evolution are evidenced by energy consumption which had made miracles and revolution in his life style. Invention of fire is one of them which has transform human life and made it easier than earlier. Human being use different modes and means to generate power from Coal, petroleum, Natural gas, Solar, Wind, Biogas, Bio Fuel, hydroelectricity etc. Among these all Petroleum and Coal are limited, expensive and harmful to environment. Therefore, for sustainable development of mankind renewable energy will become key for unlocked resources and sustainable solution. Wind energy is one of the best form energy which can easily harness from blowing wind and ecofriendly for environment. To understand the current situation of the wind energy in Ahmednagar district it is important aim of this paper. In this regard certain attempt has been done by some scholars. Ramachandra and Shruthi [1] have estimated the wind energy potential of Karnataka using GIS technology. Sen [2] has used CSV (Cumulative Semi-Variogram) approach to predict the solar irradiation at any point from a given set of known data points. This paper provides a framework for analyzing the status of renewable energy for Ahmednagar District of Maharashtra state of India.

STUDY AREA

Ahmednagar is one of the Largest district of the Maharashtra state rest on Deccan traps which is made by the volcanic lava flow in the Eocene age. (3) Mostly rock is Basaltic. It is partly occupied by Sahyadri Mountain in west and rest by platue. Most of the soil of this district is a Black and red soil. Godavari, (Pravara, Adula, Mula, Dhora) and Sina River are important rivers in district. Entire topography and climate of district is much conducive for wind energy productions. This research paper is tries to study the wind energy of Ahmednagar district.



Location Map : Ahmednagar District

GENERATION OF WIND ELECTRICITY

Wind is simply horizontal movement of air caused by spatial different between pressure. First attempt of wind electricity was done by Prof. James Blyth (1887) in Scotland. It is kinetic energy which converted in the electrical energy. Group of the windmill is known as the wind farm. Wind turbine converts the kinetic energy in electricity. There are two basic type of wind turbine on the basis of axis are Horizontal axis and Vertical axis and location offshore and onshore. Today worldwide production of the wind electricity is 5,00,000. MW, India is the produces 40,000 MW and secure fifth rank in the world after the US, China, Spain, and Germany. India is sixth largest nation in the power generation of the world. In India, there are the 237 Station for the economically good for the electricity.

In our state Tamilnadu is largest producer of wind power. Muppanddal wind farm (Kanyakumari) in Tamilnadu is largest wind farm in State which has capacity of 1500 MW. Cape Comorine (Kanyakumari) and Kayathar Subhas (Kaythar) are major wind power plants having capacity 33 MW and 30 MW respectively. Second rank in wind power harnessing is secured by Rajsthan.It produces 1065 MW power through wind in Jaisalmer Wind Park (Jaisalmer), Dangiri Wind farm (Jaisalmer).Maharashtra with 1065 MW stood third position in exploring wind energy. Brahmanwel wind farm (528 MW, Dhule), Dhalgaon (278 MW, Sangli), Vankusawade (259 MW, Satara) are the major wind farms in Maharashtra. Oddisha (99MW) and Karnataka (56.1) are next to Maharashtra.

DISTRICTWISE WIND POWER SCENARIO IN MAHARASHTRA

Table 1: Site wise Wind Farm Installations in Maharashtra (31/03/17)

Sr.No.	District	Site	No. of Wind Turbine	Total Capacity (in MW)
1	Sindhudurga	Deogad, Vijaydurga	35	12.69
2	Satara	Thoseghar, Chalakwadi, Vankusavade, Marewadi, Sadawaghpur, Agaswadi Chavneswar, Kas.	1872	1503.65
3	Sangli	Gudepachgani Vaspeth, Dhalgaon, Jath, Mendhegiri, bhud, Jadhavwadi	1055	1499.6
4	Kolhapur	Bhendawade	51	67.5
5	Ahmednagar	Kavadya Dongar, Panchpatta, Khandke, Jamgaon	413	386.8
6	Beed	Gangadevi Sautada	160	192.7
7	Dhule	Brahmanwel	566	581.5
8	NandurBar	Chakala	230	315.6
9	Amaravati	Motha	4	4
10	Nasik	Aundhewadi	48	61.1
11	Yavatmal	Isapur	7	31
12	Pune	Andhralake	133	106.4
Total			4431	4769.21

Source: MEDA 2017

According to MEDA (Maharashtra Energy Development Agency) wind energy potential of our country is 1,02,788 MW Out of that, state has potential of 9400MW. Largest wind power project in Maharashtra of capacity 581 MW is located in Brahmanwel Dhule district. In the Maharashtra, there is Suzlon, Enercon, Vestas, Regan wind energy manufacturing organization. In Maharashtra largest windmills were planted in Satara District (1872) which has capacity of 1503.65 MW. Sangli district stood second with 1055 windmills and capacity of 1499.60 MW. Dhule District have capacity of 581 MW wind energy with 588 wind mills. Ahmednagar District ranks fourth in wind power harnessing 413 windmills in district produces 386.80 MW electricity.

WIND POWER IN AHMEDNAGAR DISTRICT

Geographical location of Ahmednagar is conducive for wind power harnessing. Its typical plateau location gives more suitable situation for wind power generation. It is connected to Sahyadri Mountain from Akole Tehsil. The crestline of Sahyadri is observed in

Akole tehsil. The average elevation of crestline of Sahyadri within tehsil is about 1300 mt. Kalsubai and Adula, Baleshwar and Harishchandra are main sub ranges passes through district.

Baleshwar and Harishchandra sub ranges very close go through Sangamner, Parner and Nagar Tehsil. The leeward slope of these sub ranges are very favorable for wind power generation and wind power density is between 119 to 131 Watts per sq mt. become more suitable for the wind energy therefore district is one of the pioneer district for the wind energy. Out of the total wind electricity of the Maharashtra, 10% of the electricity is occur in this district.³

Potential sites for the wind from in Ahmednagar are Kavda Donger, Khandke, Kolgaon, Pachpatta Dongar. Wind Power Project at the Khandke, there was project started in 2006 with capacity of 50 MW. Second power plant is running smoothly under SJVNL (Satluj Jal Vidyut Nigam ltd) with 56 Wind Power turbines which is generating 47 MW electricity at Khivire (Akola). Third project is situated near Supa in Parner tehsil. This is operated by Suzlon.

Table 2: Wind Energy Scenario of Ahmednagar District

Name of Site	District	No. of Wind Turbines	Wind Turbine Make	Capacity KW per Turbine	Total Capacity MW
Kavadya Dongar (Near Supa)	A'Nagar	57	Suzlon Energy	1000	57.000
		6	Suzlon Energy	1250	7.500
Sub-total		63			64.500
Panchpatta Dongar (Akole)	A'nagar & Nashik	24	Suzlon Energy	1500	36.000
		65	Enercon India	800	52.000
		2	Suzlon Energy	2100	4.200
		55	Gamesa	850	46.750
Sub-total		146			138.950
Khandke (Near Ahmednagar)	A'nagar	192	Enercon India	800	153.600
Sub-total		192			153.600
Nandur Pathar (Parner)	A'nagar	4	Kenersys	2625	10.500
		8	Kenersys	2400	19.200
Sub-total		12			29.700
Grand total		413		13325	386.75

Source: MEDA 2017

CONCLUSION

Wind energy is renewable energy. It is clean energy sources and available ubiquitous in nature. As coal, Natural gas and petroleum will come to end in coming future in such energy crisis era it will work as a great remedy for energy need fulfillment. But Wind energy is available in certain topographic and climatic conditions only, In this concern Ahmednagar District has boon of plateau and mountainous relief. More than half of district having including Parner, Jamkhed, Nagar, Shrigonda, Sangamner, Akole tehsil have plateau and hill location which is conducive to more energy production and it will bring energy in economic development of district in coming years.

Conflicts of interest: The authors stated that no conflicts of interest.

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Energy audit a case study of K. J. Somaiya College of Arts, Commerce and Science, Kopergaon, MS, India

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ABSTRACT

Climate Change & Global warming, ever increasing energy prices, acute energy shortage, forever widening and supply gap, hence energy efficiency and conservation measures have gained importance in the recent years. This paper involved an energy auditing with a view to enhance the existing energy efficiency level in the K.J. Somaiya College, Kopergaon. Energy auditing is a systematic study of existing energy consumption pattern. We know that electricity is unique source of energy to run college activities.

During the energy audit, a complete survey of power consumption in the College was carried out. Audit was conducted for lighting, fans, computers, Air conditioners, single phase, three phase water pump and the laboratory equipment and their power consumption pattern was determined. The present energy consumption pattern of institute was identified and suitable energy conservation measures were suggested for minimizing the power consumption in the college. Energy conserved is energy produced. This audit not only conserves energy but also produces energy.

Keywords: Energy audit, Energy Consumption, instruments, energy conservation

INTRODUCTION

An energy audit is a study of a plant or facility to determine how and where energy is used and to identify methods for energy savings Zhang Jian *et al* [1-2]. There is now a universal recognition of the fact that new technologies and much greater use of some that already

exist provide the most hopeful prospects for the future. The opportunities lie in the use of existing renewable energy technologies, greater efforts at energy efficiency and the dissemination of these technologies and options. The energy audit of the K.J.Somaiya College has been carried out and reported in this paper. We have compiled a list of possible actions to conserve and efficiently utilize our scarce resources and identified their savings potential. The next step would be to prioritize their implementation. I look forward with optimism that the institute authorities, staff and students shall ensure the maximum execution of the recommendations and the success of this work. Before planning this audit, the various papers related to the Energy Audit available in the IEEE archives were studied [3-4]. Most of the papers [5- 6] related to such studies made in different industries like, mechanical and heavy engineering. To the best of our knowledge no paper could be located on the energy auditing of educational institutions. However, the following paper was identified. M.Bala Raghav *et al* [7] have mentioned that the Energy auditing has been conducted at the Technical Institute Campus. In this paper the Energy Auditing has been dealt as the index of the consumption which normalizes the situation of Energy crisis by providing the conservation schemes. This has been done to minimize the unwanted power shutdown either incidentally or by load shedding. Here author has defined Energy auditing is one of the tools through which balancing of demand and supply is determined. These commendations reduce around 15-20% of the energy and 25-30% of cost reduction. In the paper Equipment wise analysis has been performed in order to identify the electrical equipment's, within same application area, which consume more power as compared to others. During equipment wise analysis of the overall campus, the equipment's with power consumption less than 1% of total power consumption of the campus were ignored so as to make the analysis results simple and easy to observe.

Table 1: Replacement of existing inductive choke with electronic choke of T-12 as well as T-12 bar with T-8 bar of fluorescent

Existing item to be replaced	Number of items	Saving KWH	Saving in electricity bill per year	Total cost of T8 bar, electronic choke	Pay-back period
T-12 tube light	65	741	7158	2925	5 month
Inductive choke	81	2539	24527	14175	7 month

Scope of Energy Audit:

The work of energy audit has the objective of finding opportunities of energy conservation, saving and to recommend action plan with calculation of investment option and energy saving. The scope of energy audit is,

1. To study and audit MSEDCL bill.
2. Study of lighting system and its measurement.
3. Harmonic measurement and its study.
4. Splitting of air conditioner.
5. Identification of energy saving opportunity and energy conservation.
6. Load study and submission of technical report.

METHODOLOGY

The audit involves visiting physical position of load and carry out inventory of load. Due measurement of electrical load of equipment and circuit is carried out. Energy bill received from MSEDCL is audited and studied for KWH requirement and how efficiently energy is used. Energy conservation and saving opportunities are identified during round and measurement for implementation.

System Studied During Energy Audit:

1. MSEDCL monthly electricity is studied and audited.
2. Lighting system in campus is studied and illumination is measured.
3. Motor pump set measurement and study.
4. UPS load measurement (harmonic measurement at UPS input and main feeder after MSEDCL meter).
5. Study of energy utilization requirement.
6. Split air conditioner operation.
7. Energy saving opportunities is identified.

The identified saving opportunities are summarized for review and implementation,

Table 2: Energy saving by overhauling of bore well motor

Motor rating HP	KW rating	Measured drawing power in KW	% overloading of motor	Wastage of power per year in KW	Wastage amount per year
3	2.25	5.29	200	9120	88099

Table 3: Replacement of CRT with energy efficient LCD monitor

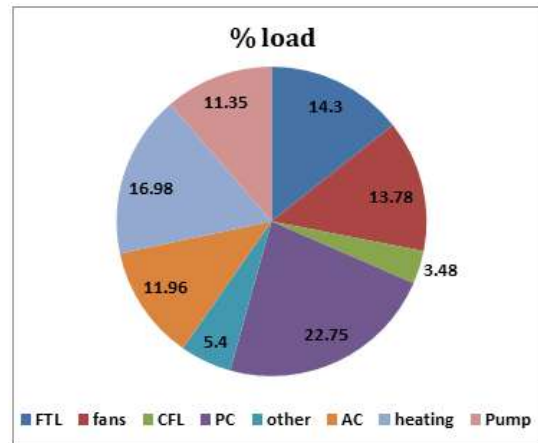
Total CRT monitor	Watt of each CRT monitor	Total power in watt	Watt of each LCD monitor	Total power in watt	Saving in electricity KWH	Saving of bill per year	Pay-back period in year
25	200	5000	55	1375	8265	79840	2.66

Table 4: Electrically Connected load Study

Types of load	Administrative building		Ladies hostel		Science building		Total		Total load	
	No.	Watt	No.	Watt	No.	Watt	No.	Watt	Watt	%
FTL										
36 watt	97	3492	14	504	39	1404	150	5400		
40 watt	41	1640	5	200	19	760	65	2600		
Total									8000	14.30
Choke										
Electronic	81		14		39		134	00		
Magnetic	57		05		19		81	00		
Ceiling fan	74	4440	17	102	30	1800	121	7260	7710	13.78
Exhaust fan					10	450	10	450		
CFL Lamp	17	246	67	1704			84	1950	1950	3.48
PC										
CRT	24	6000	1	250			25	6250		
LCD	36	2880			45	3600	81	6480		
Total								12730	12730	22.75
Fridge	1	175	3	425			4	600		
Water Cooler	1	300	1	300			2	600		
TV	1	120	1	300			2	420		
Mixer	1	650	1	750			2	1400		
Total								3020	3020	5.40
AC	5	5495			1	1200	6	6695	6695	11.96
Hot plate					1	1500	1	1500		
Oven					2	3000	2	3000		
Auto clave					1	1500	1	1500		
Incubator					1	1500	1	1500		
Geyser	1	2000					1	2000		
Total	1	2000			5	7500	6	9500	9500	16.98
Water Pump										
3-phase	3	5250						5250		
1-phase	1	1100						1100		
Total	4	6350						6350	6350	11.35
									55955	100.00

Table 5: Graphical Presentation of Load Mix

Sr. No	Types of Load	Total Load	
		%	Watt
1	FTL	14.30	8000
2	Ceiling & Exhaust Fan	13.78	7710
3	CFL Lamp	3.48	1950
4	PC	22.75	12730
5	Other	5.40	3020
6	AC	11.96	6695
7	Heating Load	16.98	9500
8	Water Pump	11.35	6350
		100.00	55955

**Table 6:** UPS Load Measurement

Location	Capacity	Battery			Input power measurement				% Load
		NO.	AH	Volt	KW	KVAR	KVA	P.F.	
BCA Lab		16	190	12	1.9	2.15	2.97	0.64	37
Computer Lab	7.5KVA,	20	100	12	3.39	3.43	4.82	0.7	64
BCS Lab	1-phase	16	100	12	2.47	2.6	3.59	0.68	49

Table 7: Water Pump Load measurement

Location	Capacity in HP	Input Power Measurement						% Loading
		KW	KVAR	KVA	P.F.	Volts	Amp	
Indoor game hall	2	1.48	0.56	1.58	0.64	226	7	84
Indoor game hall	2	5.29	6.14	8.73	0.6	221.7	11.3	200
						230.7	11.4	
						234.3	15.3	
Near gate	3	0.29	1.84	1.86	0.15	225.4	2.7	No lead
						237	2.7	
						231.6	2.7	

Table 8: Voltage Harmonic Measurement and Limit as Per IEEE 519-1992 Standard

Location	Harmonic	Harmonic order								
		1	2	3	4	5	6	7	8	9
UPS-2 Com. Lab	Input voltage	212	0.3	19.4	0.1	14.8	0.3	6.7	0.2	2.2
	% THD	11.7	11.8	12	11.4	12	11.9	12.4	1	11.7
UPS-3 BCA Lab	Input Voltage	228	0.6	12.4	0.1	13.2	0.1	1.6	0.2	5.9
	% THD	8.9	8.7	8.7	8.7	8.7	8.7	8.7	8.7	8.7
Permissible limit	% THD	5								

Table 1 shows that, when T12 tube and inductive choke are replaced by T8 tube and electronic choke the total saving of power in KW is 3280 and total saving of electricity bill per year is Rs.31685. from **table 2** it is observed that wastage of power per year is 9120 KW and wastage of amount per year is Rs.88099. Therefore servicing of 3 HP motor after three month is suggested. **Table 3** shows that when CRT monitor are replaced with LCD monitor, total power saving is about 8265 KWH and amount saving per year is Rs.79840 having pay-back period 2.66 per year. Physical chemistry laboratory with IR spectrometer and UV visible spectrophotometer are placed under controlled temperature with AC in cabinet. This cabinet was studied in point of energy consumption as AC is working 24 hours. It is observed that there is continuous cooling load of ambient air on AC due to lack of insulation to cabinet and leaking of cooled air from slit below doors. This is leading to wastage of energy at about 10%. So it is strongly recommended to insulate and seal inside space from outside to save energy and its cost. In other chemistry laboratory gas burners are used to heat up chemicals. The flames of burners are totally exposed to atmospheric air, so heat is carried out by flowing air around it and useful heat is wasted. So the stem of burner with flame shall be covered with cabinet to save loss of heat and LPG gas.

Lighting Study and Measurement in Laboratory/ Classroom:

It is suggested that natural light shall be used optimum and only additional light requirement shall be met with electricity to conserve and save energy. Illumination level is measured with Lux meter and found that overall illumination level is below standard which is to be required and maintain within 300-500 lux in laboratory and class rooms.

From **table-8**, it is observed that voltage harmonic are more than permissible limit, i.e. permissible limit is % THD = 5. The current harmonics are also beyond permissible limit. So it is suggested that harmonic mitigation technique is required at input of UPS to avoid over loading and excess drawn of power.

Recommendations:

- 1) Chairman cabin and administrative office is recommended to provide key tag switch to avoid unwanted operation and wastage of electricity.
- 2) T12 tube light and magnetic choke is recommended to replace with energy efficient T5 and electronic choke to conserve energy.
- 3) Submersible pump set is recommended to overhaul after three month to avoid wastage of energy due to poor performance.
- 4) Motor pump set is recommended to provide power capacitor.
- 5) It is strongly recommended to insulate and seal inside space of IR spectrophotometer and UV visible spectrophotometer cabin from outside to arrest loss of reconditioned air.
- 6) Air conditioner shall be operated between temperature range of 23-25°C to maintain lower cooling load on compressor to save energy.
- 7) Submersible motor found overload which need urgent repairing.
- 8) Voltage and current harmonic measured are beyond permissible limit which needs harmonic mitigation treatment.
- 9) CRT monitor of PCS are recommended to replace with energy efficient LCD monitors to conserve energy.
- 10) Solar energy application is recommended for battery charging of UPS.

CONCLUSION

Energy audit is an effective tool in identifying and perusing a comprehensive energy management program. A careful audit of any type will give the organization a plan with which it can effectively manage the organization energy system at minimum energy cost. In this paper a detailed study has been made to reduce the electrical energy consumption in the campus of K.J. Somaiya College. It highlights the amount of energy savings, thereby reducing the energy crisis considerably. After doing energy audit of institute the electrical energy saving per year is 20466KWH and total cost saving of electrical bill per year is Rs -199633.

Conflicts of interest: The authors stated that no conflicts of interest.

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Green Audit a case study of K. J. Somaiya College, Kopargaon, MS, India

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ABSTRACT

The rapid urbanization and economic development at local, regional and global level has led to several environmental and ecological crises. On this background it becomes essential to adopt the system of the Green Campus for the institute which will lead for sustainable development. Kopargaon Taluka Education Society's K. J. Somaiya College of Arts, Comm. & Science, Kopargaon Dist- Ahemadnagar, is deeply concerned and unconditionally believes that there is an urgent need to address these fundamental problems and reverse the trends. Being a premier institution of higher learning, the college has initiated 'The Green Campus' program two years back that actively promote the various projects for the environment protection and sustainability. The purpose of the audit was to ensure that the practices followed in the campus are in accordance with the Green Policy adopted by the institution. The methodology include: preparation and filling up of questionnaire, physical inspection of the campus, observation and review of the documentation, interviewing key persons and data analysis, measurements and recommendations. It works on the several facets of 'Green Campus' including Water Conservation, Tree Plantation, Waste Management, Paperless Work, Alternative Energy and Mapping of Biodiversity. With this in mind, the specific objectives of the audit are to evaluate the adequacy of the management control framework of environment sustainability as well as the degree to which the Departments are in compliance with the applicable regulations, policies and standards. It can make a tremendous impact on student health and learning college operational costs and the environment. The criteria, methods and recommendations used in the audit were based on the identified risks.

Keywords: Green Audit, Green Campus, Green Policy, water conservation, Eco System.

INTRODUCTION

The term "Green" means eco-friendly or not damaging the environment. This can acronymically be called as "Global Readiness in Ensuring Ecological Neutrality" (GREEN). "Green Accounting" can be defined as, systematic identification, quantification, recording, reporting & analysis of components of ecological diversity & expressing the same in financial or social terms. "Green Auditing", an umbrella term, is known by another name "Environmental Auditing". In auditing literature both the terms are being used interchangeably. To implement the green audit other important aspects such as objective of green audit, drivers of green audit, future scope, benefits, and advantages are necessary to understand. The green audit practically involves energy conservation, use of renewable sources, rain water harvesting, and efforts of carbon neutrality, plantation, hazardous waste management & E-waste management. Finally, Green audit is a requirement of NACC committee to the junior college. The concept of Green Audit, industries are using it as a management tool to evaluate the environmental standards; industries can perform better and better for the sustainable development of the organization. The experiments on the nature by avoiding natural rules, this can be a one major reason behind that is green Audit.

About the College:

Kopergaon Taluka Education Society's K. J. Somaiya College of Arts, Comm. & Science, Kopergaon Dist-Ahemadnagar, Maharashtra is a NAAC (A) Grade, 53 year's young college having four faculties - Arts, Commerce, Science and Computer Science. This is also been certified by ISO 9001:2005 and 'Green Audit-Reference A064 Latest Version'. The college is located on a beautiful campus of 7 acres. The college main building is on the bank of the Godavari River. There are separate buildings of "Padmbhushan Karmasibahi Somaiya Science & Technical Bhuvan" with Physics, Chemistry, Botany, Zoology, and Computer Science, Information Technology and Advanced Soft Skill. The college has also adopted the 'Green Campus' system for environmental conservation and sustainability. There are main three pillars i.e. zero environmental foot print, positive impact on occupant health and performance and 100% graduates demonstrating

environmental literacy. The goal is to reduce CO₂ emission, energy and water use, while creating an atmosphere where students can learn and be healthy. The 'Green Campus' has been active since last 32 years both as an assembly group of sub committees that actively promote the various projects. The college administration works on the several facets of 'Green Campus' including Water Conservation, Tree Plantation, Waste Management, Paperless Work, Alternative Energy and Mapping of Biodiversity.

Objectives of the Study:

The main objective of the Green Audit is to promote the Environment Management and Conservation in the College Campus. The purpose of the audit is to identify, quantify, describe and prioritize framework of Environment Sustainability in compliance with the applicable regulations, policies and standards. The main objectives of carrying out Green Audit are:

- To introduce and aware students to real concerns of environment and its sustainability
- To secure the environment and cut down the threats posed to human health by analyzing the pattern and extent of resource use on the campus.
- To establish a baseline data to assess future sustainability by avoiding the interruptions in environment that are more difficult to handle and their corrections requires high cost.
- To bring out a status report on environmental compliance.

METHODOLOGY:

In order to perform green audit, the methodology included different tools such as preparation of questionnaire, physical inspection of the campus, observation and review of the documentation, interviewing key persons and data analysis, measurements and recommendations. The study covered the following areas to summarize the present status of environment management in the campus:

- Water management
- Energy Conservation
- Waste management
- E-waste management
- Green area management

OBSERVATIONS AND RECOMMENDATIONS:**A) Water Use**

This indicator addresses water consumption, water sources, irrigation, storm water, appliances and fixtures. A water audit is an on-site survey and assessment to determine the water use and hence improving the efficiency of its use.

i) Observations

The study observed that Well and Ponds are the two major sources of water. Water is used for drinking purpose, canteen, toilets, laboratory and gardening. During the survey, no loss of water is observed, neither by any leakages nor by over flow of water from overhead tanks. The data collected from all the departments is examined and verified. On an average the total use of water in the college is 25,000 L/day, which include 7,000 L/day for domestic purposes, 12,000 L/day for gardening and 8,000 L/day for different laboratories. Two rain water harvesting units of capacity 200000 liters are also functional for storing and reuse. Gardens are watered by using drip/sprinkler irrigation system to save water. This is one of the unique steps towards greening practices.

ii) Recommendations:

- Need of monitoring, controlling overflow is essential and periodically supervision drills should be arranged. In campus small scale/medium scale/ large scale reuse and recycle of water system is necessary.
- Minimize wastage of water and use of electricity during water filtration process, if used, such as RO filtration process and ensure that the equipment's used for such usage are regularly serviced and the wastage of water is not below the industry average for such equipment's used in similar capacity.
- Ensure that all cleaning products used by college staff have a minimal detrimental impact on the environment, i.e. are biodegradable and non-toxic, even where this exceeds the Control of Substances Hazardous to Health (COSHH) regulations.

B) Energy Use and Conservation:

This indicator addresses energy consumption, energy sources, energy monitoring, lighting, appliance,

natural gas and vehicles. Energy use is clearly an important aspect of campus sustainability and thus requires no explanation for its inclusion in the assessment.

i) Observations:

Energy source utilized by all the departments and common facility centre is electricity only. Total energy consumption is determined as 25308 KWH/Year by major energy consuming equipments. All the departments and common facility centres are equipped with CFL lamps. Approximately 90 CFLs (Capacity) are counted during survey. Besides this, photovoltaic cells are also installed in the campus as an alternate renewable source of energy. Equipments like Computers are used with power saving mode. Also, campus administration runs switch -off drill on regular basis. In science department like Physics, Chemistry, Mathematics, Botany and Zoology electricity was shut down after occupancy time is one of green practices for energy conservation.

ii) Recommendations:

- Support renewable and carbon-neutral electricity options on any energy purchasing consortium, with the aim of supplying all college properties with electricity that can be attributed to renewable and carbon-neutral sources.
- Appreciate that it is preferable to purchase electricity from a company that invests in new sources of renewable and carbon-neutral electricity.
- Installation of LED lamps instead of CFL.

C) Waste Generation:

This indicator addresses waste production and disposal of different wastes like paper, food, plastic, biodegradable, construction, glass, dust etc and recycling. Furthermore, solid waste often includes wasted material resources that could otherwise be channeled into better service through recycling, repair, and reuse. Solid waste generation and management is a burning issue. Unscientific handling of solid waste can create threats to everyone. The survey focused on volume, type and current management practice of solid waste generated in the campus. The different solid wastes collected as mentioned above.

i) Observations:

The total solid waste collected in the campus is 27 Kg/day. Waste generation from tree droppings and lawn management is a major solid waste generated in the campus. The waste is segregated at source by providing separate dustbins for Bio-degradable and Plastic waste. Segregation of chemical waste generated in chemistry and zoology laboratories is also practiced. Single sided used papers reused for writing and printing in all departments. Important and confidential reports/ papers are sent for pulping and recycling after completion of their preservation period. Very less plastic waste (0.150 kg/day) is generated by some departments, office, garden etc but it is neither categorized at point source nor sent for recycling. Metal waste and wooden waste is stored and given to authorized scrap agents for further processing. Few glass bottles are reused in the laboratories. The food waste from main canteen and mess is used or sent for Vermi-composting.

The institute has adopted vermiculture composting in culture house on 500 sqft. land. The main purpose of this is to reduce disposable waste in the college campus. After complete process of vermicomposting, it is used as manure in the garden and lawns. Awareness program among farmers is also conducted in the village nearby.

ii) Recommendations:

- Reduce the absolute amount of waste that it produces from college staff offices.
- Make full use of all recycling facilities provided by City Municipality and private suppliers, including glass, cans, white, colored and brown paper, plastic bottles, batteries, print cartridges, cardboard and furniture.
- Provide sufficient, accessible and well-publicized collection points for recyclable waste, with responsibility for recycling clearly allocated.
- Single sided papers to be used for writing and photocopy.
- Important and confidential papers after their validity to be sent for pulping.

D) E-Waste Generation:

E-waste can be described as consumer and business electronic equipment that is near or at the end of its

useful life. This makes up about 5% of all municipal solid waste worldwide but is much more hazardous than other waste because electronic components contain cadmium, lead, mercury, and Polychlorinated biphenyls (PCBs) that can damage human health and the environment.

i) Observations:

E-waste generated in the campus is very less in quantity. The cartridges of laser printers are refilled outside the college campus. Administration conducts the awareness programmes regarding E-waste Management with the help of various departments. The E- waste and defective item from computer laboratory is being stored properly. The institution has decided to contact approved E-waste management and disposal facility in order to dispose E-waste in scientific manner.

ii) Recommendations:

- Recycle or safely dispose of white goods, computers and electrical appliances.
- Use reusable resources and containers and avoid unnecessary packaging where possible.
- Always purchase recycled resources where these are both suitable and available.

E) Green Area:

This includes the plants, greenery and sustainability of the campus to ensure that the buildings conform to green standards. This also helps in ensuring that the Environmental Policy is enacted, enforced and reviewed using various environmental awareness programmes.

i) Observations:

Campus is located in the vicinity of approximately 250 types (species) trees. Various tree plantation programs are being organized during the month of July and August at college campus and surrounding villages through NSS unit. This program helps in encouraging eco-friendly environment which provides pure oxygen within the institute and awareness among villagers. The plantation program includes various types of indigenous species of ornamental and medicinal wild plant species.

ii) Recommendations:

- Reviews periodically the list of trees planted in the garden, allot numbers to the trees and keep records. Give scientific names to the trees.
- Promote environmental awareness as a part of course work in various curricular areas, independent research projects, and community service.
- Create awareness of environmental sustainability and takes actions to ensure environmental sustainability.
- Establish a College Environmental Committee that will hold responsibility for the enactment, enforcement and review of the Environmental Policy. The Environmental Committee shall be the source of advice and guidance to staff and students on how to implement this Policy.
- Ensure that an audit is conducted annually and action is taken on the basis of audit report, recommendation and findings.
- Celebrate every year 5th June as 'Environment Day' and plant trees on this day to make the campus Greener.

the campus well within the limit i.e. below 45 dB at day time.

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CONCLUSIONS

Considering the fact that the institution is predominantly an undergraduate college, there is significant environmental research both by faculty and students. The environmental awareness initiatives are substantial. The installation of solar panels, paperless work system and vermi-composting practices are noteworthy. Besides, environmental awareness programmes initiated by the administration shows how the campus is going green. Few recommendations are added to curb the menace of waste management using eco-friendly and scientific techniques. This may lead to the prosperous future in context of Green Campus & thus sustainable environment and community development. As part of green audit of campus, we carried out the environmental monitoring of campus includes Illumination, Noise level, Ventilation and Indoor Air quality of the class room. It was observed that Illumination and Ventilation is adequate considering natural light and air velocity present. Noise level in

Chlorococcalean Biodiversity of Riverine ecosystem with special reference to the pollution status

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ABSTRACT

Lotic water bodies like rivers and streams play very pivotal role in maintaining biodiversity and biological balance in nature. In India, most of perennial rivers and their tributaries are being used as sites for disposal of domestic and industrial wastes which impair their water quality, favour the growth of algal blooms and jeopardizing the survival of aquatic life. During present investigations, water qualities of riverine ecosystem like Godavari river was monitored for two year (August 2008-July-2010). From ten sampling stations water samples and algal samples were collected and monitored for qualitative analysis. Present studies revealed that, in all 25 genera and 55 species of Chlorococcales have been reported from all 10 sampling stations. Chlorococcalean flora was found to be dominant during summer. Its number was declined during monsoon and again increased during winter. The commonly found genera were *Ankistrodesmus*, *Scenedesmus*, *Pediastrum*, *Chlorella*, *Crucigenia*, *Golenkinia* etc. Disposal of municipal sewage and agricultural run-off favours the growth of Chlorococcalean flora. The commonly found pollution tolerant genera were *Ankistrodesmus*, *Scenedesmus*, *Chlorella* etc. Their flourished growth indicates pollution status of river at certain stations. The water flow and physico-chemical parameters influenced the occurrence and abundance of Chlorococcalean diversity in the Godavari river.

Keywords: Godavari river, Chlorococcalean flora, pollution.

INTRODUCTION

Algae constitute the important part of food chain of aquatic life. They are primary producers and acts as food for aquatic animals. As the algal growth and composition alters, they also affects the food web and food chain of aquatic ecosystem. Chlorococcales is one of the important group of algae belonging to class Chlorophyceae. The species diversity and distribution pattern of Chlorococcales was studied for two years from river Godavari. Godavari is the sacred river where Sinhstha Kumbha-mela is being held after 12 years time interval. It originates at Trymbakeshwar just 30 kms upstream of Nashik and flowing through Maharashtra and Andhra Pradesh, it joins the Bay of Bengal. The river receives huge quantitative of domestic matter and agricultural run-off causing organic pollution favouring the luxurious growth of algal blooms. Chlorococcales is the important group of green algae contributing the quality and aesthetic appearance of the water. Many workers has studied the diversity and distribution pattern of Chlorococcales diversity like Mruthunjaya *et al* [1], Jose and Patel [2], Habib and Chaturvedi [3], Habib and Chavan [4], Tiwari *et al*[5], Jyothi *et al* [6] etc.

Literature survey revealed that Chlorococcalean flora has been studied by many workers but still survey of Chlorococcalean flora from Nashik to Kopargaon is remained untouched. So present survey was made to monitor the water quality in relation to Chlorococcalean flora of river Godavari.

METHODOLOGY

For the collection of water samples 10 sampling stations were selected on river Godavari from Nashik to Kopargaon showing the range of variation. For physico-chemical parameters water samples were collected in cleaned plastic containers. For the study of Chlorococcalean flora the water samples were collected separately by using plankton net 200mesh/linear inch and preserved in 4% formaldehyde and Lugols solution. For physico-chemical parameters standard methods were used [7,8]. Identification of Chlorococcalean forms were made by using standard literature like Prescott [9, 10,11], Philipose [12] etc.

RESULTS AND DISCUSSION

Seasonal data of physico-chemical parameters is depicted in Table 1. Municipal sewage and human excreta is dumped daily in river water which resulted the higher Chloride values during summer and winter seasons. It might be due to less quantity of water in river water and found to be beyond the permissible limits. Higher values of nitrates and phosphates during summer and winter were due to the concentration effects and low water level, while during monsoon may be due to agricultural run-off [14]. Alkalinity was ranged more at all stations in all months. Higher values during winter season were noticed might be due to the use of soaps and detergents for washing the cloths and utensils by people, while during summer might be due to concentration of salts in water and domestic wastes. Due to washing of clothes, bathing, city sewage, agricultural run-off cleaning of automobiles and animals, the hardness values increased. Our results are agreeable with Singh *et al.* [15] and Mohanta and Potra [16].

Due to the organic matter and low water level the, BOD values recorded were in higher ranges. Free CO₂ values recorded were more during summer season and might be due to the discharge of huge quantity of sewage accompanied by increase in organic matter. During summer season DO values ranged from 1.5 to 5.1 mg/L. It was declined at certain stations and was due to high temperature, low dissolution of oxygen, and high oxidisable organic matter, while more during monsoon was due to low temperature and flood condition. Our result coincides with Venkateswarlu and Jayanti [17]. It was observed that the raised values of EC, Chlorides, hardness, alkalinity, BOD, free CO₂ while low values of pH and DO at certain stations showed the polluted nature of the river water.

Chlorococcalean Diversity:

The distribution pattern of different species of Chlorococcales is influenced by physico-chemical parameters of water. A total of 25 genera and 55 species of this group were recorded (Table 2). This class has been represented by the genera like *Characium*, *Ankistrodesmus*, *Pediastrum*, *Tetrastrum*, *Scensdesmus*, *Coelastrum*, *Dimorphococcus*, *Golenkinia*, *Actinastrum*, *Dictyosphaerium*, *Kirchneriella*, *Excntrosphaera* sps. etc.

Table 1: Seasonal variation in physico-chemical parameters of Godavari river. Aug.2008 - July.2010)

Sr. No.	Parameters	Summer	Monsoon	Winter	WHO standard
1	Light penetration in cm	28 - 190	14 - 78	17 - 156	-
2	Temp (°C)	23 - 35	16 - 24	15 - 22	40°C
3	E.C. m mho/ cm	0.66 - 1.06	0.52 - 1.22	0.26 - 1.59	1 m mho/cm
4	TDS	180 - 678	201 - 821	163 - 716	500 mg/L
5	pH	6.6 - 8.3	7.0 - 8.2	7.0 - 8.2	7.0 - 8.5
6	Chlorides	118 - 252	102 - 208	49 - 219	200 mg/L
7	Nitrates	0.39 - 1.98	0.0 - 1.89	0.1 - 2.08	45 mg/L
8	Phosphates	0.8 - 2.55	1.2 - 2.30	0.98 - 1.98	-
9	Alkalinity	42 - 119	58 - 256	44 - 198	100mg/L
10	Hardness	69 - 179	73 - 289	67 - 202	100 mg/L
11	BOD	5.2-19.3	1.5-3.2	5.4-15	6 mg/lit
12	Free CO ₂	1.1 - 5.4	1.1 - 4.1	2.2 - 10.0	30 mg/L
13	DO	1.5 - 5.1	5 - 11	2.5 - 7.3	5 mg/L

Table 2: Chlorococcalean algae encountered during investigation period

Sr.No.	Name of Chlorococcalean algae	Sr.No.	Name of Chlorococcalean algae
1	<i>Characium acuminatum</i> A.Braun in Kuetzing	29	<i>Coelastrum cambricum</i> Archer
2	<i>Characium limneticum</i> Lemmermann	30	<i>Coelastrum reticulatum</i> (Dang) Senn.
3	<i>Ankistrodesmus fulcatus</i> (Corda.) Ralfs.	31	<i>Coelastrum microporum</i> Naegeli in A. Braun
4	<i>Ankistrodesmus spiralis</i> (Turner)Lemmermann	32	<i>Coelastrum sphaericum</i> Naegeli
5	<i>Ankistrodesmus convolutus</i> Corda	33	<i>Oocystis gigas</i> Archer
6	<i>Dimorphococcus lunatus</i> A.Brown	34	<i>Oocystis solitaria</i> var. major Wille
7	<i>Botryococcus braunii</i> Kuetzing	35	<i>Actinastrum gracillimum</i> G.M.Smith
8	<i>Hydrodictyon reticulatum</i> (L) Lagerheim	36	<i>Actinastrum hantzschii</i> Lagerheim
9	<i>Crucigenia tetrapedia</i> Kirch. West & West	37	<i>Actinastrum hantzschii</i> var. fluvatile Schroeder
10	<i>Selanastrum minutum</i> (Naegeli) Collins	38	<i>Actinastrum</i> sp.
11	<i>Scenedesmus incrassatulus</i> var.mononae G.M.Smith	39	<i>Golenkinia paucispina</i> West & West
12	<i>Scenedesmus acuminatus</i> Chodat	40	<i>Golenkinia radiata</i> (Chod) Wille
13	<i>Scenedesmus dimorphus</i> (Turp)Kuetzing	41	<i>Tetraedron duospinum</i> Ackleg
14	<i>Scenedesmus longus</i> var. Naegelii G.M.Smith	42	<i>Tetraedron minimum</i> (A.Braun) Hansgirg
15	<i>Scenedesmus obliquus</i> (Turp.) Kuetzing	43	<i>Tetraedron muticum</i> (A.Braun) Hansgirg.
16	<i>Scenedesmus quadricauda</i> var. Westii (G.M.Smith)	44	<i>Chlorococcum humicola</i> (Naeg.) Rabenhorst
17	<i>Scenedesmus quadricauda</i> var. maximus West & West	45	<i>Dictyosphaerium pulchellum</i> Wood
18	<i>Scenedesmus quadricauda</i> var. parvus G.M.Smith	46	<i>Sorastrum spinulosum</i> Naegeli
19	<i>Scenedesmus abundans</i> var. longicauda G.M.Smith	47	<i>Echinosphaerella limenetica</i> G.M.Smith
20	<i>Scenedesmus hystix</i> var.linearis Hansg	48	<i>Schroederia setigera</i> (Schrod)Lemmermann
21	<i>Scenedesmus muzzyaensis</i> Hyber Pestalozzi	49	<i>Actidesmium Hookeri</i> Reinsch
22	<i>Scenedesmus acutiformis</i> Schroeder	50	<i>Tetrastrum heterocanthum</i> Nordst Chod.
23	<i>Pediastrum tetras</i> Ralfs.	51	<i>Chlorosarcina consociata</i> (Klebs) G.M.Smith.
24	<i>Pediastrum simplex</i> var. deodenarium (Bailey) Rabenhorst	52	<i>Kirchneriella lunaris</i> (Kirch) Moebius
25	<i>Pediastrum duplex</i> var. cohaerens Bohlin	53	<i>Excentrosphaera viridis</i> G.T.Moore
26	<i>Pediastrum Boryanum</i> (Turp.) Meneghini	54	<i>Chlorella vulgaris</i> Beyerinck
27	<i>Pediastrum duplex</i> var. gracillimum West & West	55	<i>Micractinum pusillum</i> Fresenius
28	<i>Pediastrum biradiatum</i> Meyen		

Municipal sewage and domestic waste is responsible for the growth of algal forms. Similar result was obtained by Mruthunjaya *et al* [1] and Jose and Patel [2]. *Chlorella* and *Scenedesmus* were found dominant in the water with oxidisable organic water. Similar results were obtained during investigation. During present studies it was also observed that *Pediastrum sp.* was found in dominant condition. Our results matches with that of Munnawar [18] and Seenayya [19] who opined that oxidisable organic matter supports the growth of Chlorococcales. The growth of Chlorococcalean flora flourishes by the presence of high pH. Similar condition was found during present investigation during summer. Our results matches with that of Habib and Chaturvedi [3] who opined that tropical climate and mineral rich condition was favourable for the luxuriant growth of algae. Chlorococcalean flora was found dominant at all sampling stations during the investigation period.

Throughout the investigation period at all stations Chlorococcales were found dominant as compared to other members. *Scenedesmus* comprised 13 species, while six species of *Pediastrum* were recorded. Besides this, *Coelastrum* are also found abundantly. *Characium* and *Ankistrodesmus*, were found more in number during summer season. Thus, it was observed that Chlorococcalean flora was flourished during late winter and summer seasons. Tiwari *et al.*[5] also found the same results from river Ganga. Low level of DO, high BOD and nutrients during summer season favours the growth of phytoplankton [20, 21]. Pandey *et al* [22] encountered maximum density of Chlorococcalean flora during the month of April and May and least in September from river Kosi and showed co-relation with the temperature and pH which matches with our findings.

Discharge of anthropogenic wastes in river stream drastically affects the water quality and consequently the algal flora inhabiting it. Chlorococcalean flora flourishes well both in polluted and unpolluted habitats (Tiwari *et al* [5]. According to Palmer's organic pollution indices the common pollution tolerant forms encountered were *Ankistrodesmus fulcatus*, *Chlamydomonas* species, *Chlorella vulgaris*, *Scenedesmus quadricauda*, grew well at station S2, and S3 and S10 showing the polluted nature. Sedamker

and Andgadi [23] were of opinion that higher values of alkalinity, nitrates, phosphates and BOD attribute the growth of Chlorococcalean group.

Chlorococcalean forms were dominant at all stations during the investigation period and their number was more during summer. Our results were co-relates with Sheeba and Ramanujan [24] and Lakshminarayana [25].

Thus, it was observed that fluctuation in physico-chemical parameters favours the growth of Chlorococcales. It was also observed that Chlorococcalean forms flourished well in water that was rich in nitrates and phosphates. Thus, periodicity and population (abundance) of Chlorococcales depended upon the mode of nutrition, changes in water level, transparency and temperature.

CONCLUSION

During present studies of Godawari river physico-chemical parameters were showing the range of variation during various seasons of the year. River water showed high values of chlorides, alkalinity, hardness, BOD and low values of pH and DO which indicate the organic pollution of river. River water was always alkaline and it favours the growth of Chlorococcalean flora. Bright sunlight during summer resulted the increase in population and diversity of Chlorococcalean flora. Due to dumping of municipal sewage and domestic waste of Nashik city, the algal flora was flourished imparting the unpleasant odour to water. To protect this ecosystem there should be proper management and planning of dumping the municipal sewage for health hygiene and sustainable environment.

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Generation of Electricity from Anaerobic Waste Water Treatment in Microbial Fuel Cell

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ABSTRACT

Microbial fuel cells (MFCs) are a promising technology for sustainable wastewater treatment. Microbial fuel cells (MFCs) are devices that use bacteria as the catalysts to oxidize organic and inorganic matter and generate current. In the present work, we constructed a Microbial fuel cell and a different type of anode material is used. Waste water Sample collected from, dairy, sugarcane industry, domestic waste etc. During the treatment of waste water electricity generation and other parameters were measured. The obtained results are presented in this paper.

Keywords: Microbial fuel cells (MFCs), Microbial fuel cell, waste water electricity generation.

INTRODUCTION

Microbial fuel cells (MFCs) are devices that use bacteria as the catalysts to oxidize organic and inorganic matter and generate current. Electrons produced by the bacteria from these substrates are transferred to the anode (negative terminal) and flow to the cathode (positive terminal) linked by a conductive material containing a resistor, or operated under a load (i.e., producing electricity that runs a device)

Microbial fuel cells (MFCs) are a promising technology for sustainable wastewater treatment. In an MFC, biochemical reactions are carried out by electrogenic bacteria in an anaerobic anode chamber generating electrons & protons through the degradation of the organic substrates embedded in wastewater, concurrently,

Electrochemical reactions occur in the aerobic cathode chamber, whereby electrons & protons are accepted through an oxygen reduction reaction (ORR).

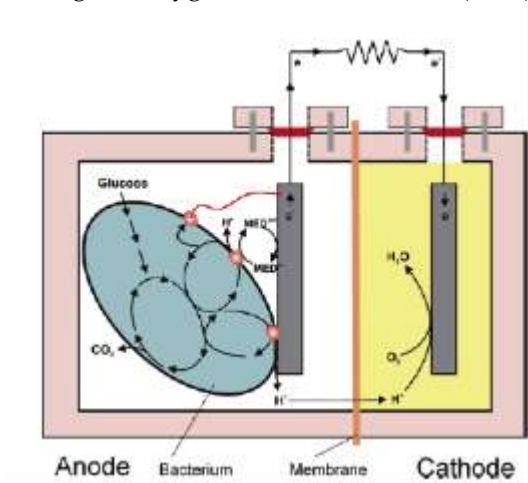


Fig.1: Microbial fuel cells

Anaerobic treatment of wastewater is substantially low energy intensive than aerobic treatment, however is taken longer to accomplish due to the inherently slow growth process of anaerobic microorganisms. Because of these, there has been little interest in applying anaerobic processes to dilute wastewater (e.g. domestic wastewater).

A microbial fuel cell (MFC) is a device that uses microorganisms as the biocatalysts for the oxidation of the organic matter to generate electricity. The electrodes used in the construction of microbial fuel cells should have a good electrical conductivity. More surface area, less resistance & should be non corrosive, biocompatible, chemically & mechanically stable to obtain a reproducible result. The anode materials such as graphite rod, graphite fiber, brush, carbon cloth, carbon paper, carbon felt & RVC have been used in the microbial fuel cells. The higher current was obtained when the platinum-coated graphite was used in the place of fresh graphite cathode. The distance between the electrode is also plays an important role in the performance of the microbial fuel cell so distance should be as close as possible to overcome the electrical leakage & to have a more internal resistance one of the critical challenges in microbial fuel cell is the selecting proper electrodes (cathode & anode) which affect the power output. The basic components of MFC include anode, cathode, ion exchange membrane & electrode catalyst.

METHODOLOGY

Samples of waste water were randomly collected from various sources. Sample collected from paper industry, dairy, sugarcane industry, domestic waste etc. Synthetic waste sample prepared in our laboratory.

Sampling sites: Samples were collected from following different locations with an aim to generate electricity as well as treatment of sewage.

Domestic waste : This domestic waste collected from Annabrahma mess in T.C. college hostel, Baramati, domestic waste mainly contains vegetable parts, food ingredients etc.

Dairy waste : This dairy waste collected from Nimbalkar dairy Baramati. In this dairy there are large production of milk & milk products. Waste sample contains whey droplets of milk etc. & also mainly waste collected from cleaning equipments

Sugarcane Industry : This sugarcane waste sample collected from "shree someshwar sahakari sakhar karkhana someshwar, Baramati." Sugarcane waste mainly contain molasses, extract of sugarcane etc.

Paper Industry : This paper waste sample collected from

Synthetic waste sample : This sample was prepared in Microbiology laboratory of T.C. college Baramati. Synthetic waste mainly contains chemical ingredients

Construction of MFC

Dual chambered MFC was using air-tight food grade plastic containers of 1.3 liter volume each. A side opening of 1.23 cm radius was made at a height of 6 cm from the bottom of the container on each contained & was connected with PVC pipe. PVC pipe is of length 12 cm & diameter is 2.5 cm is required. Agarose of concentrations ranging from 7% to 12% along with 4% potassium chloride (KCl) salt was prepared by heating is in a water bath & the molten agarose was allowed to cool down & poured into the PVC pipe & pipe sealed at one end using cello-tape. The PVC pipe containing the salt-agarose mixture was

fixed between the two containers using epoxy material such as M-ceal & Acradilite & behaved like the salt bridge assisting in the proton transfer mechanism during the MFC operation. Carbon rods are of usually 9 cm in height & 0.5 cm in diameter were used as electrodes. The distance between the two electrodes was maintained. Copper wires were used to connect the electrodes to the circuit. An external resistance (R) of 1.2 kΩ was connected & readings were measured using a digital multimeter

For domestic waste, zinc was used as anode and cathode. The parameters and electricity generated were measured.

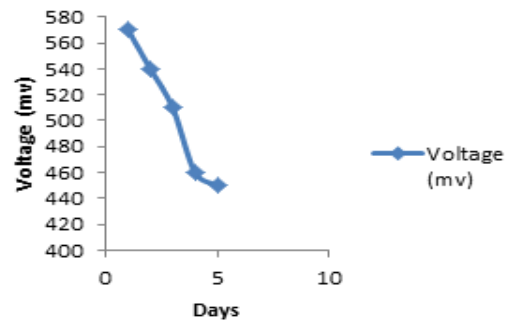
RESULTS AND DISCUSSION

The anode chamber of the MFC was inoculated with the wastewater collected from the industries of the wastewater treatment plant. Before inoculation the physico-chemical analysis of the samples was performed & the such as BOD, COD, TSS, TDS & pH, E.C. & nitrogen. The setup was placed in room of temperature of 27°c to 35° c.

1] **Domestic Waste:** During the treatment of waste water electricity generation and other parameters were measured. For generation of electrical energy, zinc and copper used as electrode. The volume of waste water used is 1.3 liter

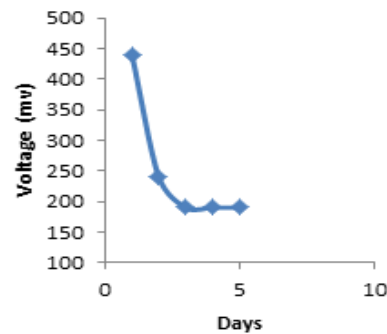
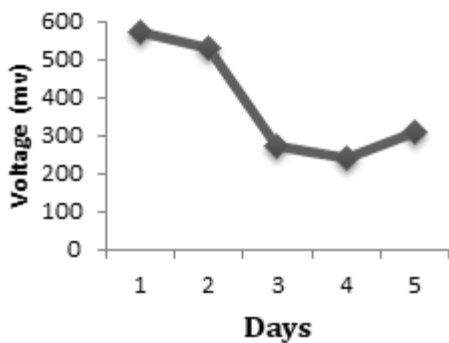
2] **Dairy Waste:** For dairy waste, zinc was used as anode and copper as cathode. The parameters and electricity generated were measured.

	Parameters	Influent	Effluent
1	pH	8	7.4
2	Conductivity	1.3x10 ⁻³	0.7x10 ⁻³
3	TSS(mg/lit)	720	570
4	TDS (mg/lit)	360	220
5	Nitrogen	65%	40%
6	DO (mg/lit)	6.4	4.7
7	BOD(mg/lit)	800	630
8	COD (mg/lit)	1100	840



	Parameters	Influent	Effluent
1	pH	8	7.5
2	Conductivity	1.5x10 ⁻³	0.8x10 ⁻³
3	TSS(mg/lit)	250	130
4	TDS (mg/lit)	400	200
5	Nitrogen	30%	20%
6	DO (mg/lit)	6.4	4.8
7	BOD(mg/lit)	400	290
8	COD (mg/lit)	1500	1100

	Parameters	Influent	Effluent
1	pH	7.8	7.2
2	Conductivity	1.3x10 ⁻³	0.7x10 ⁻³
3	TSS(mg/lit)	220	180
4	TDS (mg/lit)	300	220
5	Nitrogen	40%	22%
6	DO (mg/lit)	8	6
7	BOD(mg/lit)	700	545
8	COD (mg/lit)	1220	930



It was observed that the parameters such as BOD, COD, TSS, TDS & pH, E.C. & nitrogen are decreased and the electricity generated is also decreased rapidly.

Conflicts of interest: The authors stated that no conflicts of interest.

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Relation of Energy Resources and Environment

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ABSTRACT

The World Energy Committee states that there exists no risk free energy resource and for this reason, while choosing the energy resources, cost factors must be considered with environmental effects. Today, prevention of environment pollution and conservation of environment have a dimension exceeding national borders. The risks that result from using of fossil fuels increasingly (petroleum, coal, gas) must be decreased (air pollution, thinning of ozone layer, acid rains etc). To decrease such risks, besides to increasing of energy productivity, energy resources that emit less sera gas in the atmosphere (like Carbon-dioxide (CO₂)) must be preferred. Otherwise, destruction of ecological balance and disasters in future will be inevitable. The negative effects of renewable energy resources on environment are lesser than the conventional energy resources. Costs of renewable energy resources are lesser than the fossil origin fuels. They never consume as they are renewable and in contrary to the conventional fuels, they do not exhibit a significant threat for environment and human health. In this study, effects of energy resources on environment are considered in detail. Especially, effects of renewable energy resources on environment and criteria that must be observed in energy production to prevent environment pollution are examined.

Keywords: Energy, fossil fuels, nuclear power plants, renewable energy, environment, global warming.

INTRODUCTION

One of the most important elements to meet the essential needs of modern life is the use of electric energy. This feature makes the electric energy a sector that gives input to almost all sections in economy. Besides, as production, transmission, distribution and marketing of the electric energy are an individual investment area, it may be considered as an economical output. One of our most important needs of which consumption increases continuously and will definitely continue to increase in future is undoubtedly the energy. Rapid development in technology and industry in recent years causes increase in environmental problems. Today, negative effects of solid wastes on nature that increase rapidly in respect to both content and quantity in parallel to technological development, industrialization and urbanization have been an important environmental problem.

Energy Resources

The energy need of world rapidly grows by consuming all the stock of energy resources in nature. When the effects of the petroleum crises in 1970's and the gulf war in 1991 on petroleum reserves are considered, it is clear that there is not any other option for all the world to use the reserves in hand in the best way and direct towards to new energy resources. If we also consider the effects of fuels on environment after they are processed, to get benefit from the energy resources in the best and most effective ways in a manner to produce the least waste becomes very important.

Fossil Fuels

Fossil fuels are also known as mineral fuels. They are the natural energy resources like coal, petroleum and natural gas that contain hydrocarbon. Fossil fuels are widely used in the industrial area. In electric production, the energy that comes out through combustion of fossil fuel is transmitted to a turbine as power. In former generators, the vapor obtained by combusting a fuel was used to rotate the turbine but in new energy power plants, the obtained gases directly rotate the gas turbine. The economical growth of industrialized modern societies depends on energy benefiting base they obtained from fossil fuels. At present, 80% of the world's energy need is met from

fossil fuels like coal, petroleum or natural gas. These resources that are intensive in some definite areas of world exist in various forms. The human being has learned to take out such resources in different methods and obtained the energy they desire. As fossil fuels can be stored and transported easily, they are considered as a perfect fuel.

The fossil fuels are widely used in houses, commercial and industrial sectors, heat production and production of electric energy. In transportation sector, mostly petroleum products (gasoline, diesel oil, jet fuel etc.) are preferred. The heat production, space heating, is used for cooking, hot water, vapor production, direct heating or drying of many industrial products. For these purposes, three kinds of fossil fuels can be used. While very small amount of electric energy is produced in hydro or nuclear power plants, mostly coal and natural gas is preferred. Usage of fossil fuels in such high rates begins to create destructive results.

Table 1: Greenhouse gases and global warming effects

Greenhouse Gas	Global Warming Effect (%)
Carbon-di-oxide (CO ₂)	50
Chlorofluorocarbons (CHF)	22
Methane (CH ₄)	13
Nitrogen Oxides (NO _x)	5
Ozone (O ₃)	7
Water Vapor (H ₂ O)	3

Effects of Hydroelectric Power Plants on Environment:

The water power is considered as an energy resource related to the geographical location. As we all know, electric is produced in barrages by using the water force. Collecting water in barrages does not negatively affect the environment and the turbines used in hydro power plants (like Kaplan turbines) produce electric without negatively effecting the environment. These plants can be defined as development and usage of water resources including their energy production purpose. In other words, hydroelectric energy ensures converting of potential energy of water to kinetic energy.

The hydroelectric power plants have climatic, hydroelectric, ecological, socio-economical and cultural effects. The water collecting part of a hydroelectric power plant (reservoir) creates environmental effect when it is in operation. As the surface area of a reservoir is wider than a river and as the vaporizing increases, climatic effects occur. In this manner, humid rate in air increases, air movements change and temperature, raining and wind events differ. The flora and animal living both on land and in water of the region enter into sudden changing and animal species that can adapt themselves in such an environment can survive. The hydrological effects result from flowing regime of stream and changing of physico-chemical parameters. To convert rivers to reservoirs cause vaporizing of water and increasing of quantity of salt and other minerals in water. In transition from stream to lake, natural cleaning capacity decreases depending on decrease in water speed diffusion and oxygen taking capacity and the lake enters into mortification process. Changes in water quality of lake cause alterations in hygrophilous living. Blocking of migration ways both on land and in water, living areas remaining under water and annihilation of some important species cause occurring of ecological effects. Dissolution of air azoth in excessive saturation level because of falling off waters is fatal for the fish.

On the other hand, the social-economic and cultural effects are felt negatively and positively since construction phase of barrage. As a result of the expropriation made depending on size and quality of the land under water, internal and external migration events are experienced and value of land changes. However, because of the manpower movement during construction phase, the regional economy enlivens and infrastructure services and social services (school, health facilities, etc.) cause positive effects especially in integrated projects. The barrage lake is a resource for recreation and production of water products.

Effects of Thermal Power Plants on Environment

The thermoelectric power production is made generally by using coal, petroleum and natural gas fuels. Only 30-40% of the energy produced in thermal power plants can be converted to electric energy. The

remaining part is called as "fault energy" and comes from its boiler with radiation or discarded from funnel together with funnel gas. One of the most important environmental effects of thermal power plants is related to cooling water and the cooling water need of thermal power plants is great. For this reason, thermal power plants are generally constructed near resources like lake or sea where cooling water can be used. Disposing of wastes in sea and scattering on land is the feckless wasting method known since old days.

The gases that come out from funnel of thermal power plants and greatly affect the flora are dioxide and azoth oxides. The organ of plants mostly sensitive to such gases is their leaves. Such gases that enter into leaves by means of stomas destroy the structure of chlorophylls in leaves. Damages on plants are seen in three different dimensions. These are acute, chronicle and hidden damages. Plants expose to acute damage die immediately. Though the chronicle damage is not vital, it greatly destroys the quality of plants. The hidden damage occurs in a time.

Effects of Nuclear Power Plants on Environment

Though the Nuclear Energy Power Plants (NEPS) that leaves its mark of "atom era" on this century is a clear, reliable and settled technology in electric production, it takes reactions by the public in many countries.

The effects of nuclear plants on environment appear during taking out of uranium and thorium, preparation of fuel, production, enriching, re-treatment of fuel, storing and detaching of reactors. The biggest effect of nuclear plants on environment is emission of a radioactive matter in environment as a result of an accident. Gases and liquid radioactive wastes from nuclear plants cause significant environmental effects. However, the effects of radiation on environment vary depending on power of accident, type of reactor and security system out of reactor. If various radioisotopes disperse to environment as a result of the accident, radiation contaminated to water, soil and air taking medium effects the environment and human health. Here the important thing is that, well-conditioned storing and keeping of high level radiating wastes after the fuel completes its usage life. With contributions of countries like Canada, South Korea, Taiwan, France

and Belgium that increased their nuclear capacities, it is observed that other sera gases (greenhouse) and poisonous aside rains have decreased in great extent.

The radioactive effects reach to environment and all living beings including humans by means of two different ways. The first way: transportation of emissions arising from funnels in the atmosphere and their reaching to the earth and living beings on earth. The second way: reaching of liquid and solid wastes arising from power plants to rivers, lakes and seas and their effect on living beings and underground waters. Because of the circulation of natural life, the human beings and animals living on earth can affect from the radioactivity arising from nuclear power plants by means of both ways.

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CONCLUSION

Today, the top priority resources in the world's energy production are the renewable energy resources like petroleum, natural gas and coal. Especially, as natural gas pollutes the environment less than the other resources, its share in energy production increases day by day. As it can be seen in Figure 1, the energy resource most commonly used in the world is petroleum. The mine coal of which usage increasingly decrease takes place in the second row and natural gas of which production and consumption rapidly increase in the third row. In different periods, a definite energy resource was used dominantly. Petroleum took the place of coal and in next year's, natural gas has become important. In future years, alternative energy resources will become important.

Conflicts of interest: The authors stated that no conflicts of interest.

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Performance and Emission Analysis of Palm Biodiesel Engine

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ABSTRACT

The Growing rate of population and increasing demand of resources in terms of fuel catches attention of researcher to search for a renewable alternative fuel. Therefore, in this research paper the prospects and opportunities of using palm biodiesel in an engine are studied. The experimentation was conducted on a four stroke, single cylinder, D.I. diesel engine with Diesel and various blends of Palm biodiesel. The analysis of performance and emission of various blends of palm biodiesel and neat diesel was carried out. The results reveal that at blend B20, the better performance and less emission are obtained as compared to other blends.

Keywords: BTE, BSFC, smoke density, NO_x, Palm biodiesel etc.

INTRODUCTION

Current study focuses that biodiesel and its derivatives, have received much attention in recent years for diesel engines. Biodiesel is an oxygenated diesel engine fuel that can be obtained from vegetable oils or animal fats by conversion of the triglycerides to esters via trans esterification. It has similar properties to those of fossil diesel. Therefore, research on biodiesel derived from vegetable oils and animal fats lead to the study of alternative to petroleum based diesel fuels [1][2]. It has been reported by the results of many studies that biodiesel can be used in diesel engines with little or no modifications, and with almost the same performance.

The results vary according to the base vegetable oil or animal fats, the process of biodiesel production as well as biodiesel fuel properties [3][5].

On the other hand, biodiesel has high viscosity, high density, lower calorific value and poor non-volatility, which leads in pumping problem, atomization problem and poor combustion inside the combustion chamber of a diesel engine. In case of long-term use of vegetable oils in diesel engines, problems such as gumming, injector fouling, piston ring sticking and contamination of lubricating oils are bound to occur [6][9][10]. Due to the high viscosity of vegetable oils all these problems occur. Hence, it is necessary to reduce the viscosity of vegetable oil to a more approximate value of diesel. The solution to the problems has been approached in several ways, such as preheating the oils, blending them with diesel, thermal cracking and trans esterification [7][8][11].

In the present research study the biodiesel derived from palm seed oil has been used in diesel engine to analyze the performance and engine characteristics. The properties of Palm biodiesel are given in Table 1. [4]

Table 1. Properties of palm biodiesel [4]

Calorific Value, kJ/kg	37254
Density @ 15°C, kg/m ³	875.1
Calorific Value, kJ/kg	37254
Specific gravity @15°C	0.8722
Pour Point	-12°C
Flash Point	175°C
Viscosity at 40°C, mm ² /s	4.1
Cetane number	52
Visual appearance	Dark Brown liquid

METHODOLOGY

The experimentation was carried out to analyze the performance and emission characteristics of palm oil biodiesel. Biodiesel (B100) and its blends B20, B40, B60, and B80 were used to test the engine of the specifications mentioned in Table.2. The experiments were conducted on a single cylinder, 4 stroke D.I. diesel engine. No engine modifications were done.

During experimentation palm biodiesel was preheated and maintained at 50°C. The engine was loaded using the eddy current dynamometer. The engine speed in rpm was sensed using a sensor pre-installed in the dynamometer and was recorded from the display on the control panel of the dynamometer.

Table 2. Specifications of engine

Type	Single-cylinder, four-stroke, compression ignition diesel engine
Bore	80 mm
Stroke	110 mm
Compression ratio	16.5:1
Rated speed	1500 rpm
Rated output	3.7 kW
Dynamometer	Eddy current, water-cooled with loading unit

The constant engine load corresponding to various blends of biodiesel was maintained. At each blend, the engine was stabilized for 60 minutes and then performance and emission parameters were measured. The various graphs were plotted between Brake thermal efficiency and BMEP, BSFC and BMEP, Smoke density and BMEP and between NO_x and BMEP as shown in figure 1, figure 2, figure 3 and, figure 4.

RESULTS AND DISCUSSION

Brake Thermal Efficiency:

The variation of Brake thermal efficiency with brake mean effective pressure for different blends are shown in figure 1. In all cases it increases with increase in brake mean effective pressure up to full load (BMEP 5.53 bar). This is due to a reduction in heat loss and increase in power with increase in load. The lower brake thermal efficiency obtained for B0, due to reduction in calorific value and increase in fuel consumption at full load. The maximum brake thermal efficiency is observed for blend B20 at full load.

Brake specific fuel consumption:

The variation of brake specific fuel consumption is shown in figure 2. For all blends tested, brake specific

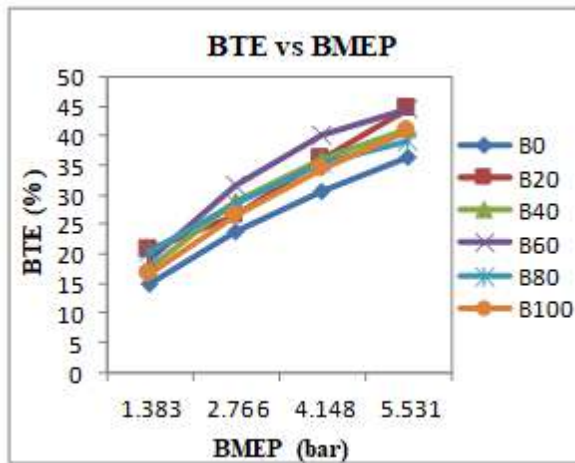


Fig.no. 1. BTE vs BMEP

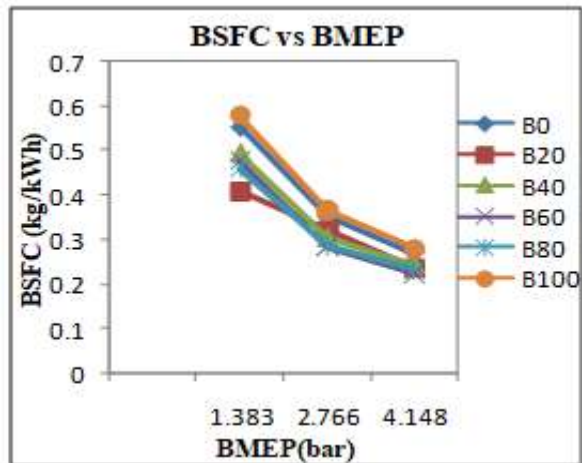


Fig. no. 2. BSFC vs BMEP

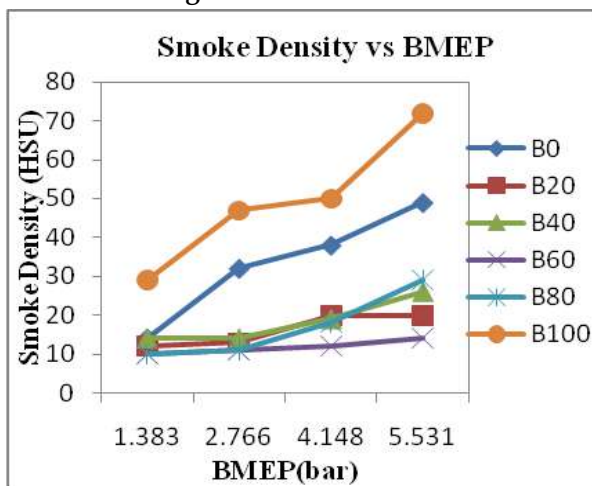


Fig. 3. Smoke Density vs BMEP

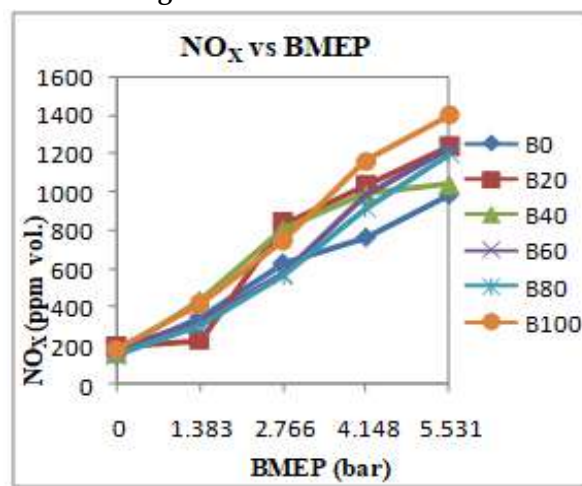


Fig. 4. NOx vs Biodiesel blend

fuel consumption decreases with increase in brake mean effective pressure up to full load (BMEP 5.53 bar). This reduction is due to the higher percentage of increase in brake power with load as compare to fuel consumption. The overall characteristics of palm biodiesel and diesel are similar. The lowest Brake specific fuel consumption is predicted for B20 at full load. Also, highest Brake specific fuel consumption is observed at B100. This is due to the combined effect of low heating value and high density of palm biodiesel.

Smoke density:

The variation of smoke density is shown in figure 3. For all blends tested, smoke density increases with increase in brake mean effective pressure. As blending proportion increases from 0 to 100 percents, smoke also increases. This increase in smoke is more at low loads as compared to high loads. The smoke is formed due to incomplete combustion of fuel. It is highest for

B100 and lowest for B20 at full load. The reason for decreasing exhaust emissions with palm biodiesel blends is the presence of oxygen (O₂) in the biodiesel.

Nox:

The variation of NO_x is shown in figure 4. It is observed that as load increases the NO_x formation increases and attains maximum at full load. At full load NO_x is highest for B100 and lowest for B20. B80 shows sudden rise in NO_x at full load for preheating temperatures. This may be due to small amount of nitrogen contents present in Palm biodiesel, which contributes towards NO_x production.

CONCLUSION

It can be concluded that, Due to preheating the viscosity of palm biodiesel blend decreases, which

helps to improve the performance of engine. Also from overall observations it can be stated that B20 blend of palm biodiesel shows an optimized trend in almost all parameters at 50°C preheating temperature and 16.5 compression ratio. The use of palm oil creates a need to increase palm oil sources. This in turn will increase the use of waste land productivity and generate rural employment and increase the countries' GDP. Local production of biodiesel will save a huge amount of foreign exchange. This capital when invested in country will improve its financial structure.

ABBREVIATION

B0 - Diesel 100%

B20 - Palm Biodiesel 20% +Diesel 80%

B40 - Palm Biodiesel 40% +Diesel 60%

B60 - Palm Biodiesel 60% +Diesel 40%

B80 - Palm Biodiesel 80%+Diesel 20%

B100- Palm Biodiesel 100%

BSFC - Brake Specific Fuel Consumption (kg/kW h)

BTE - Brake Thermal Efficiency (%)

Nox - Nitrogen oxide (ppm)

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Role of electrification in the Rural development

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ABSTRACT

India is one of the developing nation of the world. It has covered about the 20% world population. It is one most rural population of the world. This population is working in the farming. Our nation is monsoonal country. There is not fixation about the rainfall. Due to the uncertainty of the rainfall which is most of effecting on the economy. National economy Is most of the effecting on the social-cultural development.

Keywords: World Population, Rainfall, National Economy, social-cultural development.

INTRODUCTION

After the independence of India it has made most of big project on the irrigation project as the Bhakra-Nagal dam [1]. The dam was Hircude and Nagarjun. This was new temple in the rural development. It has multipurpose dam which has given number of the facility as the – Irrigation, Electricity, Food and environmental activity.

The next activity was the fertilizer at the Shindri [2] we the nation has started the new project as industry of the fertilizer. It was new scope of Green revolution. It gives new technological direction for the population of the India. With the help of the five year plan, it has taken properly development of our nation from the 1951. There was one the scope of the Industry. There was new five industrial belt [3] for the regional development. This industrial development there was Iron and Steel Industry, chemical industry and cement, Instrumental

and the cotton. It was the basic need of the rural development. Due to this basic development living of standard has improve the engine cycle.

ELECTRICITY IN INDIA

In the 1960, there is one of the needs of the Electrical need which was converting after the communication technology. It was the period of the Globalization in which shortage of the coal and petroleum. This need is convert the electricity. Hence the period of the 1970 period of the electricity in our nation [4], India.

In the beginning period electricity was made with the help of the hydro-electricity. In which water is used for the purpose of the formation was electricity. It was eco-friendly. It was also renewable but has the shortage in the drought. Electrical engineer has stated new scope of Thermal Electrical which was more ability to develop the electrical energy. This was not good for the environment. It makes the global warming. It was more polluted for the air and land pollution. This thermal power project was non-renewable, which was based on the coal.

After the energy crisis weight age of the convectional energy is converting in the non-renewable source as the solar, wind, nuclear electricity. It has the lot of efficiency for the electricity as the developing India. India has the more need of the electricity due to the rapidly growth the population in India. Today it is 125×10^6 , total need of the electricity is 320 GW. But we are not come up to the level. That's why there is shortage as the load shading. We has made the Eight electrical grid system. Which are collecting whole the electricity of the India and the supplying the proper voltage and capacity. It is one of the best capacities of the national development. Maharashtra is one of the prospers state which has need of the 10% need of the national electricity. There is special ministry of the energy in our nation.

RENEWABLE ELECTRICITY

Another Renewable source of the Electricity [5] are the solar Electricity which is more applied in our tropical country. India is one most prospectus nation of the

world which have ten months more ability to supply the electricity. Government has given the more subsidies for the facility. The next one the wind energy which is the continuous ability to give the electricity. It is 8.3% of the total electricity. Tamilnadu is pioneer country of the India. After it Gujrat and our Maharashtra. In the Maharashtra it is 4000 MW. The windmill is made by the Suzlon and windworld. Wind energy is more useful in the rural development because of the it has stand in the remote area. It is also clean Eco-friendly energy, which has highest growth rate in the electricity.

USES OF ELECTRICITY IN INDIA

There is the following role of the electricity in the rural development in our India.

- Electricity is energy which can be gives the speed for the rural development.
- For the purpose of agricultural activity as the Irrigation. And the modification and the Industrial scope.
- For the purpose of the lighting
- To spread of the new technology.
- For the purpose of the house kitchen as the heating energy.
- Small rural industrialization is based on the electricity
- In the practices of the transportation.
- Now day this era is digital India, which is possible with the help electricity.
- National communication as the TV and other instrument is run by the electrical energy.
- For the social equality and justice.
- As a part of globalization.

SOME DATA:

now a day Government of the India is supplying about the 1000 Watt/Hr. per capita. But we had the more need of this electricity. Due to the shortages of the electricity in our Maharashtra the load shading is started in 2004. It supplies the only the 8 Hour electricity in the rural India. Which the bad for the agricultural development. For solving this problem, we have make the wind energy. This is clean energy.

Conflicts of interest: The authors stated that no conflicts of interest.

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A study of conventional Sunspot Solar Oven: A Cook Stove

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ABSTRACT

Energy saving is serious problem because as no fuel is available in large quantity. The vast majority of the world's population does even know that it is possible to cooks food with the sun light. There are different types of solar oven to cooks the food. Anything can be cooked in a conventional sunspot solar oven. It works on the principle of reflection, concentration, and absorption. The oven has properly arranged reflective inner walls to direct and concentrate the sun's energy on the dark pot. This paper reported, food such as rice will cook within 30-35 minutes and maximum temperature of cooking oil is reaches upto 67 °C. Food never burns your pots and no stirring required for oven. It cooks food deliciously and save vitamins.

Keywords: Solar Oven, Solar Energy, Dark Pot.

INTRODUCTION

The vast majority of the world's population does not even know that it is possible to cook with the sun. The heat energy produced by the sun is immense. In equatorial regions the solar radiation can exceed 1000 Watts/m². That is equivalent to half the power of an electric kettle whenever there is good sunlight. It takes only 50-60 minutes to boil water on a solar stove. And it's free, as long as you have clear blue skies. Reflective surfaces concentrate the radiation into a central chamber. This oven has a small capacity and it suitable for cooking small quantities of food for one person. Most often used as an educational tool, it makes a good start to solar cooking or as an addition to existing solar cookers. Black pots work a lot better than silver pots.

The pot needs to absorb as much light as possible and silver tends to reflect the light. Dull or 'matt' finishes absorb more light than 'shiny' surfaces.

In this work, authors study and observed that food such as rice will cook within 30-35 minutes and maximum temperature of cooking oil is reaches upto 67 °C. Food never burns your pots and no stirring required for oven.



Figure 1: Ray diagram for solar oven

METHODOLOGY

Solar oven work on basic principles: sunlight is converted to heat energy that is retained for cooking. The solar oven split the work up into three main sections. First section: A four plane reflector (mirror) serves to concentrate more sunlight into an area of oven. Dark surfaces get very hot in sunlight. Second section: The control arm allows the mirror (reflector) to be set facing the sun and holds the pot at the focal point of the reflector. Third section: To use the solar oven, adjust the angle of the (mirror) reflector until the pot's shadow falls in the centre of oven. When properly adjusted, there should be no glare from the reflector and the pot handle should not become too hot to hold. For long cooking times, the oven will have to be adjusted every 30 minutes to follow the sun. If a lower heat is required, the oven may be rotated to move the pot out of the focus or part of the reflector can be covered. When not in use, the oven should be stored inside, out of the sun or covered with a waterproof cover.

MATERIALS

The oven can be made by anyone with experience in simple carpentry and access to basic hand tools. The following is a list of materials needed:

- **Dimensions:** Closed: 23 x 44 x 44, Opens: 39 x 39 x 14
- **Weight:** 15-20 kg
- **Materials:** Wood, Mirror Glass, etc.
- **Temperatures:** Can reach 67 °C (340 °K) when cooking small amounts of food.

Cost: The cost of these materials is about Rs. 1500 in 2017-18.



Figure 2: Typical and Experimental diagram of solar oven for observations recorded

Benefits:

- Energy savings: no fuel is required.
- Prepared for any interruption to traditional power sources.
- Great for camping and emergencies.
- Totally safe: no danger of fire.
- Keeps the kitchen cool: in hot summer weather.
- Bake anything: cooked in a conventional oven.
- Food never burns or scorches pots.
- No hot spots that require stirring.
- No drudgery to gather fuel, watch or stir food.

- Cooks food deliciously and saves vitamins.
- Sun baked foods stay moister and have less shrinkage than conventional oven cooked foods.
- In villages, women have to travel less often to forage for firewood, thus keeping them closer to home and safe as a result.
- Cheaper than cooking with firewood or charcoal
- Reduced CO₂ emissions
- Solar cookers can be easily constructed in a matter of hours after very basic training
- Solar cookers are generally light-weight

RESULTS AND DISCUSSION

The cooking time depends primarily on the equipment being used, the amount of sunlight at the time, and the quantity of food that needs to be cooked. Air temperature, wind and latitude also affect performance. Food cooks faster in the two hours before and after the local solar noon than it does in either the early morning or the late afternoon. Larger quantities of food, and food in larger pieces, take longer to cook. As a result, only general figures can be given for cooking time. With a small solar panel oven, it might be possible to melt butter in 30-35 minutes, to bake cookies in 2 hours, and to cook rice for four people in 4 hours. Also maximum temperature of cooking oil reaches upto 67 °C. However, depending on the local conditions and the solar oven type, projects could take half as long or twice as long.

CONCLUSION

In areas where sunshine is plentiful and conventional fuels are expensive. The solar oven is an ideal complement to a regular stove. It is cheap, easy to use and requires no fuel. The oven works by concentrating the power of the sun onto a small area in which a pot or other implement is placed. Under strong sunlight, a food can be brought to cook in about 30 minutes. Also maximum temperature reaches for cooking oil. Food never burns your pots and no stirring required for oven. The cooking trial shows that the new device can be used twice a day, even on winter days.

Conflicts of interest: The authors stated that no conflicts of interest.

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Renewable Resources

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ABSTRACT

The electricity requirements of the world including India are increasing at alarming rate and the power demand has been running ahead of supply. It is also now widely recognized that the fossil fuels (i.e., coal, petroleum and natural gas) and other conventional resources, presently being used for generation of electrical energy, may not be either sufficient or suitable to keep pace with ever increasing demand of the electrical energy of the world. Also generation of electrical power by cold based steam power plant or nuclear power plants causes pollution, which is likely to be more acute in future due to large generating capacity on one side and greater awareness of the people in this respect. The recent severe energy crisis has forced the world to develop new and alternative methods of power generation, which could not be adopted so far due to various reasons. The magneto-hydro-dynamic (MHD) power generation is one of the examples of a new unique method of power generation. The other non-conventional methods of power generation may be such as solar cells, fuel cells, thermo-electric generator, thermionic converter, solar power generation, wind power generation, geo-thermal energy generation, tidal power generation etc. This paper elucidates about Different Energy sources, why we are going for non-conventional energy sources, Different non-conventional energy sources & comparison between them, about fuel cells and their applications.

Keywords: Magneto-Hydro-Dynamic (MHD) Power Generation, Solar Power Generation, Wind Power Generation, Geo-Thermal Energy Generation, Tidal Power Generation.

INTRODUCTION

Why we are going for renewable resources?

Basically, the energy sources are two types; they are conventional energy sources like coal, petroleum, natural gas etc. & non-conventional energy sources like solar cells, fuel cells, thermo-electric generator, thermionic converter, solar power generation, wind power generation, geo-thermal energy generation, tidal power generation ETC.

A magneto- hydrodynamic generator (MHD generator) is a magneto-hydrodynamic device that transforms thermal energy and kinetic energy into electricity. MHD generators are different from traditional electric generators in that they operate at high temperatures without moving parts. MHD was developed because the hot exhaust gas of an MHD generator can heat the boilers of a steam power plant, increasing overall efficiency. MHD was developed as a topping cycle to increase the efficiency of electric generation, especially when burning coal or natural gas. MHD dynamos are the complement of MHD propulsors, which have been applied to pump liquid metals and in several experimental ship engines.

An MHD generator, like a conventional generator, relies on moving a conductor through a magnetic field to generate electric current. The MHD generator uses hot conductive plasma as the moving conductor. The mechanical dynamo, in contrast, uses the motion of mechanical devices to accomplish this. MHD generators are technically practical for fossil fuels, but have been overtaken by other, less expensive

technologies, such as combined cycles in which a gas turbine's or molten carbonate fuel cell's exhaust heats steam to power a steam turbine.

Natural MHD dynamos are an active area of research in plasma physics and are of great interest to the geophysics and astrophysics communities, since the magnetic fields of the earth and sun are produced by these natural dynamos.

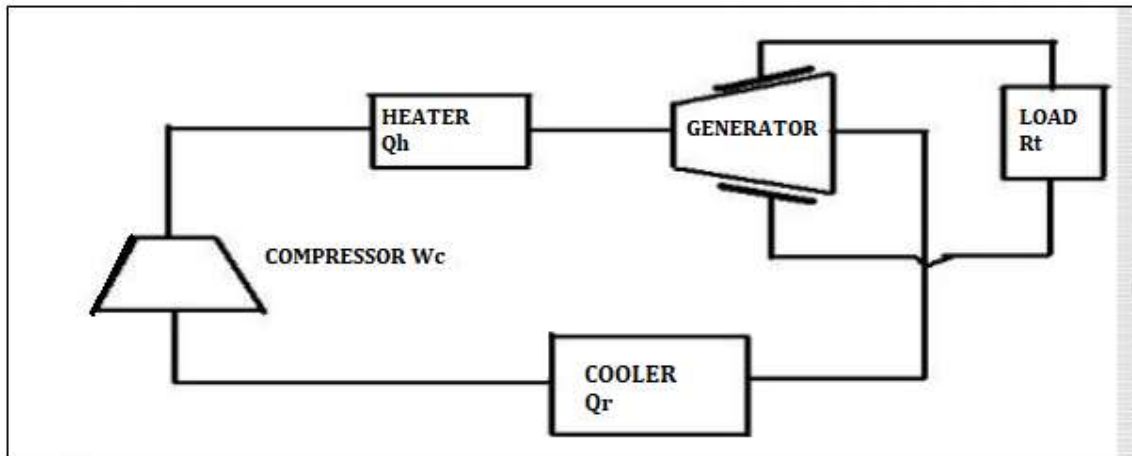
Fast depletion of conventional energy sources made us to look after alternate energy sources.

METHODOLOGY

1. MHD generator consist of a Combustion chamber and generator chamber,
2. The fluid conductor is passed into the combustion chamber where they are ionized at very high temperature.
3. There is a nozzle through which the ionized gas passé into the generator chamber.
4. The generator chamber consists of powerful magnet and a number of oppositely located electrode pair is inserted in the channel to conduct the electrical current generated to an external load.
5. Both combustion chamber and generator chamber are surrounded by a heat resistance material and water cooler.
6. The gaseous (fluid) conductor is passed into the combustion chamber through inlet.

Table 1:

Sr. No.	Method	Efficiency	
		Present	Future
1.	MHD Power Generation	Around 50%	Up to 60%
2.	Thermo-electric power generation	Around 3%	Up to 13%
3.	Thermionic converters	Around 15%	Up to 40%
4.	Photo-voltaic or solar cells	Around 15%	_____
5.	Fuel cell technologies	Around 50%	Up to 60%
6.	Solar Power Generation	Around 30%	Up to 50%
7.	Wind Power Generation	Around 30%	_____
8.	Geo-thermal Power Generation	Around 15%	_____



7. By using a fuel like oil (or) natural gas (or) coal, the fluid conductor is heated to a plasma state and hence it is ionized.
8. The temperature in the combustion chamber is around 2000°K to 2400°K.
9. The heat generated in the combustion chamber removes the outermost electrons in the fluid conductor.
10. Therefore, the gas particle acquires the charge
11. The charged gas particles with high velocity enter into the generator chamber via nozzle.
12. The positive and negative charge moves to corresponding electrodes (anode and Cathode) and constitute the current.
13. In generator chamber, based principles of Faraday's law, the high velocity ionized conducting gas particles experience the magnetic field at right angles to their motion of direction and hence the potential (current) is produced.
14. The direction of current (Potential) is perpendicular to both the direction of moving gas particle and to the magnetic field.

CONCLUSION

Faraday generator

The Faraday generator is named after the man who first looked for the effect in the Thames River. A simple Faraday generator would consist of a wedge-shaped pipe or tube of some non-conductive material. When an electrically conductive fluid flows through the tube, in the presence of a significant perpendicular magnetic field, a voltage is induced in the field, which

can be drawn off as electrical power by placing the electrodes on the sides at 90 degree angles to the magnetic field.

There are limitations on the density and type of field used. The amount of power that can be extracted is proportional to the cross sectional area of the tube and the speed of the conductive flow. The conductive substance is also cooled and slowed by this process. MHD generators typically reduce the temperature of the conductive substance from plasma temperatures to just over 1000 °C.

The main practical problem of a Faraday generator is that differential voltages and currents in the fluid short through the electrodes on the sides of the duct. The most powerful waste is from the Hall Effect current. This makes the Faraday duct very inefficient. Most further refinements of MHD generators have tried to solve this problem. The optimal magnetic field on duct-shaped MHD generators is a sort of saddle shape. To get this field, a large generator requires an extremely powerful magnet. Many research groups have tried to adapt superconducting magnets to this purpose, with varying success.

Hall generator:

The most common solution is to use the Hall Effect to create a current that flows with the fluid. The normal scheme is to place arrays of short, vertical electrodes on the sides of the duct. The first and last electrodes in the duct power the load. Each other electrode is shorted to an electrode on the opposite side of the

duct. These shorts of the Faraday current induce a powerful magnetic field within the fluid, but in a chord of a circle at right angles to the Faraday current. This secondary, induced field makes current flow in a rainbow shape between the first and last electrodes.

Losses are less than a Faraday generator, and voltages are higher because there is less shorting of the final induced current. However, this design has problems because the speed of the material flow requires the middle electrodes to be offset to "catch" the Faraday currents. As the load varies, the fluid flow speed varies, misaligning the Faraday current with its intended electrodes, and making the generator's efficiency very sensitive to its load.

Disc generator:

The third and, currently, the most efficient design is the Hall effect disc generator. This design currently holds the efficiency and energy density records for MHD generation. A disc generator has fluid flowing between the center of a disc, and a duct wrapped around the edge. The magnetic excitation field is made by a pair of circular Helmholtz coils above and below the disk. The Faraday currents flow in a perfect dead short around the periphery of the disk. The Hall effect currents flow between ring electrodes near the center and ring electrodes near the periphery.

Another significant advantage of this design is that the magnet is more efficient. First, it has simple parallel field lines. Second, because the fluid is processed in a disk, the magnet can be closer to the fluid, and magnetic field strengths increase as the 7th power of distance. Finally, the generator is compact for its power, so the magnet is also smaller. The resulting magnet uses a much smaller percentage of the generated power.

ADVANTAGES

1. The conversion efficiency of MHD system can be around 50% much higher compared to the most efficient steam plants.
2. Large amount of power is generated
3. It has no moving parts so reliable

4. It has been estimated that overall operational costs in plant would be about 20% less than conventional steam plants.
5. It is possible to use MHD for peak power generation and emergency service.

Conflicts of interest: The authors stated that no conflicts of interest.

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Impact of Wind, Solar & Geothermal Energy on Environment

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ABSTRACT

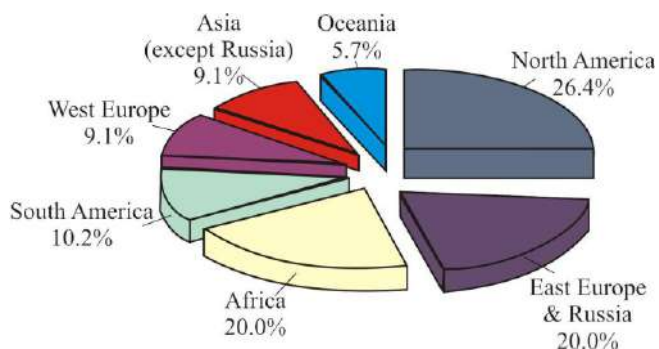
Today, prevention of environment pollution and conservation of environment have a dimension exceeding national borders. The risks that result from using of fossil fuels increasingly (petroleum, coal, gas) must be decreased (air pollution, thinning of ozone layer, acid rains etc). To decrease such risks, besides to increasing of energy productivity, energy resources that emit less sera gas in the atmosphere (like Carbon-dioxide (CO₂)) must be preferred. Otherwise, destruction of ecological balance and disasters in future will be inevitable. The negative effects of renewable energy resources on environment are lesser than the conventional energy resources. Costs of renewable energy resources are lesser than the fossil origin fuels. They never consume as they are renewable and in contrary to the conventional fuels, they do not exhibit a significant threat for environment and human health.

Keywords Energy, renewable energy. Environment.

THE WIND ENERGY

The wind energy is a clean energy resource that may contribute to the usual energy production as an energy resource under suitable conditions. There has been esteemed that until year 2017, the windmills installed capacity, should cover up about 10% of the planet's electrical energy needs. Energy to be obtained from wind completely depends on the speed of wind and blowing period. The wind is a reliable, continuous and determinant resource. The wind plants may require a wide area for turbines.

They are noisy and cause bird deaths and make parasites on radio and TV receivers. For this reason, in many European countries, mainly in England, the wind turbines are banned to be installed within boundaries of national parks or nearby to them because of their environmental effects. The wind energy is one of the clean energy resources and has positive effects on environment. A 500kW wind turbine realizes the CO₂ cleaning process equal to 57000 trees.

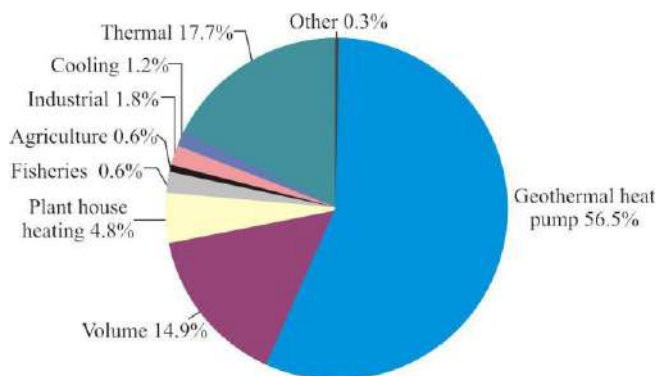


GEOHERMAL ENERGY

It is defined as hot water, vapor and gases arising from the heat accumulated in various depths of the earth crust and of which temperatures are above the atmospheric temperature. The geothermal energy is the heat potential accumulated extraordinarily in accessible depths of the earth crust that can be benefited economically. This energy is a clean renewable energy. By aid of the energy transformation technologies, electric production is realized from hot water and vapor or they are directly used for purpose of heat energy. The waste fluid of which energy is benefited is re-injected to underground because of its negative environmental effects. As many countries that use geothermal energy apply re-injection, geothermal energy is considered the most positive energy resource in respect to environment. When geothermal energy is used in electric production, it comes before fossil fuels with its almost zero waste even though it is only evaluated with sulfide emissions. In geothermal power plants, azoth oxide emissions have much lower values than the power plants that use fossil fuels. For this reason, geothermal power plants are considered as a clean energy resource as they are classified risk free in respect to its effect on ozone layer and health. 27% of total electric

production in Philippines and 7% in California State are being covered from geothermal plants and 56MWe - capacity geothermal electric energy production is made in Papua New Guinea. 75% of energy need of gold mining is covered from geothermal. 86% of total heat energy (city heating) in Iceland is covered from geothermal.

Among the advantages of geothermal energy there are; it is environment friendly, it does not need fossil energy to heat and vaporize water and it uses natural resources. One of the disadvantages of geothermal energy is that it requires re-injection because of emission of gases like hydrogen sulfide and carbon dioxide. In Figure 1, usage areas and rates of geothermal energy other than electric production are given



SOLAR ENERGY

It is an energy resource that comes from the sun, has a fixed force out of the atmosphere of world (1370 W/m²) and varies between the values of 0-1100 W/m² on earth. The solar energy is clean, costless and limitless. Firstly, the solar energy was used as heat energy but in recent years, it is also being used as an electric energy together with the developed technology.

The electric energy is being obtained by means of solar panels and photovoltaic (PV) cells with decreasing costs day by day. The conventional PV generation systems have two big problems that the efficiency of PV system is very low, especially under low irradiation states and the output available power of PV system is always changing with weather conditions, i.e., the intensity of the solar radiation (irradiation) and ambient temperature. In order to extract as much energy as possible from a PV system,

it is important to have an efficient maximum power point tracking algorithm. In developing nations, the PV generate system is expected to play an important role in total electrical energy demand, and solar photovoltaic energy has gained a lot of attention because it is renewable, friendly to the environment, and flexible for installation. The solar energy is inconsumable energy resource that does not cause environment pollution. Because of the increase in fuel prices experienced in recent years, the solar energy that was not considered economical a few years ago has become very economical in some usage areas. The solar energy, alternative to energy resources like petroleum and coal, is highly promising.

Among the advantages of solar energy, there are; it uses solar energy, prevents unnecessary and excessive commercial energy consumptions of buildings by using the natural heating and cooling systems, uses natural and harmless materials, meets the energy need in areas lack of electric network, is continuous, economical and not foreign dependent. The disadvantages of solar energy are; its first investment cost is very high and PV cells operating in low output. The environmental problems created by technologies that ensure using of solar energy are unimportant when compared to other technologies. Effect of planar collector systems on environment is in negligible level. However, in some conditions, there may be dangerous situations in respect to health because of high temperatures and poisonous heat transformation fluids.

CONCLUSION

The nature has resources and opportunities sufficient enough enabling people to live in balance without giving damage to the environment and even, to obtain comfortable life level by being industrialized. Unless we destroy the natural balance by giving as much as we take to the nature, if we give back what we take from environment under same conditions, give opportunity and time for reestablishment of natural balance, the nature will renew itself and compensate its lacking component. The renewable energy use is an option that increases variety in energy resources, may be replaced to fossil resources, decreases foreign dependency in fossil fuels as it is domestic, important

in electric supply in rural areas and solves the air pollution-sera gas problems by being used in place of fossil fuels. Whatever its kind is, the energy production systems have an effect on environment. The solar and wind energies that do not have any negative effect on environment is hoped to be used economically in production of electric energy in long-term. The hydroelectric energy potential that does not have any negative environmental effect, except the agricultural lands staying under water, must be re-determined in a realistic manner by considering the new technologies.

Consumptions of fossil fuels in energy production and other applications continue in its today's speed, it is clear that the ecological balance of world will be destroyed. According to the study of Frankfurt University Meteorology Institute on sera effect, it is forecasted that there will be temperature changes until 2040; 10°C in Pacific, 8°C in the Bering Gulf, 6°C in Japan, 4°C in Siberia and Antarctica and -2°C in West Africa. While restricting the use of fossil fuel energy resources, the clean energy technologies that pollute the environment less or have no polluting effect must be considered and developed. Otherwise, it will be impossible to prevent degeneration of ecological balance and arising of some disasters to be experienced by people.

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Effect of Cisplatin and 5- Fluorouracil on Acid Phosphatase activity in different tissues of fresh water bivalve, *Parreysia corrugata* (M)

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ABSTRACT

Cisplatin and 5-Fluorouracil are potent and effective anticancer drugs commonly used for chemotherapy against solid tumors. These drugs show effective chemoprevention in chemotherapy and also lead to several manipulations and cytotoxicity in tissues. In present studies, sub-lethal doses of Cisplatin and 5-fluorouracil (LC₅₀/10 for 96 hours) were given to fresh water bivalves, *Parreysia corrugata* for 30 days. The acid phosphatase activities were determined from different tissues of control and experimental bivalves by method of Gutman and Gutman. It was found that acid phosphatase activities were increased in different tissues with increased period of exposure to anticancer drugs in experimental bivalves. It was also observed that acid phosphatase activity increased in different tissues were found to be more in Cisplatin treated bivalves than that of 5- fluorouracil treated bivalves.

Key Words: Anticancer drugs, acid phosphatase, Cytotoxicity, Bivalves.

INTRODUCTION

Biochemical reactions in all living organisms occur rapidly at optimum temperatures and under moderate conditions of PH, pressure etc., this basically happens because of the metabolic action of biological catalysts called as an enzyme. All enzymes are chemically proteins produced specifically to carry out specific catalytic reaction. Every step in a pathway of biochemical reaction is always catalyzed by a specific enzyme. The absence of any one enzyme can arrest the pathway and proves to be fatal physiological defect. The actual catalytic site of an enzyme molecule is a small part where the amino acid component are arranged precisely to bind its substrate and thus forming enzyme substrate complex to convert it into the particular product.

The substance that binds with the enzyme and decreases the rate of enzyme catalyzed reaction is called as an enzyme inhibitor. Enzyme catalyzed reaction depends partly on how will the enzyme and substrate bind together to form enzyme substrate complex. The amount of which gives the rate of activity of the enzyme per unit time. An enzyme alkaline phosphatase proposed to study enzyme activity is very important in recycling phosphate in the living cells. This seems to be prevalent particularly in tissues which are engaged in transport of nutrients. Mollusc bivalves are the aquatic organisms representing submerged benthic fauna of marine and fresh water resources. Bivalve molluscs form important aquatic biota, where anticancer drugs can enter into the body of molluscs and interfere with the normal enzyme action which can lead into many physiological and biochemical changes in the body. All fresh water organisms when exposed to toxicants for even a short duration of time leads to considerable destruction of the internal organs with respect to enzymatic components. Most of the enzymes which are functional in different metabolic pathways have shown altered pattern of enzyme activities due to exposure of anticancer drugs. Certainly, this is the indicator of functional disorders. Enzyme assays and estimation of metabolites have been proposed as a most acceptable biochemical mean for monitoring toxicity of anticancer drugs. A normal regulatory mechanism ever tries to overcome inhibitory action to

maintain the overall fitness of the body of an organism.

The possible mechanism in cisplatin induced nephrotoxicity has been attributed to reactive oxygen species (ROS) [1]. ROS is a currently recognized mechanism in the pathogenesis of the cisplatin induced testicular toxicity in experimental study [2],[3]. Cisplatin causes lipid peroxidation (LPO) and decreases the activity of enzymes that protects against oxidative damage in testicular tissue from cisplatin treated rats [4]. Oxidative damage caused by ROS has been implicated in the pathogenesis of cisplatin induced testicular injuries [5].

Therefore, the fresh water bivalve, *Parreysia corrugata* is selected as an experimental model for the enzyme study. Enzyme bioassay thus could remain useful technique to study sub lethal effects of drugs and toxic compounds.

The first platinum antitumor agents were found as a result of study of effects of electric current on the bacterial growth, where growth inhibition was found to occur but it was due to platinum complex of ammonia and chloride produced in the culture medium at the platinum electrode. Several platinum compounds were found to have antitumor properties against murine tumors and the most effective was cisplatin [6], Jorden *et al.*, [7] reported that anticancer drugs, Cisplatin and 5-fluorouracil inhibit ribosomal RNA in vivo.

5-Fluorouracil (5-FU) is also one of the most important anticancer drugs. In 5-fluorouracil, the hydrogen atom of the 5th position of uracil is replaced by fluorine atom, 5-FU was designed to occupy the active sites of the desired enzyme targets, and thus inhibiting metabolic pathway in cancer cells. Although this antimetabolite is toxic, its positive effect in chemoprevention makes it one of the most popular anticancer drugs used for treatment against solid tumors [8]. All enzymes are chemically proteins in nature and control various sub cellular functions.

Acid phosphatase:

Acid phosphatase is a nonspecific monoesterase, regarded as the biological marker enzyme. It has been

found in lysosome and Golgi cisternae. Acid phosphatase, a lysosomal enzyme, hydrolyses phosphate esters in acidic medium. It also catalyzes the transfer of phosphoryl groups. Ide and Fischman [9] suggested that the lysosomal enzymes get involved in many metabolic transformations *in vivo*.

The changes in acid and alkaline phosphatase activities in various organs of snails which serve as an intermediate host for trematode parasites have been reported by number of workers, Cheng [10] Karyakarte and Yadav [11] Krishna [12]. The increased rate of activities of acid and alkaline phosphatase is quite obvious in animals under morbidity condition. Among crustaceans, the distribution of acid and alkaline phosphatase and rise in their activity in the hemolymph, hepatopancreas [13], cuticle [14] and gastrolith walls [15] have been observed.

Acid and alkaline phosphatase enzymes are responsible for transphosphorylation and play an important role in overall energy metabolism of an organism. Bendse and Karyakarte [16] studied acid phosphatase and alkaline phosphatase activities in hepatopancreas of trematode, *Melania tuberculata* on exposure to toxicant secreted by *Cercaria bengalensis*.

Impact of Anticancer drugs on Tissue Phosphatase Activity:

Influence of anticancer drugs on a series of physiological reactions can enable to establish specific response. High level of toxic chemical compounds brings about the adverse effects on aquatic organisms at molecular or cellular level and leads to imbalance in biochemical components, which become useful in determination of different toxicants and protective mechanisms of the body to combat the toxic effect of the substances. In addition to anticancer drugs, many drugs induce the apoptosis, under such condition the alkaline and acid phosphatase activity increases. Chronic exposure to anticancer drugs, Cisplatin and 5-fluorouracil increased the acid and alkaline phosphatase activities in various tissues of fresh water bivalve, *Corbicula striatella* [17].

Hence these enzymes are used as diagnostic enzymes in clinical analysis work. The damaged RNA and

DNA are also vulnerable to the RNase and DNase attacks respectively.

METHODOLOGY:

The fresh water bivalves, *Parreysia corrugata* (M) were collected from Girna lake area near Jamda, which is 14 km away from Chalisgaon, District Jalgaon of Maharashtra State. Bivalves were collected and brought to laboratory in aerated container. The bivalves were cleaned and kept in glass aquarium. They were maintained in a glass aquarium containing dechlorinated water for 3- 4 days at 21°C- 26°C temperature. The PH of water was in the range of 7.0 - 7.5 and well acclimatized at laboratory conditions. The water in aquarium was changed regularly after every 24 hours. After acclimatization, healthy bivalves with size ranging from 2.8-3.00 cm height X 4.6-5.3 cm length were selected from the aquarium and used for the experiments.

The well acclimatized bivalves, *Parreysia corrugata* were divided into three groups with equal number of animals. They were kept in separate aquarium for 30 days. Bivalves from one of the three groups were not exposed to anticancer drugs and were maintained as a control. Out of remaining two groups, one was treated by chronic concentration (LC₅₀/10 value of 96 hours) of Cisplatin, 1.007 ppm and another group was treated by sub lethal concentration (LC₅₀/10 value of 96 hours) of 5- Fluorouracil, 4.078 ppm.

On 10th, 20th and 30th day of exposure, bivalves from each experimental group were dissected. The tissues such as gonads, digestive glands, mantle and foot were removed and kept in ice cold condition. Then 01% homogenate of each tissue was prepared in ice cold buffer. Then 01% homogenate of each tissue was prepared in ice cold buffer. The homogenate was centrifuged and supernatant removed was used to determine the acid phosphatase activity.

Acid phosphatase activity:

Acid phosphatase activity of different tissues was estimated by the method of Gutman and Gutman [18]. The enzyme activity was carried out in reaction mixture containing 01 ml (0.01M) substrate Disodium

phenyl phosphate, 2 ml citrate buffer with PH 4.9 and 0.5 ml ice cold tissue homogenate. The reaction mixture was incubated at 37°C for one hour. The reaction was terminated by adding 1 ml of Folin Ciocalteu's phenol reagent and reaction mixture was centrifuged at 3000 rpm for 10 minutes. Then 2 ml of 15 % sodium carbonate was added in each test tube of three repeats. The blue color complex developed was read at 660 nm on colorimeter. The blank readings were taken without incubation of reaction mixture. The initial reading of the reaction before incubation was subtracted from the final reading of the enzyme activity after the incubation.

The calibration of standard graph was developed by using phenol as a standard. The activity of acid phosphatase enzyme was expressed as KA units/100 gm. of fresh tissue/ hour at 37°C at PH 4.9. (K.A. unit = King Armstrong unit). Standard deviation and

student 't' test of significance were calculated and expressed in respective tables.

RESULTS

Effect of sub lethal concentration of cisplatin (1.007 ppm) and 5-fluorouracil (4.078 ppm) on acid phosphatase activity was studied in tissues such as gonads, digestive glands, mantle and foot of fresh water bivalve, *Parreysia corrugata*. Acid phosphatase activities determined are given in the Table. The enzyme activities of acid phosphatase were expressed in KA units / 100 gram fresh tissue / hour at 37°C.

Standard deviations of five repeats were calculated and are presented in the table. Student-'t' test and percentage increase or decreases in the enzyme activities are also given in the table.

Table 1 : Acid phosphatase activity in different tissues of *Parreysia corrugata* on exposure to chronic dose of Cisplatin and 5-fluorouracil.

Sr. No.	Tissue	Exposure to	10 Days	20 Days	30 Days
1	Gonads	Control	13.67 ± 0.714	14.05 ± 1.848	13.55 ± 2.192
		Cisplatin (1.007 ppm)	16.41 ± 1.782* (+20.04)	17.90 ± 1.419* (+27.40)	19.64 ± 1.199* (+44.94)
		5-FU (4.078 ppm)	15.91 ± 2.683* (+16.39)	16.78 ± 0.633* (+15.25)	18.27 ± 0.951* (+34.83)
2	Digestive glands	Control	12.18 ± 1.328	12.31 ± 2.551	11.81 ± 1.572
		Cisplatin (1.007 ppm)	13.80 ± 1.044* (+13.30)	16.28 ± 1.822* (+32.25)	18.40 ± 1.327*** (+55.80)
		5-FU (4.078 ppm)	12.43 ± 3.070* (+02.05)	14.67 ± 3.368* (+19.17)	17.77 ± 3.841* (+50.46)
3	Mantle	Control	6.09 ± 0.0979	6.22 ± 0.914	5.97 ± 2.062
		Cisplatin (1.007 ppm)	8.08 ± 0.102** (+32.68)	9.20 ± 1.735* (+47.90)	10.32 ± 0.714* (+72.80)
		5-FU (4.078 ppm)	7.46 ± 1.633* (+22.49)	8.45 ± 2.347* (+35.85)	9.82 ± 0.874* (+64.49)
4	Foot	Control	2.61 ± 2.081	2.73 ± 0.102	2.98 ± 2.258
		Cisplatin (1.007 ppm)	4.10 ± 0.619* (+57.08)	4.35 ± 0.098*** (+59.36)	4.97 ± 4.130* (+66.84)
		5-FU (4.078 ppm)	2.98 ± 1.478* (+14.18)	3.60 ± 0.870* (+31.87)	4.85 ± 0.918* (+62.75)

1. Values are expressed in K.A. units /100 gm of wet tissue/hour at 37 °C.

2. ± indicates S.D. of five observations.

3. (+) indicates % increase over control.

4. Significance of t-test: *p<0.05, **p<0.01, ***p<0.001, NS= Non-significant.

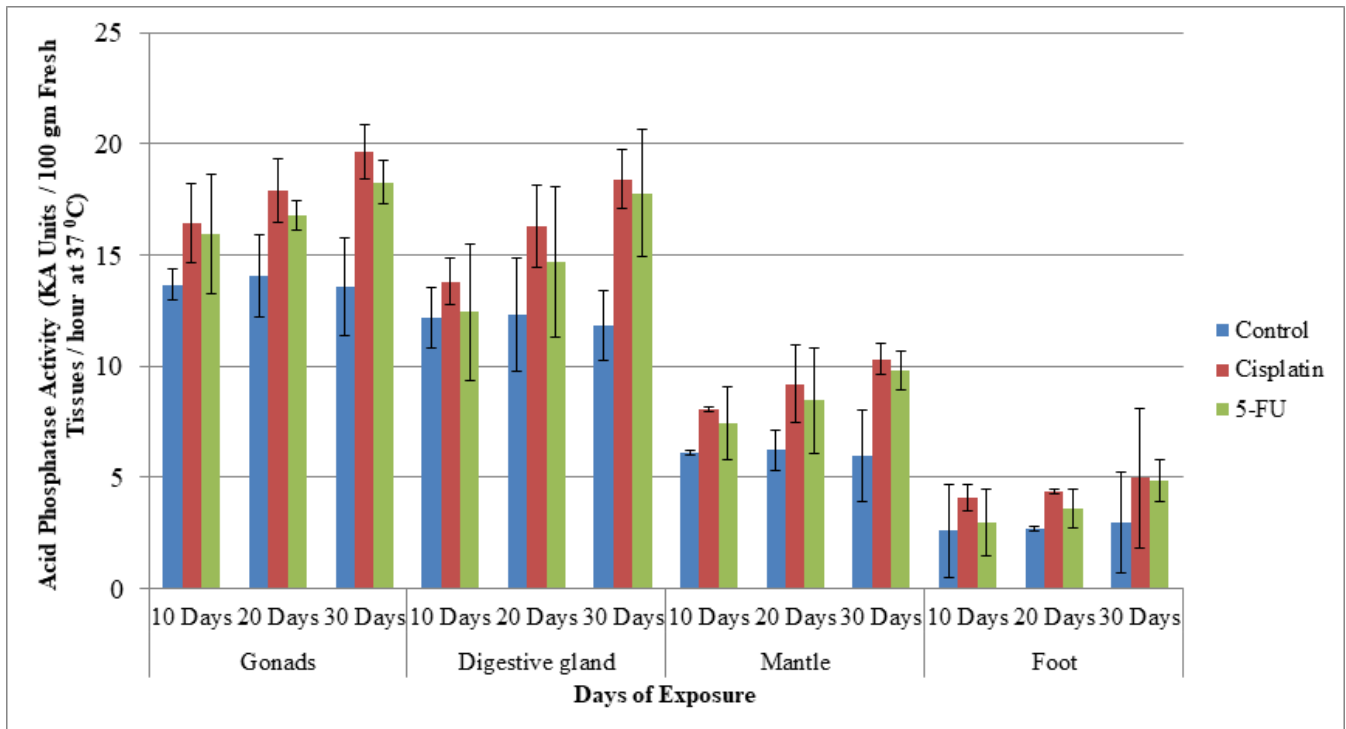


Fig. 1 : Acid phosphatase activity (K.A. units / 100 gm of fresh tissue / hour at 37 °C) in different tissues of *Parreysia corrugata* after chronic exposure to Cisplatin and 5-Fluorouracil.

DISCUSSION:

Acid phosphatase is non-specific monoester. The acid phosphatase and alkaline phosphatase enzymes are responsible for transphosphorylation and playing an important role in the general energy metabolism of an organism. The activities of acid phosphatase on chronic exposure to anticancer drugs, Cisplatin and 5-Fluorouracil was found to be increased in various tissues of *Parreysia corrugata* indicates the effect of the drugs on the cells with high metabolic rate. Increase or decrease in the enzyme activities represents the stress condition on an organism that results into burden on body metabolism.

In the present study, it was observed that after chronic exposure to cisplatin (1.007 ppm) and 5-fluorouracil (4.078 ppm) the enzyme activities of acid phosphatase was found to be increased significantly ($p < 0.05\%$) in mantle, foot, gonads and digestive glands of experimental bivalves, *Parreysia corrugata* as compared to those of control group of bivalves. It was also observed that, the increase in enzyme activities was found to be more in gonads and digestive glands than

mantle and foot tissues of experimental group of bivalves, probably due to high rate of metabolism. As cisplatin and 5-fluorouracil damage the nucleic acid particularly DNA, the cells become morbid and thus to recycle the phosphates, the level of these enzymes increase in the cells. The activities of acid phosphatase and alkaline phosphatase on chronic exposure to anticancer drugs cisplatin and 5-fluorouracil was found to be increased in various tissues of fresh water bivalve, *Corbicula striatella* indicating the effect of the drugs on the cells with high metabolic rate [17].

Norseth [19] reported decrease in acid phosphatase activity due to bioaccumulation of mercury in the lysosomes, and blockage in the availability of enzyme. Generally, the acid phosphatase activity increases due to induced condition and inhibition of enzyme, which would remain in latent state inside the membrane of lysosomes, due to damage of the membrane [20]. Acid phosphatase is regarded as the marker enzyme; it has been found in lysosomes and Golgi cisternae. Acid phosphatase enhances the rate of metabolism and transphosphorylation [21]. Ide and Fishman [9] suggested that the lysosomal enzymes cause

metabolic transformations in animals and leads into change in substrate specificity. Sensitization of cells in tissues may induce proliferation of smooth endoplasmic reticulum in digestive glands and resulted in elevated production and release of acid phosphatase [22] Bhatia *et al.*, [23] declared that degradation and necrosis induced by toxicants in hepatopancreas leads to release of acid phosphatase enzyme. Dutta *et al.*, [24] concluded that the concentration of metals influences the induction and inhibition of phosphatase enzymes.

Increased acid phosphatase and alkaline phosphatase activity indicates the increased apoptosis and nucleic acid digestion in the Cisplatin and 5-Fluorouracil treated bivalves [17].

Increased acid phosphatase activities in various tissues of *Parreysia corrugata* indicate the increased apoptosis and nucleic acid digestion in the Cisplatin and 5-Fluorouracil treated bivalves.

CONCLUSIONS

1. Cisplatin and 5- Fluorouracil are used as anticancer drugs for the control of neoplastic growth. The effects of these anticancer drugs on the enzyme activity were studied on the experimental model animal fresh water bivalve, *Parreysia corrugata*.
2. The effect of chronic concentration (LC₅₀/10 value of 96 hours) of Cisplatin (1.007 ppm) and 5-fluorouracil (4.078 ppm) on acid phosphatase activity in gonads, digestive glands, mantle and foot of *Parreysia corrugata* was studied.
3. Acid phosphatase activity in gonads, digestive glands, mantle and foot of *Parreysia corrugata* were found to be increased significantly on chronic exposure to Cisplatin and 5- fluorouracil.
4. The Cisplatin and 5- fluorouracil on inhibiting the replication and transcription may induce the apoptosis and hence the activity of enzyme acid phosphatase increases in gonads, digestive glands, mantle and foot of *Parreysia corrugata*.
5. Increase in acid phosphatase enzyme activity was found to be more in gonads and digestive glands

than that of mantle and foot of experimental bivalves might correlate to rate of metabolism.

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Effect of roadside air pollution on Phylloplane fungal diversity of *Polyalthia longifolia* Sonn.

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ABSTRACT

Leaves of plants provide a good habitat for microorganisms. The interaction between the microorganisms and the leaf surface is of great importance to both the partners. Present paper is aimed to study the effect of roadside particulate matter on Phylloplane mycoflora of *P. longifolia*. A total of the 07 fungal species were isolated from the leaf surfaces of *P. longifolia*. Phylloplane fungi were significantly reduced away from the roadside as compared to the exact roadside. This indicated that pollution influence the growth of fungi on *Polyalthia* leaves collected from exact roadside.

Keywords: microorganisms, *P. longifolia*, fungal species.

INTRODUCTION

It was Last [1] who for the first time introduced the term phyllosphere for leaf surface mycoflora. Thereafter, a new term phylloplane was suggested for leaf surface environment by Last and Deighton (1965). Thus, phylloplane is the leaf surface itself that harbours a variety of microorganisms both pathogens and saprophytes.

Air pollution influence biological systems in different ways at a global level. At regional or local levels these effects are more significantly detectable, especially in urban and industrial areas or when the pollution is associated with roadways [2]. The microbial ecosystems established on plant surfaces are strongly influenced by pollutants [3, 4].

The phylloplane, the surface of plant leaves is a complex terrestrial habitat that is characterized by a variety of microorganisms including bacteria, filamentous fungi, and yeast [5].

Phylloplane fungi are the mycota growing on the surface of leaves [5]. Phylloplane fungi play a major role in litter decomposition and help in recycling of mineral cycling in ecosystem.

Leaves of plants provide a good habitat for microorganisms. The microbes harbouring on the surface of leaves are known as phylloplane mycoflora. The interaction between the microorganisms and the leaf surface is of great importance to both the partners. The microbes and their spores get nutrition from the chemicals diffusing from the leaf and they also get suitable habitat for survival. Phylloplane microorganisms are also capable of influencing the growth of their host plants in various ways. There is evidence that they are able to fix atmospheric nitrogen and involved in N₂ economy of nature. The effect of dust pollution on crops, grasslands, trees and woodlands, bryophytes and lichen communities has been studied by various workers from time to time. But little work has been done to show the effect of roadside dust particle pollution on the phylloplane microorganisms to compare variation of pollution from roadside to the away from the roadside trees [6].

Fungi are found everywhere such as in water, in soil, in air and in footsteps, in an Antarctica too - in snowy also biodiversity is the variation of life forms in a given ecosystem. Biodiversity is to be studied to avail the knowledge and behavior of living things in a particular environment or in biological systems.

As aerobiology deals in large parts with bio-particles in air, it contributes a lot in enumeration of types of bio-particles present, among all the air borne bio-particles, fungal spores constitute the greatest and most important portion in air (Salvagno and Lars 1981).

Aero-mycology deals with the study of air borne fungi and their spores. Fungi have both positive and negative effects on our lives from the negative point of view they destroy our food leather and other similar

articles they are also responsible for causing a large number of diseases in plants like rusts, smuts, blight etc. Leaf surfaces of roadside trees are exposed to various trace metal and gaseous contaminants discharged from the vehicles. The increasing number of vehicles running on petrol and diesel, fuel produces excessive fumes containing tar particles and other metal contaminants due to the incomplete combustion of fuel. Certain other human activities like road construction, sand milling, stone grinding, etc. also add to the atmospheric dust and trace contaminants which get settled on the leaves of roadside trees.

The relationship between air pollution and microorganisms is an important and incompletely appreciated topic. Air pollution has been reported to bring about change in the lichen cover in a tropical habitat over a period of time.

Aims and Objectives

- Therefore, a study to understand the impact of vehicular air pollution on the phylloplane microorganisms of roadside trees (*P. longifolia* Sonn.).
- Phylloplane fungi have been poorly studied as compared to endophytes, saprobes and pathogen fungi.
- This work is aimed to study the effect of roadside particulate matter on phylloplane mycoflora of *P. longifolia* Sonn.

METHODOLOGY

Selection of Site:

Survey of various sites which are more prone to vehicular and dust pollution was made. Out of these, one site, at Belapur Khurd has been selected. The fresh leaves of *P. longifolia* Sonn. were collected.

P. longifolia is a common roadside tree. It is planted for its lush green, beautiful foliage. Leaves are simple, glaucous with wavy margins arranged in alternate manner forming a dense canopy. *Polyalthia* leaves were collected from the exact roadside, 5 ft, 10 ft, 15 ft, 20 ft away from the roadside respectively. Collected leaves were put in sealed polythene bags, stored at 0°C in a refrigerator.

Media Preparation :

For the identification of fungi (CDA) Czapek's Dox Agar medium was used.

Composition of Media:-

Chemical	Amount gm/l
Sodium nitrate	2.0
Potassium chloride	0.5
Magnesium glycerophosphate	0.5
Ferrous sulphate	0.01
Potassium sulphate	0.35
Sucrose	30.0
Agar	12.0
pH	6.8 ± 0.2 at 25°C

Procedure:

Suspend 45.4 gm. in 1 lit of distilled water. Bring to the boil to dissolve completely sterilize by autoclaving at 121°C for 15 minutes. Mix well before pouring.

Description:

CDA is a medium containing sodium nitrate as the sole source of nitrogen, it is one of the most solid media for the general culture of fungi. The medium was made up to 1 lit by addition of distilled water. The pH of the medium was adjusted to 5.6 finally the medium was cotton plugged and autoclaved at 121°C for 15 min.

Isolation and Identification of fungi:

For the isolation of fungi from the leaf surface, leaf impression method was followed. Fungi were identified referring the standard manuals.

Leaf Impression Method:

In this method leaves are gently pressed on the surface of nutrient agar medium in Petri plates. After incubations microorganisms grows which are isolated and identified.

RESULTS AND DISCUSSION

Data depicted in table indicates that the *Alternaria* spps. is common among all the fungi found on both the leaf surfaces (i.e.- upper and lower). *Aspergillus niger* is common on upper epidemis in all the plants. Investigation showed that air pollution influence phyllosphere microflora. Leaves collected from the exact roadside have observed luxuriant growth of fungi on both the surfaces i.e. upper and lower while leaves collected from 5 ft. away from roadside have observed less growth on lower surface in comparing to the upper surface. In case of leaves collected from the 10ft away, lower surface contained slightly more growth of fungi than the upper surface.

Table : Growth of fungi in petriplates with respect to the leaf surfaces.

Sr.No.	Name of fungi	Exact road side		5ft		10ft		15ft		20ft	
		L.S	U.S	L.S	U.S	L.S	U.S	L.S	U.S	L.S	U.S
1.	<i>Aspergillus niger.</i>	+	+	+	+	-	+	-	+	-	+
2.	<i>Alternaria</i> spps.	+	+	-	+	+	+	+	+	+	+
3.	<i>Colletotrichum</i> spps.	-	-	-	-	+	+	-	+	-	-
4.	<i>Fusarium</i> spps.	+	+	+	+	-	-	-	-	-	-
5.	<i>Mucor</i> spps.	+	+	+	+	-	-	-	-	-	-
6.	<i>Penicillium</i> spps.	-	-	+	+	+	-	+	+	-	-
7.	<i>Rhizopus</i> spps.	-	+	+	+	-	-	-	-	-	-

[(+) = present , (-)= absent]



Fig: Microscopic images of fungi observed under compound microscope (45X)

In comparison to the 10 ft. observation, 15 ft. observation of upper surface shows slightly higher colony of microorganisms while lower surface contain very negligible amount of growth while the leaves collected 20 ft. away from the roadside shows sudden increase in microbial growth. As per result observed from exact roadside to 20 ft. away from the roadside, the continuous decrease in phylloplane fungal diversity and the rate of growth and occurrence of phylloplane fungi on both leaf surfaces also decreased. Due to higher pollution abundant amount of increase in fungal diversity on leaves of *P. longifolia* which is occurred on exact roadside. Phylloplane mycoflora colonies occurred on the roadside *Polyalthia* plant shows the abundant amount of increase in fungal colonies. Colonies observed in this are majorily *A niger* and *Alternaria* spp., *Fusarium* spp.

CONCLUSION

From above study we have concluded that, effect of air pollution on Phylloplane fungal diversity. It is observed that, fungal diversity decreases on leaves of *P. longifolia* Sonn. collected from away from roadside.

Conflicts of interest: The authors stated that no conflicts of interest.

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Study of solvent-solvent interaction in tertiary mixture at different temperatures by ultrasonic technique

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ABSTRACT

The basic parameters like viscosity (η), density (ρ) and velocity (U) can be measured by ultrasonic Interferometer. From these three parameters various thermodynamical and acoustical parameters such as specific acoustic impedance (Z), Intermolecular free length (L_f), adiabatic compressibility 's (β) etc. can be estimated using standard relations from measured values of Ultrasonic viscosities, densities and velocities in the wide range of concentrations at 35^o C, 40^oC and 45^oC temperatures for Acetone + Propanol-2 + chloroform tertiary system. The solvent-solvent interactions are studied on the basis of increase or decrease in ultrasonic velocity, density, viscosity and other derived acoustical parameters in terms of structure making and structure breaking tendencies of various solvent molecules.

Keywords viscosity (η), density(ρ) and velocity (U), thermodynamical and acoustical parameters.

INTRODUCTION

The study of molecular interactions in the liquid mixtures is of considerable importance in the elucidation of the structural properties of the molecules. Lagemann and Dunbar [1] were the first to point out the sound velocity approach for qualitative determination of the degree of association in liquids. Recent developments have made it possible to use ultrasonic energy in medicine, engineering, agriculture and other industrial applications. [5,6].

Ozawa and Minamisawa [7] have observed concentration of ultrasonic velocity invariant with respect to temperature in alcohol-water mixtures. Hanel [8] has measured sound velocity and thickness of thin samples by time -resolved acoustic microscopy. Bae and Yun [9] have studied the ultrasonic velocity in binary solutions of silicon dioxide and water. Knowledge of thermodynamic and acoustical properties is of great importance in studying the physio-chemical behavior and molecular interactions in a variety of liquid mixtures [1,3]. The compositional dependence of thermodynamic properties has proved to be a very useful tool in understanding the nature and extent of pattern of molecular aggregation resulting from intermolecular interaction between components.

METHODOLOGY

Ultrasonic velocity for the mixture was measured using the ultrasonic interferometer (Model M 81) supplied by Mittal Enterprises, New Delhi, that has a reproducibility of ± 0.4 m/s at 25⁰ C with a fixed frequency of 3 MHz. The temperature was maintained constant by [Type equation here](#) circulating water from a thermodynamically controlled water bath (accuracy ± 0.1 ° C). The temperature of the cell as measured using a thermocouple was found to accurate to ± 0.25 ° C. The density of the mixtures has been measured using a sensitive pycnometer with an accuracy of 0.5 kg/m³. Chemicals used in this study are ultrapure, supplied by Sigma-Aldrich Ltd and used without purification. Tertiary system is studied at different temperatures, 35⁰ C, 40⁰C and 45⁰C with different concentrations of the system. Especially for these system ultrasonic velocities, densities and viscosities of the mixtures have been measured at different temperatures.

THEORY

Other acoustical parameters such as adiabatic compressibility ((β), Intermolecular free length (L_f), Molar Sound velocity(R), Specific acoustic impedance (Z) etc can also be determined.

$$\text{Intermolecular free length } (L_f) = K\beta^{1/2} \quad (1)$$

$$\text{Adiabatic compressibility } (\beta) = \frac{1}{U^2 \rho} \quad (2)$$

Where k values for different temperatures were taken from the work of Jacobson [29]; at 35,40 and 45° C the K values are 637, 642 ,647 respectively.

$$\text{Molar sound velocity } (R) = U^{1/3} V \quad (3)$$

$$\text{Molar compressibility } (B) = \left(\frac{M}{\rho}\right) \beta^{-1/7} \quad (4)$$

where V and M are the molar volume and molecular weight of the mixtures, respectively.

$$\text{Specific acoustic impedance } (Z) = \rho U \quad (5)$$

The excess adiabatic compressibility (β^E) and excess intermolecular free length (L_f^E) are evaluated by the following expressions:

$$B^E = \beta_{\text{exp}} - \beta_{\text{ideal}} \quad (6)$$

$$(L_f^E) = L_{f,\text{exp}} - L_{f,\text{ideal}} \quad (7)$$

For β_{ideal} and $L_{f,\text{ideal}}$, the densities and the ultrasonic velocities of various components in pure state at the three given temperatures have been measured. Further, the velocities of both the systems at different concentrations and temperatures have been evaluated theoretically using volume additive rule [21] as :

$$U_{\text{ideal}} = U_1\phi_1 + U_2\phi_2 + U_3\phi_3 \quad (8)$$

Where U_1, U_2 , and U_3 are the velocities of the three components of the ternary liquid mixture in pure state and ϕ_1, ϕ_2 and ϕ_3 are their volume fractions .

Similarly ideal density is evaluated using :

$$P_{\text{ideal}} = \rho_1 \phi_1 + \rho_2 \phi_2 + \rho_3 \phi_3 \quad (9)$$

Finally β_{ideal} and $L_{f,\text{ideal}}$ are evaluated using following equations :

$$\beta_{\text{ideal}} = \frac{1}{U_{\text{ideal}}^2 \cdot \rho_{\text{ideal}}} \quad (10)$$

and

$$L_{f,\text{ideal}} = \beta^{1/2}_{\text{ideal}} \quad (11)$$

RESULTS

Ultrasonic velocity, density and viscosity for the acetone-propanol-2 and chloroform have been listed in table 2. The appropriate conversion of CGS units to SI units have been provided in Table 1.

Table 1: Conversion of CGS units to SI units.

No	Parameter	CGS units	SI units
1	Ultrasonic velocity (U)	1 cms ⁻¹	10 ⁻² ms ⁻¹
2	Density (ρ)	1 g cm ⁻³	10 ³ Kg m ⁻³
3	Adiabatic compressibility (β)	1dyn ⁻¹ cm ²	10 N ⁻¹ m ²
4	Intermolecular free length(L _i)	1A ^o	10 ⁻¹⁰ m
5	Molar sound velocity (R)	1 cm ³ mol ⁻¹ (cm s ⁻¹) ^{1/3}	10 ^{-20/3} m ³ mol ⁻¹ (ms ⁻¹) ^{1/3}
6	Molar compressibility (B)	1 cm ³ mol ⁻¹ (dyn ⁻¹ cm ²) ^{-1/7}	10 ^{-43/7} m ³ mol ⁻¹ (N ⁻¹ m ²) ^{-1/7}
7	Wave number (λ)	1 cm ⁻¹	10 m ⁻¹

Table 2:

Temp	Mole fraction			Ultrasonic	Density(ρ)	Viscosity (η)
				Velocity(U)		
	X ₁	X ₂	X ₃	m/sec	gm/cm ³	Centipoise
35 ° C	0.02792	0.03271	0.6251	875	1.4841	0.4920
	0.2790	0.03891	0.6248	878	1.4790	0.4917
	0.02787	0.03893	0.6241	879	1.4732	0.4913
	0.02783	0.03897	0.6238	882	1.4714	0.4911
	0.02771	0.03901	0.6238	883	1.4652	0.4909
	0.02767	0.03904	0.6235	895	1.4648	0.4899
	0.02760	0.03910	0.6234	892	1.4635	0.4892
	0.02756	0.03915	0.6231	890	1.4623	0.4889
	0.02751	0.03918	0.6229	886	1.4600	0.4885
	0.02699	0.03922	0.6222	884	1.4591	0.4880
40° C	0.02792	0.03271	0.6251	881	1.321	0.4820
	0.02790	0.03891	0.6248	883	1.319	0.4817
	0.02787	0.03893	0.6241	885	1.316	0.4815
	0.02783	0.03897	0.6238	892	1.316	0.4810
	0.02771	0.03901	0.6238	895	1.314	0.4804
	0.02767	0.03904	0.6235	898	1.310	0.4804
	0.02760	0.03910	0.6234	887	1.308	0.802
	0.02751	0.03918	0.6229	882	1.305	0.4795
	0.02751	0.03918	0.6229	879	1.301	0.4794
	45° C	0.02699	0.03922	0.6222	864	1.299
0.02792		0.03271	0.6251	862	1.317	0.4654
0.02790		0.03891	0.6248	866	1.315	0.4651
0.02787		0.03893	0.6241	867	1.311	0.4648
0.02783		0.03897	0.6238	870	1.309	0.4641
0.02771		0.03901	0.6238	877	1.307	0.4638
0.02767		0.03904	0.6235	890	1.707	0.4621
0.02760		0.03910	0.6234	888	1.307	0.4617
0.02751		0.03918	0.6229	865	1.301	0.4610
0.02751		0.03918	0.6229	863	1.298	0.4602
0.02699	0.03922	0.6222	840	1.295	0.4599	

DISCUSSION

It is seen from that at 35^o C ultrasonic velocity (U) increases with increasing concentration attains a maximum value at 0.03904 mole fractions. The non-linear variation of ultrasonic velocity with concentration indicates occurrence of complex formation between unlike molecules. The molecular association becomes maximum at those concentrations where velocity maxima occurs. This may be interpreted due to the formation of strong hydrogen bonding resulting into complex formation producing displacement of electrons and nuclei. The chemical interaction may involve the association due to hydrogen bonding, due to dipole -dipole interaction or due to the formation of charge transfer complexes. All these processes may lead to strong interaction of forces. (fort and Moore, 1965). With increase of concentration of solution, the density and viscosity of the mixture decreases.

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Nutritional and environmental aspect of cowpea (*Vigna unguiculata* (L.) Walp.)

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ABSTRACT

Cowpea (*Vigna unguiculata* [L.] Walp.) belongs to family Fabaceae It is one of the most important pulse crops in India. There are about twenty two varieties of Cowpea have been recommended for different states and union territory. It is valued immensely as food and fodder for it's role in biological nitrogen fixation. Induced mutagenesis may brings about changes in the overall morphology of plants and also increase in biochemical nature like carbohydrates, proteins, fats, vitamins and minerals. Cowpea is an important grain legume throughout the tropics and subtropics. It is cultivated as intercrop with maize, sorghum, millet.

Keywords: Cowpea, Legumes, Nitrogen fixation.

INTRODUCTION

Pulses are one of the important segments of Indian agriculture after cereals and oil seeds. These pulses constitute chickpea, pigeon pea, lentil, mungbean, urdbean, field pea, grass pea, cowpea, common bean and horse gram. The split grains of these pulses are known as *dal* are excellent source of high quality protein, amino acids, fatty acids, fibers, minerals and vitamins. Pulses are less preferred by farmers because of high risk and less remunerative than cereals. The pulses are belongs the family Leguminoceae or Fabaceae. This member of family includes the economically important legume that is pulses, oil seed crops, forage and fodder crops, shrubs and tropical or subtropical trees.

Pulses received about 80% of its nitrogen requirement from symbiotic nitrogen fixation from air thus these crops improve soil fertility by enriching nitrogen status, long term fertility and sustainability of the cropping systems [1].

The Cowpea Cowpea [*Vigna unguiculata* (L.) Walp] (2n=22) belonging to family Fabaceae. Cowpea is one of the oldest sources of human food. It is known by number of common names *crowdel pea*, *black eyed pea*, *southern pea* and internationally as *lobia*. The habit of Cowpea is erect, semi erect, prostrate or climbing type. Cowpea is tap rooted annual legume. Trifoliate leaves are developing alternately which are smooth, dull to shiny and pubescent. Flowers are born in multiple racemes are purple colored contribute to the attraction of insects. Cowpea is self-pollinating type.

ORIGIN AND HISTORY OF COWPEA

The Cowpea has been recognized as of African origin [2], that distribution of wild forms covers much of the tropical Africa, where as the greater part of the variability within the wild species confined to South Africa .

Cowpea is an important versatile food legume. It is cultivated in tropic and subtropics region of Asia, Africa, Central and southern America. Part of southern Europe and USA Sangwan (2004). Cowpea growing countries in the Asian region are India, Shrilanka, Bangladesh, Myanmar, China, Korea, Thailand, Indonesia, Nepal, Pakistan, Philippines and Malaysia. Food and agriculture organization (FAO) estimated that nearly 4 million metric tons of dry Cowpea grains produced about 10 million. In India Cowpea is cultivated all over the country. However western, central and peninsular regions are the prominent areas of Cowpea cultivation. In northern India the states like Rajasthan, Gujarat, U.P, Haryana, Punjab, and part of Himachal Pradesh are main Cowpea growing zones.

NUTRITIONAL ASPECTS IN COWPEA

Cowpea is considered as poor man's food. It is nutritionally cultivated in India for food, fodder, green manure and cover crop. Cowpea is low in fat, and high in fibre content. They contain about 54.5% carbohydrates, 24.1% protein, vitamin C, calcium,

iron, phosphorus and ascorbic acid providing good nutritional quality.

Table No. 1.: Nutritional composition of Cowpea seeds

Constituents (per 100g edible portion)	Content
Energy (kcl)	323
Protein (g)	24.1
Fat (g)	1.0
Carbohydrate (g)	10.8
Thiamine (mg)	0.51
Riboflavin (mg)	0.20
Niacin (mg)	1.3
Calcium (mg)	77.0
Phosphorus (mg)	414.0
Iron (mg)	8.6

Source: Tewari Pratibha et al. Cowpea in India (2004).

Cowpea seed is nutritious component in the human diet, and cheap livestock feed. Cowpea grown to maturity can be used as feed, fodder or its pods can be harvested and eaten as a vegetable. Tender green leaves are used as vegetable. It may be used as green or dry fodder. The incorporation of Cowpea organic manure into the soil leads to improvement in soil structure, water infiltration rate and water holding capacity of soil. Organic matter provided by this legume is quickly decomposed by soil micro-organisms and does not persist It is also used as green manure, a nitrogen fixing crop or for erosion control. As Cowpea hay and fodder are used in southeastern united states and in other parts of world hence known as Cowpea. Cowpea is important component of farming system because of ability to restore soil fertility .

METHODOLOGY

Selection of experimental seed material:

The experimental seed material of cowpea (*Vigna unguiculata* [L.] Walp). Variety - **Phule Pandhari (PCP-9708)** was collected from pulse and oil seed research Station, Pandharpur, District - Solapur.

Mutagens used:

Physical mutagen - Gamma Rays

The experimental seeds were packed and irradiated with 20 kR, 30 kR, 40 kR and 50 kR obtained from source Co⁶⁰.

Chemical mutagen - Ethyl Methane Sulphonate (EMS)

Dry and healthy seeds were treated with EMS at the concentration of 0.050%, 0.075%, 0.10%, and 0.125%. Combination of both Gamma Rays and EMS as 20 kR + 0.050%, 30 kR + 0.075%, 40 kR + 0.10% and 50 kR + 0.125% are also used.

Seeds of each treatment along with control were sown in research field by complete Randomize Block Design (RBD) with three replications and result was recorded



Plate 1: Experimental Material

i) Leaf protein content

The leaf protein seed protein content in the present studies has revealed an enhancement in majority of the M₄ generation. The viable mutants have developed combination treatments.

The estimated sample of leaf protein content in the control was 4.52%. The leaf protein content in mutants showed increasing in values as compared to control. The average of leaf protein content of ten different mutants was found from 3.40% to 9.00%. The highest leaf protein content 9.00% was observed in luxuriant mutant and the lowest leaf protein content 3.40% was observed in early flowering mutant. The dwarf mutant shows 7.40% of leaf protein content next to the luxuriant mutant.

ii) Seed protein content:

The seed protein content in majority of the mutants showed increasing values as compared to control. The seed protein content in the control 5.19% was observed. The highest seed protein content 8.42 % in tall mutant and 8.41% in divergently branched mutant lowest seed protein content 4.71% was observed in branched mutant. The average of seed protein content of ten different mutants was found from 4.71% to 8.42 %.

iii) Total Carbohydrates content

Total carbohydrates content in viable mutants of Cowpea ranges from 1.79% to 5.58%. In control plant 2.33% total carbohydrate was found. The highest 5.58% total carbohydrates was observed in dwarf mutant and lowest 1.79% total carbohydrates content was found in branched mutant. Total carbohydrates content in morphological viable mutants of Cowpea ranges from 1.79% to 5.58 %.

Table 2: Protein and Carbohydrates content .

Morphological Mutants	Seed protein content %	Leaf protein content %	Carbohydrates content %
Control	22.19	4.52	2.33
Robust Mutant	25.44	7.40	2.44
Branched Mutant	24.71	4.36	1.79
Dark Green Mutant	25.10	6.56	2.09
Early flowering Mutant	24.67	3.40	2.08
Late flowering Mutant	26.45	4.44	2.13
Tall Mutant	25.11	5.44	4.02
Dwarf Mutant	22.83	4.92	5.58
Bold seeded Mutant	23.86	5.20	3.42
Luxuriant Mutant	27.46	9.00	3.03
Divergently Branched Mutant	23.01	4.12	2.53

Table 3: Chlorophyll content.

Morphological mutants	Chlorophyll 'a' mg/gm	Chlorophyll 'b' mg/gm	Total Chlorophyll mg/gm
Control	0.6052	1.0960	1.2960
Robust mutant	0.9668	1.7524	2.1921
Branched mutant	0.7029	1.2722	1.4636
Dark green mutant	1.0767	1.9539	2.6018
Early flowering mutant	0.6458	1.1690	1.3433
Late flowering mutant	0.6568	1.1887	1.3571
Tall mutant	0.8795	1.5949	2.0519
Dwarf mutant	0.6235	1.1298	1.3866
Bold and large seeded mutant	0.6720	1.2176	1.4858
Luxuriant mutants mutant	1.0772	1.9523	1.9876
Divergently branched mutant	0.5370	0.9725	1.1628

Total chlorophyll content in leaves of the morphological mutants of Cowpea. It was ranged from 1.1628 mg/gm to 2.6018 mg/gm. The total chlorophyll content in leaves particular in Chl 'a' and Chl 'b' shows the fluctuations

The sample of control plant shows 1.2960 mg/gm of total chlorophyll. The highest 2.6018/gm. amount of total chlorophyll content was observed in dark green leaves mutant the lowest 1.1628mg/gm. amount of total chlorophyll content was found in divergently branched mutant. Total chlorophyll content in morphological mutant of Cowpea was ranged from 1.1628 mg/gm to 2.6018 mg/gm. In chlorophyll 'a' and chlorophyll 'b' was observed in the fluctuations. The fluctuation in chlorophyll pigments shows direct effect on physiology of plants.

Conflicts of interest: The authors stated that no conflicts of interest.

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Comparative study of Noise pollution level in Yeola and Manmad towns belonging in Nashik District during Normal days

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ABSTRACT

Sound that is unwanted or disrupts one's quality of life is called as noise. When there is lot of noise in the environment, it is termed as noise pollution. It disturbs the normal activities such as working, sleeping, and during conversations. Community noise, or environmental noise, is one of the most common pollutants. Community noise includes the primary sources of road, rail and air traffic, industries, construction and public works and the neighborhood' (WHO, 1999). Environmental noise is increasingly becoming a community concern internationally. Considerable efforts have been made over about the last four decades to reduce noise impacts from transportation sources such as road and rail traffic. Most of the towns in the Nashik district of Maharashtra are congested and densely populated. Towns having the combinations of old and new structure. Because of heavy traffic, urbanization, migrants of peoples from village to town for their civil work with vehicles and residential has been increased noise level. We were mentioned noise level by sound level meter at different locations of Yeola and Manmad town. Noise level is notably high at different location as compared to prescribed standard of pollution control Board at both towns, but the present study investigate that noise level in Yeola town is comparatively lower than the noise level in Manmad town. Also Railway junction in Manmad campus this is achieved because well noise more than as in Yeola. Planned development of Yeola town, roads are widened, good plantation cover, modern design of hospitals, Govt. Official building with proper spacing and acoustic design consideration. We conclude that public awareness and public environmental education is essential to safeguard natural environment and to control pollution. Peoples showed be aware about importance of human health and environment protection Act.1986.

Keywords: Noise pollution, Noise data, sound level meter, peoples awareness Environment projection Act.1986.

INTRODUCTION

Vibration in air pressure produce sound. Sound may be pleasant as well as unpleasant, vibrating sound reaches our ears and we hear the sound. The unwanted sound (Loud sound) irritates ear and human health and it is known as noise. We can not hear all sound. Human ear can hear sound between frequency range 20 Hz to 20 KHz. Below 20 Hz is called infrasonic and above 20 KHz is called Ultrasonic, Loudness, and pitch and quality three characteristics of sound. Loudness is measured in decibel (dB)

The speech zone lie in the range of 500 to 2000 Hz. The human ear is most sensitive in the range of 2,000 to 5,000 Hz. Noise has been recognized as ambient air pollutant. Standards in this regard are laid down under Environment (protection) Rules, 1986 and under the model rules of the factories Act. 2948.

Noise pollution is one of the major problems faced by the people of Yeola & Manmad town in Nashik district. A rapid growth of population, uncontrolled urbanization, rural urban migration, industrialization, rail and road transportation, traffic jamming, civil work and machinery, human activities in festivals & cultural programme and unnecessary use of loudspeakers, loud musical systems, harsh sounds of vehicle horns, barking of dogs are the major source & contributors in noise pollution.

Noise is derived from the Latin word "NIVSEA" means unwanted sound. It is undesired. Unpleasant, unexpected, irritant and source of stress. Sound is measured in decibel (dB). It is a logarithmic scale invented by engineers of the bell telephone network in 1923 and named in the honor of the inventor of Telephone Alexander Graham Bell (1847-1922) Audio Engineering Society recommends that a space be used dB A. In India it is often written as dB (A)

LEGAL PROVISION

According to Report of WHO to the UN Conference on environment, out of all environmental problems noise is easiest to control. It is controlled by law & awareness of people. Constitution of India provides in Article 48A the provision of environment protection

improve the environment and to safeguard the forest and wildlife of the country. Article 51(A) (G) which says that every citizen shall have the duty to protect and improve the natural environment including forest, lakes, rivers and the wildlife. In India number of legislation have been enacted for the protection and preservation of environment. The important legislation Act were framed as Environment Protection Act.1986. under which noise pollution, regulation and control rules 2000 have been framed. Now noise has been recognize as a pollutant and the production and use of high sound intensity firecrackers have been banned. The Central pollution control board (CPCB) committee has recommended permissible noise level for different locations as given be Table.

Area Code	Category of Area/Zone	Limitations in Day time (dB)	Limitations in Night time (dB)
A	Industrial Area	75	70
B	Commercial Area	65	55
C	Residential Area	55	45
D	Silence Zone	50	40

When sound level reaches 140 dB our ears are hurt and long exposure to noise results in permanent damage to ears and even at 85 dB (A) can cause hearing loss begins. The noise level 120 dB (A) is known as threshold of pain, a level 140 dB (A) is very harmful and causes permanent hearing deafness and 150 dB (A) could kill the person. The international reference pressure level of 2×10^{-5} Pa is the average threshold of hearing. A survey by Central Pollution control Board (CPCB) shown in Delhi, the noise level in most places exceeds the permissible limits, similarly a survey and study of Maharashtra Pollution Central Board (MPCB) shown that people in residential commercial, industrial and silence zone of Mumbai too suffers from high levels of noise pollution. Pinkle and Koppen (1948) showed that there is a sharp decline in auditory acuity rise in fasting blood sugar and increases fatigue. According to Kryster (1970) noise causes heart out put to decrease with greater fluctuation in an arterial blood pressure, Johnson and

Hansin (1977) in one of their studies found that systolic and diastolic blood pressures were significantly higher in industrial workers because of continuous exposure to noise. Shetyle et al (1982) had estimated that noise level in crowded places in Mumbai was almost double that of residential standards. Datta (2005) was found that sound level lies within a range of 65-83 dB or above in different places of Burdawan town. West Bengal. Bhatia (1995) showed that noise level 100 dB (A) was increased blood pressure and pulse rate. According to De (2000) 65 dB noise level at distance of one meter affect human heart while 125 dB gives sensation of pain in the ear. Banerjee (2007) estimated increase in noise level in Asansol during Kali Puja Festival.

Noises harm the body and mind both. Effects of noise pollution are auditory and non-auditory; Number of researchers & investigators discussed the impact of noise pollution on human health and behavior. World Health Organization (WHO) suggested that the people should aware and everyone should know the impact of noise pollution on human health.

Effects of Noise Pollution :

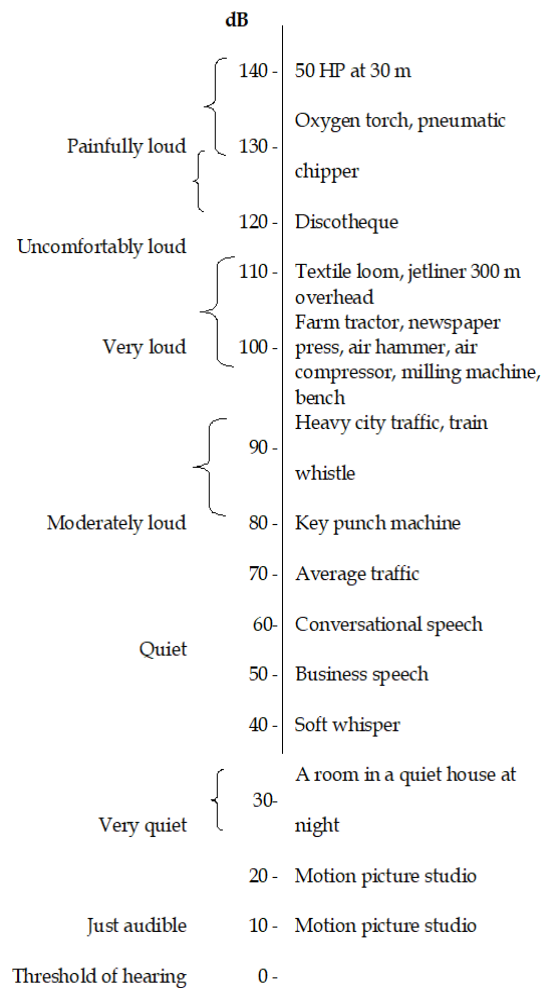
Noise affects health both by physiologically and psychologically Hearing loss, damage of ear, hearing deafness increasing systolic & diastolic blood pressure reduction in birth weight of baby, premature birth skin resistance alteration headache, neurological disorder, respiratory modification loss of memory hyper tension cardiovascular constriction are the physiological effects and annoyance anxiety fatigue, tension, tear, lack of concentration change in behavior interference in communication task inference in performance reduction in work efficiency loss of sleep, cause of irritation, frustration, depression and birds, increases in heart beat rate causing respiratory difficulties in animals and birds, general stress, reaction changes the behaviors of bird, abandonment of territory, loss of ability to produce.

INTRODUCTION OF TOWN :

Both Yeola and Manmad have history of Pilgrims. Both cities are popular and Historic background. Both town are populated with near about 80 and 55 thousand population. Holistic place Shirdi is near to Yeola. Yeola is located on Aurangabad and Nagar-

Dhule Highway. Both town are not at side of big rivers. Yeola town is known as textile, silk manufacturer. So indoor noise in handlooms and impact on workers is more than Manmad town. Yeola is also introducing as a birth origin of Senapati Taty Tope and Raghuvir Baba. Manmad is (famous) & popular for Railway Junction and Gurudwara.

NOISE POLLUTION



METHODOLOGY

Noise levels were monitored at different locations of Yeola & Manmad. it was monitored both on normal working days. This study was conducted in the month of December 2009. Noise sampling being done between 18.00-22.00 Hrs. at night time. The noise levels were observed with sound level meter YF-20 having low range 40-80 (A) and high range 80-120 dB

(A) in 2-5 minute intervals at each location average noise levels were recorded. All readings were taken at height of 1.5 meters from ground level and more than 3 meters away from roads. The sound level meter

consists of capacitance microphone calibration with signal generator amplifier, weighing network and display, indicator meter. The data noted is tabulated in table.

Table 1: Sound level information of main areas in yeola (peak hours)

Sr. No.	Location in Yeola	Noise Level in dB (A)			
		Morning	Afternoon	Evening	Night
1	S.M. College Zone	60	65	55	45
2	Rural Hospital	55	52	50	42
3	Yeola-A.bad Road	65	70	72	65
4	Nagar-Manmad Road	62	72	70	68
5	Yeola Nasik Road	58	67	65	59
6	Bus Stand Inside	70	80	72	70
7	Agricultural Market	68	74	69	62
8	Main Road in city	80	75	80	75
9	Vitthal Nagar Zone	50	50	49	42
10	Ganga Darwaza Corner	60	59	63	60
11	Railway Station Inside	58	58	58	47
12	Mini Sachivalaya	50	55	54	45
13	Krida Sankul	45	47	48	40
14	Eknath Khemchand Petrol Pump Chowfuli	65	70	75	55
15	Fattepur Gate	68	72	74	58

Table 2: Sound level information of main areas in manmad (peak hours)

Sr. No.	Location in Manmad	Noise Level in dB (A)			
		Morning	Afternoon	Evening	Night
1	ASC College	60	65	65	50
2	Railway Station Inside	85	90	89	82
3	Shivaji Chowk	72	78	70	65
4	Bus Stand Inside	85	92	72	68
5	FCI colony Area	62	68	60	55
6	SwamiVivekanand Nagar	50	55	52	45
7	Chatre High School Zone	65	75	72	68
8	Chandwad road	80	85	78	70
9	Rural Hospital	75	80	80	65
10	Yeola Road	75	70	65	55
11	Gurudwara	55	60	50	48

The comparative results of noise survey for normal days in Yeola & Manmad Cities shown that noise pollution level in Manmad is significantly higher than Yeola. In Commercial zone in salience zone and residential zone in both cities noise levels are near by equal reduction of noise level in Yeola because of road winding, good plantation cover and over all developments there is need of same development in Manmad town. In Manmad city railway junction is in town and frequency of railway traffic is more. That's why noise level is high in that particular area. In both towns in commercial area and other specific zones noise level is notably high as compared to standard data prescribed by Central Pollution Control Board. To control noise level the easiest control measure is public awareness and public environmental education. It is duty of every citizen that obey rules and regulation and safeguard protect the natural environmental and step should be taken to reduce noise and overall pollution.

CONCLUSION

This paper explores the sources, effects, assessment of noise level and offers suggestions for controlling the excessive noise. There is urgent need to implement good noise control policy and to increase people's awareness by public education and an active participation of schools & colleges in public places. The need of increase funds for environmental policy and educational programmes. The future development plan should be considered with adequate plantation, walkways and underground roads at road crossings, use of insulation and sound absorbing materials in construction is essential. There should be compulsion in use of earplugs and earmuff for industrial workers, handloom, power loom, textile workers.

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Comparative study of non linear optical (NLO) properties of Glycine and L-Alanine doped Zinc tris Thiourea Sulfate single crystal

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ABSTRACT

Zinc (tris) thiourea sulfate (ZTS) is promising semi organic nonlinear material in the field of photonics and optoelectronics. In present investigation amino acid Glycine and L-Alanine were added in molar percent in under saturated ZTS solution to enhance second harmonic generation (SHG) efficiency. Effect of Glycine and L-Alanine on SHG efficiency has been studied by Kurtz and Perry powder test. Glycine and L-Alanine doped zinc (tris) thiourea sulfate single crystals were grown from aqueous solution by slow evaporation technique. The grown crystals were subjected for various characterizations. FTIR studies have been carried out to identify the functional groups present in the crystal. The effect of Glycine and L-Alanine on transmittance of grown crystals was studied by UV-visible study. The grown crystals were subjected to single crystal X-ray diffraction.

Keywords: FTIR, UV visible Study, X-ray diffraction.

INTRODUCTION

In last several years, there has been considerable interest in growth and characterization of nonlinear optical materials [1-4]. NLO material plays a major role in applications such as telecommunications, optical data storage and optical information processing [3-5]. Second order nonlinear optical materials are used in optical switching, frequency conversion and electro-optical applications especially in Electro Optical modulators [6]. In addition to large second order susceptibilities, good

transmission in UV and visible region and stable physico thermal performance is needed for these applications [7]. Inorganic NLO materials have large mechanical strength, thermal stability and good transmittance, but modest optical nonlinearity due to the lack of extended π -electron dislocation [8]. Purely organic NLO material have large nonlinearity compared to inorganic material but low optical transparency, poor mechanical and thermal strength and low laser damage threshold [9]. Thus, the research is focused on semi organic NLO material crystal in order to obtain superior NLO crystal by combining the advantages of organic and inorganic materials.

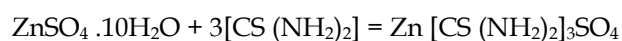
Zinc (tris) Thiourea Sulfate (ZTS) is a promising semi-organic NLO material for second harmonic generation from metal complexes of thiourea. ZTS is 1.2 times more nonlinear than KDP [10-11]. ZTS possesses orthorhombic structure with space group $Pca2_1$ [12]. Most of the amino acids individually exhibit the NLO property. The tetrahedral array of four different groups about α -carbon confers optical activity on amino acid [13].

The effects of several dopants on structural and physical properties of metal complexes of thiourea and KDP have been reported [11, 14, 15]. Semi organic nonlinear optical (NLO) crystals formed by amino acids with inorganic materials possess the advantages of high optical nonlinearity of the organic amino acids.

METHODOLOGY

Synthesis

ZTS salt was synthesized by dissolving AR grade zinc sulfate and thiourea in deionized water according to following reaction,



The synthesized salt was purified by repeated recrystallization. Saturated solution of ZTS was prepared at room temperature and 1, 2 and 3mole% of Glycine and L-Alanine was added in separate beakers. The synthesized salt was purified by repeated crystallization and tested for SHG by Kurtz and Perry powder test. We observed enhancement of SHG

efficiency in ZTS when it is doped with Glycine and L-Alanine. Hence Glycine and L-Alanine doped ZTS crystal were grown by low temperature solution growth method.

RESULTS AND DISCUSSION

1 SHG Measurement

The study of NLO conversion efficiency of grown crystal has been carried out in accordance with the classical powder method developed by Kurtz and Perry [16]. It is an important and popular tool to evaluate the conversion efficiency of NLO materials. A Q-switched Nd: YAG laser beam of wavelength 1064 nm, with an input power of 4.5 mJ, and a pulse width of 8 ns with a repetition rate of 10 Hz were used. The crystals of pure ZTS and 1, 2 and 3mole% Glycine and L-Alanine doped ZTS was powdered with a uniform particle size and then packed in a micro capillary of uniform bore and exposed to laser radiations. The output from the sample was monochromated to collect the intensity of 532nm component, and to eliminate the fundamental wavelength. Second harmonic radiation generated by the randomly oriented micro crystals was focused by a lens and detected by a photo multiplier tube. The generation of second harmonic was confirmed by the emission of green light. A sample of ZTS was used as a reference material for the present measurement. The SHG conversion efficiency of Glycine and L-Alanine doped ZTS were found to be enhanced than that of pure ZTS. The optical signal generated from sample is converted into electrical signal and was measured on oscilloscope. The measured output for pure ZTS is 35 mV. The measured output 1, 2, 3mole% Glycine doped ZTS were **145mV**, 85mV and 93mV respectively for and 1, 2, 3mole% L-Alanine doped ZTS were **61mV**, 55mV and 57mV respectively. This indicates that SHG conversion efficiency of Glycine and L-Alanine doped ZTS is greater than pure ZTS.

2 X-ray Diffraction Analysis

Single crystal X-ray diffraction analysis of grown crystal was carried by Brukers axs (Kappa Apex) diffractometer to determine lattice cell parameter. The collected data of lattice cell parameters for Glycine doped ZTS are $a = 11.168 \text{ \AA}$, $b = 7.798 \text{ \AA}$, $c = 15.516 \text{ \AA}$ and cell volume = 1351.3 \AA^3 and $\alpha = \beta = \gamma = 90^\circ$.

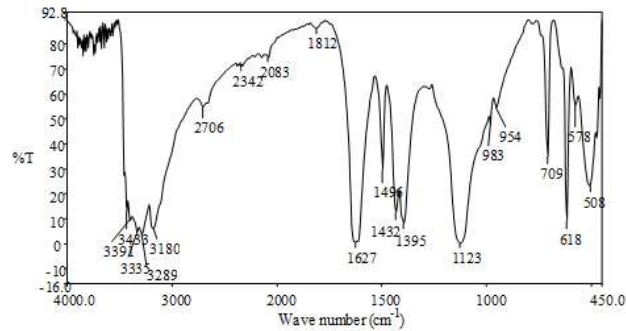


Fig.1. FT-IR spectra for pure ZTS

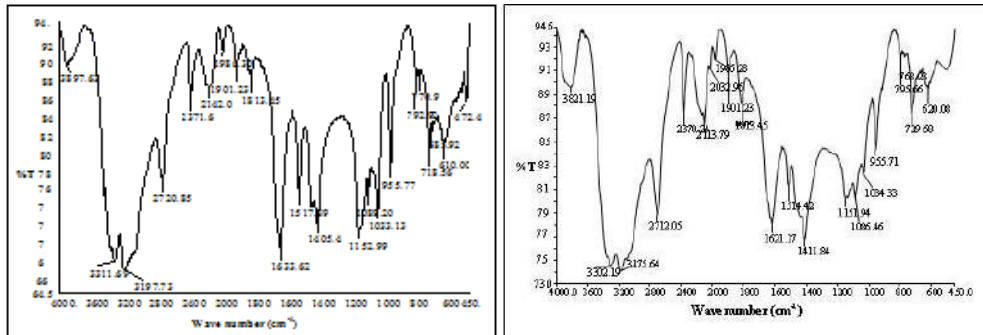


Fig. 2. FT-IR spectra for 1mole% Glycine doped ZTS

Fig.3. FT-IR spectra for 1mole% L-Alanine doped ZTS

Table 1: Comparison of IR bands of 1mole% Glycine doped ZTS with thiourea and ZTS.

Thiourea	ZTS	1mole%Glycine doped ZTS	Assignment
411	--	--	$\delta_s(\text{N-C-N})$
469	508	472	$\delta_s(\text{C-S-N})$
740	709	718	$\nu_s(\text{C=S})$
1089	1123	1089	$\nu_s(\text{C-N})$
1417	1432	1405	$\nu_{as}(\text{C=S})$
--	1496	1517	$\nu(\text{N-C-N})$
1627	1627	1633	$\delta(\text{NH}_2)$
3167	3180	3197	$\nu_s(\text{NH}_2)$
3280	3289	--	$\nu_s(\text{NH}_2)$
--	--	3311	$\nu_{as}(\text{NH}_2)$
3376	3391	--	$\nu_{as}(\text{NH}_2)$

δ - bending, ν - stretching, s - symmetric, as - asymmetric.

Table 2: Comparison of IR bands of 1mole% L-Alanine doped ZTS with thiourea and ZTS.

Thiourea	ZTS	1mole%L-Ala. doped ZTS	Assignment
740	709	729	$\nu_s(\text{C=S})$
1089	1123	1086	$\nu_s(\text{C-N})$
1417	1395	1411	$\nu_{as}(\text{C=S})$
--	1432	--	$\nu_{as}(\text{C=S})$
--	1496	1514	$\nu(\text{N-C-N})$
1627	1627	1621	$\delta(\text{NH}_2)$
3167	3180	3175	$\nu_s(\text{NH}_2)$
3280	3289	--	$\nu_s(\text{NH}_2)$
3376	--	3302	$\nu_{as}(\text{NH}_2)$
--	3391	--	$\nu_{as}(\text{NH}_2)$

δ - bending, ν - stretching, s - symmetric, as - asymmetric.

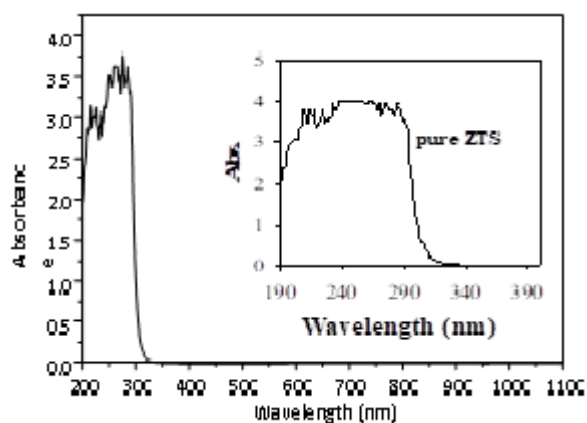


Fig. 4.

Fig. 4. UV-visible absorption spectra of 1mol%Glycine doped ZTS

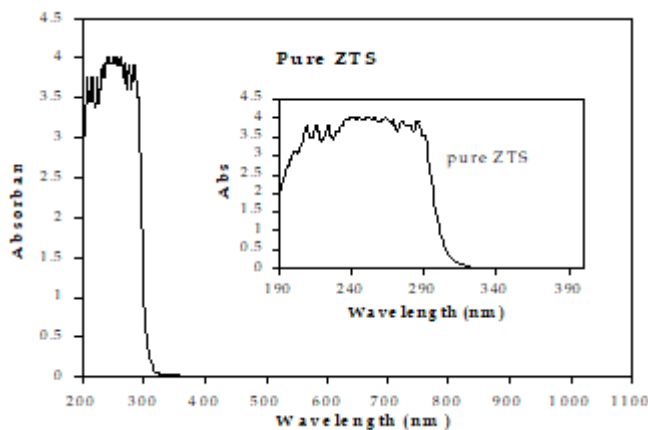


Fig. 5

Fig. 5. UV-visible absorption spectra for 1mole% L-Alanine doped ZTS

The observed unit cell parameters for L-Alanine doped ZTS are $a = 11.159 \text{ \AA}$, $b = 7.792 \text{ \AA}$, $c = 15.527 \text{ \AA}$, cell volume = 1350.2 \AA^3 and $\alpha = \beta = \gamma = 90^\circ$. Both crystals belong to orthorhombic system with space group $Pca2_1$. From single crystal X-ray analysis it is confirmed that dopant does not changes the basic structure of crystals [15, 17]. There is slight increase in unit cell volume. This increase in volume may be due to the change in pH of the solution due to addition of amino acid [17].

4 Fourier Transform Infrared Spectroscopy (FTIR) Analysis

The FTIR analysis was carried out by Perkin Elmer Spectrum FTIR spectrometer by KBr pallet technique in the range $450\text{-}4000\text{cm}^{-1}$. The FT-IR spectra of pure ZTS and 1mole% Glycine and L-Alanine doped ZTS is shown in Fig. 1 Fig. 2 and Fig. 3 respectively. In ZTS complex, there are two possibilities by which the coordination with metal can occur.

It may be either through nitrogen or through sulfur. From spectra, the N-H absorption bands in the high frequency region in thiourea were not shifted to lower frequencies on formation of metal thiourea complex, thus coordination of thiourea occurs through sulfur in ZTS [11, 12]. The comparison shows slight shift in characteristic vibrational frequencies of 1mole% Glycine and L-Alanine doped ZTS with respect to pure ZTS [17]. This confirms the addition of Glycine and L-Alanine in grown crystal.

5. UV-Visible Spectral Study

The UV-visible studies of grown crystal was carried out by Shimadzu UV 1600 UV-vis. spectrometer in a range 200 nm to 1100 nm. The absorption spectra of 1mole% Glycine and L-Alanine doped ZTS is shown in Fig. 4 and Fig. 5 respectively. The window shown in Fig shows UV spectra of pure ZTS for comparison. The absorption spectra reveal that the crystal has lower cutoff wavelength at around 290 nm. The absorption near UV region is associated with electron transition within thiourea units of ZTS. Doping of both 1mole% Glycine and L-Alanine in ZTS does not destroy the transparency of the crystal. From spectra it has also been observed that the lower cutoff wavelength is almost the same for Glycine and L-Alanine added ZTS and pure ZTS crystals [18]. The wide range of transparency in UV, visible and IR region enables good transmission of the second harmonic frequencies of Nd: YAG laser. This is an added advantage in the field of optoelectronic applications.

CONCLUSION

The 1mole% Glycine and L- Alanine doped ZTS crystal has been grown from aqueous solution by low temperature solution growth, slow evaporation technique. The Kurtz and Perry powder SHG test shows that the SHG efficiency of 1mole% Glycine doped ZTS is 4.14 times more than pure ZTS. 1mole% L-Alanine doped ZTS has SHG efficiency 1.74 times that of pure ZTS. Thus the enhancement in SHG is more for 1mole

% Glycine doped ZTS than 1mole%L-Alanine doped ZTS. Following the FTIR data one can see that the intrinsic defects in studied crystal. These defects play substantial in observed second order susceptibility and it may be main strategy to improve their nonlinear optical properties [19]. The FT-IR spectrum confirms the presence of all the functional group and presence of Glycine in the grown crystal. The powder and single crystal X-ray analysis confirms the orthorhombic structure of the grown crystal. UV-visible study reveals the Glycine and L-Alanine doped ZTS crystals has lower cutoff wavelength at around 290 nm. The enhancement in SHG efficiency of Glycine and L-Alanine doped ZTS is due to the optically active amino group which may get added in the structure and increases its non-Centro symmetry and hence increasing its SHG efficiency. Thus, the grown crystal is a potential candidate for optoelectronic and laser applications.

Conflicts of interest: The authors stated that no conflicts of interest.

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Carbamate and Organochlorine pesticide tolerance of Cyanobacteria *Nostoc muscorum* and their effect on nitrogen fixation

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ABSTRACT

In the present study, nitrogen fixation efficiency of Cyanobacteria (blue-green alga) *Nostoc muscorum* was tested at increasing concentration of commercial grade pesticides Sevin (carbaryl, 50%) and Endotaf (endosulfan, 35%). Estimation of total nitrogen (%) fixed by the tested alga at each concentration (ppm) of pesticides was carried out by using conventional Micro- kjeldahl method. The pragmatic results revealed that, in the presence of 20 ppm of Sevin and even 5 ppm dose level of Endotaf pesticides, total nitrogen content was consistently decreased with the further increase concentrations of pesticides. At the higher dose level i.e. 250 ppm of Sevin and 100 ppm of endotaf, *Nostoc muscorum* showed 86.9% and 95.0% decrease in total nitrogen content over the untreated control respectively. On the other hand, at 500 ppm concentration of Sevin and 250 ppm of Endotaf pesticide, growth and nitrogen fixation was ceased in the tested blue-green alga. In general, it was seen that higher levels of pesticides application i.e. more than 20 ppm of Sevin and even 10 ppm of Endotaf adversely affected the occurrence and survivability of *Nostoc muscorum* in the laboratory cultures which is responsible for nitrogen fixation. It was concluded that indiscriminate use of studied pesticides had deleterious effect on nitrogen fixation of cyanobacteria *Nostoc muscorum* while the recommended doses of field application, the studied pesticides had no adverse effect under various crop fields.

Keywords: *Nostoc muscorum*, Sevin and Endotaf pesticides, Nitrogen fixation, Micro- kjeldahl method.

INTRODUCTION

Cyanobacteria are unique prokaryotic organisms with the ability to perform mutually compatible functions like biological nitrogen fixation and photosynthesis. The cyanobacteria contain nitrogenase and fix atmospheric nitrogen for which these attained remarkable practical importance since last 2- 3 decades as biofertilizer [1]. They have tremendous potential in environmental management as soil conditioner, biofertilizer, biomonitors of soil fertility, water quality, feed for animals and protein supplements [2].

In Maharashtra state, the agro- ecological conditions are favourable for the growth of blue-green algae and has great scope for its adoption to marginal farmers. *Nostoc*, *Hapalosiphon*, *Aulosira*, *Anabaena* and *Calothrix* were dominant nitrogen fixing cyanobacteria encountered in various agro-practices areas of Kopergaon tahsil, Maharashtra state. Such forms hold promise for crops such as maize, rice, mungbean, tomato and sugarcane [3] and wheat [4] by fixing nitrogen. However, the agronomic potential of blue-green algae is currently little exploited. An indepth agroecological research is an essential requisite for the sustainable improvement of blue-green algal technology [5].

One of the problem that has been noticed under field conditions is the destruction of blue-green algal populations by pesticide application intended to control the insects and pests of the various agricultural crops [6,7]. Variety of pesticides like organochlorines, organophosphates, carbamates and synthetic pyrethroids are now in use. These agrochemicals also damage wide variety of beneficial microorganisms because of their long persistence in the environment [8]. Therefore, pesticides used in routine applications in crop fields have important environmental effects in addition to those usually intended.

Such investigations are useful in awakening the farmers to adopt better farm management practices that in turn will reduce the chemical fertilizer input and problem of environmental degradation due to excessive use of pesticides. By considering all these issues along with societal responsibilities the present study was done on tolerance of commonly used pesticides carbamate, Sevin and organochlorine,

Endotaf pesticides and their effect on nitrogen fixation of cyanobacteria *Nostoc muscorum* isolated from agro-practices areas of Kopergaon tahsil, Maharashtra state.

METHODOLOGY

In the present work, effect of commonly used pesticides Sevin (carbaryl, 50%) and Endotaf (endosulfan, 35%) belonging to carbamate and organochlorine group, was studied on the tolerance and nitrogen fixation of soil blue-green alga *Nostoc muscorum*. These pesticides are generally used to control sucking, lepidopterous and nematode pests and mites that occurred in maize, wheat, sugarcane, cotton, onion, vegetable and oil yielding crops of the study area. The pesticide application rates recommended to control various crop pests of this region are 0.75 kg/ha for carbaryl Sevin and 0.7 liter/ha for endosulfan (Endotaf) and domethoate (Rogor) which will provide a range of 5- 10 ppm in the agricultural crop field.

During the experiment, two commercial grade pesticides as carbamate, Sevin (Union Carbide Ltd.) and organochlorine, Endotaf (Rallis India Ltd.) were used. Stock solutions of these pesticides were prepared freshly for experiments in the sterilized media and added to the 50 ml of nitrogen free BG-11 culture media to obtain the desired concentrations (2.5, 5, 10, 20, 50, 100, 250 and 500 ppm) of each pesticide. The pH of all the media was adjusted to 7.5. Total nitrogen fixed by the cyanobacteria *Nostoc muscorum* at each concentration of two pesticides was estimated by conventional Micro- kjeldahl method [9] after 28 days of harvesting in the laboratory cultures. Experiments were conducted in triplicate sets by inoculating equal amounts of actively growing tested unialgal isolate into cotton stoppered conical flasks.

RESULTS AND DISCUSSION

The practical results as depicted in Table- 1 regarding nitrogen fixation potential of Cyanobacteria, *Nostoc muscorum* at 2.5, 5, 10, 20, 50, 100, 250 and 500 ppm concentrations of each studied pesticides in laboratory cultures were proved statistically significant. The

tested blue-green alga *Nostoc muscorum* showed increased total nitrogen content upto 10 ppm concentration of Sevin over the control. While in the presence of 20 ppm dose level of Sevin pesticide, total nitrogen content was consistently decreased with the further increase concentrations of pesticides. At the higher dose level i.e. 250 ppm of Sevin, *N. muscorum* showed 86.9% decrease in total nitrogen content over the untreated control. On the other hand, at 500 ppm concentration of Sevin pesticide, growth and nitrogen fixation was ceased in the tested blue-green alga *Nostoc muscorum* (Fig. 1).

Concurrently, with Endotaf at 5 ppm concentration, progressive decline in nitrogen fixation occurred upto 100 ppm concentration where decrease in total nitrogen content was observed by 95.0% than the control in *Nostoc muscorum*. Further increase in dose

level (i.e. above 100 ppm) of Endotaf pesticide, resulted into ending of growth and nitrogen fixation of *Nostoc muscorum* (Fig. 1).

The results obtained during the present investigation revealed that in laboratory cultures, the carbamate pesticide Sevin was less toxic than organochlorine, Endotaf to the tested cyanobacteria *Nostoc muscorum*. Further, a progressive decline in the nitrogen fixation of tested blue-green alga occurs with increasing concentrations of each pesticides. Among the different pesticides treatments, Endotaf was found to be highly toxic to *Nostoc muscorum* than the Sevin pesticide treatments. The reduction in total nitrogen content of the pesticide-adapted cyanobacteria *Nostoc muscorum* strain may occurred due to the inhibition of some stage(s) during the process of nitrogen fixation in the presence of higher concentrations of pesticides.

Table 1: Total nitrogen (%) fixed by *Nostoc muscorum* at different concentrations of Sevin (carbaryl, 50%) and Endotaf (endosulfan, 35%) pesticides. (Harvested after 28 days of incubation).

Conc. of pesticides (ppm)	0.00 (Control)	2.5	5	10	20	50	100	250	500
Sevin	4.89	4.96 (+1.4)	5.14 (+5.1)	4.96 (+1.4)	3.41 (-30.2)	2.00 (-59.1)	1.17 (-76.0)	0.64 (-86.9)	--
Endotaf	4.89	5.10 (+4.2)	4.27 (-12.6)	3.10 (-36.6)	2.00 (-59.1)	1.05 (-78.5)	0.24 (-95.0)	--	--

Values represents total nitrogen (%) mean of three replicates; figures in parenthesis () show percent increase (+) or decrease (-) relative to the total nitrogen in the control.

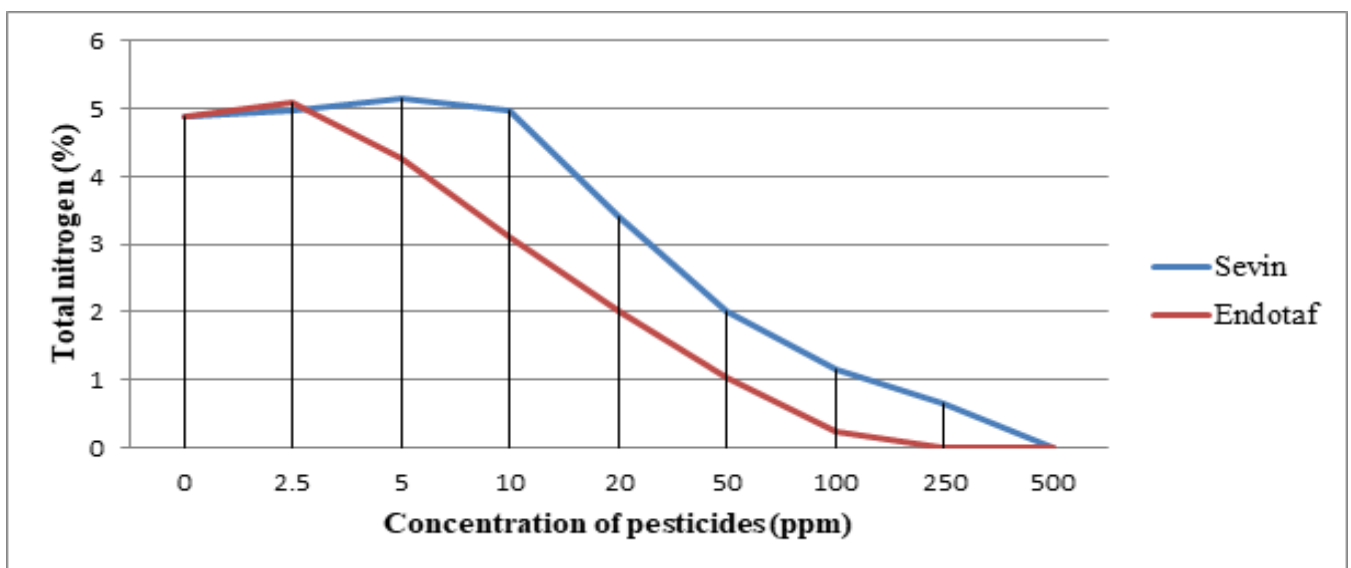


Fig. 1: Tolerance of Sevin (carbaryl, 50%) and Endotaf (endosulfan, 35%) pesticides on total nitrogen (%) fixed by *Nostoc muscorum*.

Further stimulatory effect of Furadan, Sevin at lower concentrations on nitrogen fixation by blue-green algae under culture conditions may be due to the presence of nutrients in media that minimizes the toxicity of carbofuran [10,11]. These views are coincides with the reports of earlier workers; Furadan [10]; Sevin [12]; organo- chlorine [13]; Monocrotophos and Butachlor [14] and Rogor [15].

CONCLUSION

In general, it was seen that higher levels of pesticides application i.e. more than 20 ppm of Sevin and even 10 ppm of Endotaf adversely affected the occurrence and survivability of *Nostoc muscorum* in the laboratory culture which is responsible for nitrogen fixation. It was concluded that at the recommended doses of field application, the studied pesticides had no deleterious effect on nitrogen fixation of tested cyanobacteria *Nostoc muscorum*. Caution should be taken to determine the appropriate application dosage of these agrochemicals before applying them into the crop fields. Further it was also suggested that field studies on the blue-green algal population in pesticide burdened soils is required to be supplemented the data generated in the laboratory for proper analysis.

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Energy Harvesting for Micro-Electro-Mechanical Systems (MEMS)

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ABSTRACT

“Energy harvesting” is a technology that converts the excess energy available in an environment into usable energy for low power electronics. Many ambient energy sources have been considered for this purpose such as incident light, vibration, electromagnetism, radio frequency (RF), human body functions, temperature gradient etc. However, each of these energy sources has its own drawbacks. For example, although the solar cells offer excellent power supply in direct sun light, they are inadequate in dim office lighting. On the other hand, the circuit design for transmitting the power harvested from low level vibrations is another challenging problem.

Keywords: radio frequency (RF), human body functions, temperature gradient.

INTRODUCTION

Energy harvesting, also known as “Energy Scavenging”, “Parasitic Energy”, or “Micro Generators” in the literature, is a process performed by a conversion mechanism for generating electric power from available ambient energy sources. Incident light, thermal gradients, machine vibrations and human body functions are the well known examples of ambient energy sources receiving the attention of many researchers. Since energy harvesting systems offer maintenance-free, long-lasting, green power supply for many portable, low-powered electronic devices, they are likely to become an essential part of power management systems. In this paper the growing interest in the field of energy harvesting systems is also due to great developments in related

technologies such as micro-electromechanical-system (MEMS) technology, wireless sensor network (WSN) technology. In figure (1), components of a vibration energy harvesting system are depicted. This flow chart can be generalized for all energy harvesting systems in which an energy source, a conversion device, a conditioning circuit and an electric load are the main components of the general energy harvesting system.

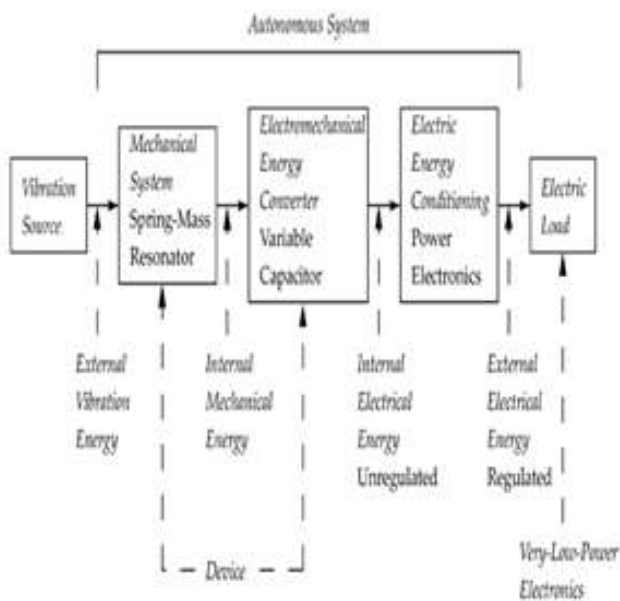


Figure 1: Vibration Energy Harvesting System Components

In this paper the general system basically aims to accomplish five consecutive tasks:

- Collecting the maximum energy from the energy source
- Converting the ambient energy into electric energy efficiently
- Rectifying and storing the maximum amount of electric energy
- Regulating the output voltage level depending on the application
- Transmitting the electric energy to the load when it is required.

Availability of the ambient sources, the power densities of the converters, the duty cycles and the power needs of the electric loads, however, are the primary limitations of the energy harvesting systems. For example, solar cells can generate excellent power densities in direct sun light; but they need to be

optimized for conditions of dim light or no light at all. Thermoelectric energy converters need large energy gradients to generate substantial power. Power delivery and user comfort are critical while generating power by means of body functions such as breathing, blood pressure, walking etc.

LITERATURE REVIEW

Energy harvesting from a vibration source for low power electronic devices and sensors is an appealing idea, since there are various kinds of vibration sources around ranging from the wind and sea waves to human body motion and vibrating machinery in the industry. Vibration sources are usually preferable to incident light or thermal gradient energy sources requiring an appropriate operating time and running condition. In this paper therefore many research programs focusing specifically on "vibration to electric energy converters" have been conducted for various medical, industrial and military applications for more than a decade. Despite the large variety of prototypes designed for this purpose so far, the technology behind these conversion mechanisms is mainly based on three well-known effects in physics, namely the electrostatic, electromagnetic and piezoelectric effects. In brief, electrostatic, electromagnetic and piezoelectric designs require a variable capacitor, a magnet and piezoelectric material respectively inducing a voltage on plates, in a coil and between the electrodes as they oscillate. However, the design of an energy converter, especially in microscale, becomes a little more sophisticated and therefore attractive for the researchers, when the system emerges as a vibration energy dissipation problem needing to be examined for various aspects to achieve a maximum power density and efficiency. While some of the reported generators have already been fabricated using MEMS techniques, others have been made on a mesoscale with the intention of later miniaturizing the devices using MEMS [2].

Williams et al. (1995) [1] introduced a generic model for estimating the power that can be generated in a microscale device. In this model, any electric component in which the energy conversion takes place is considered as an energy dissipation element

(other than the inherent mechanical dissipation element) of the mechanical system. The vibration source here is assumed to be infinitely large with respect to the system so that it is not affected by the motion of the conversion system.

Mitcheson et al. (2004) [2], classified the vibration-driven micro-generators reported in the literature so far based on three fundamental architectures, namely the velocity-damped resonant generators (VDRG), coulomb-damped resonant generators (CDRG), and coulomb-force parametric generator, for establishing a unified analytical framework for such devices and providing a methodology for designing optimized generators for particular applications. First of all, they adapted the deflection limit of the proof mass, a key constrained in a MEMS application, to the general formulation.

Roundy et al. [2] analyze the design parameters of electrostatic and piezoelectric converters, and then fabricate and test their prototypes shown in figure (2).

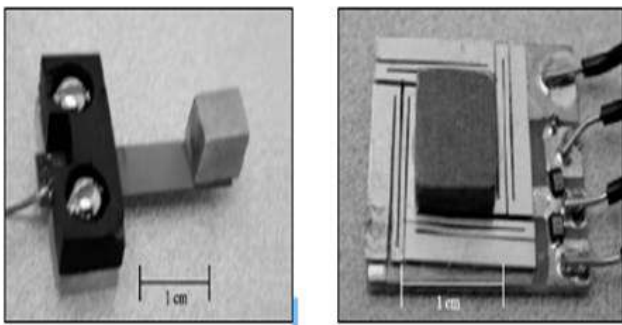


Figure (2) Piezoelectric (on the left) and Capacitive (on the right) Converter Prototypes

The mathematical model introduced by Williams et al. is modified for each mechanism by substituting the system specific design parameters. The estimated powers of the optimized converters are given in table (3) where a vibration source with a fundamental frequency of 100Hz and an acceleration magnitude of 2.25m/s^2 is employed. On the experimental side, the piezoelectric prototype without an optimum design is reported to generate an average power of $60\ \mu\text{W}$, however no comparable output power is stated for the electrostatic converter prototype.

PIEZOELECTRIC ENERGY HARVESTER MODEL

A unimorph consists of a single layer of piezoelectric material on the substrate. A proof mass is attached to the free end of the cantilever beam.

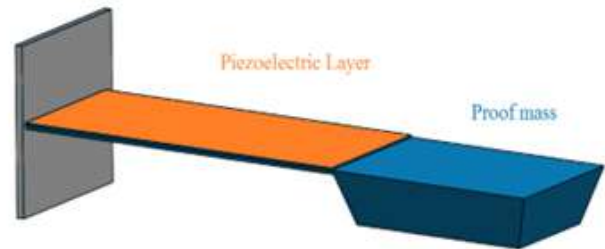


Fig 3. Perspective view of a typical piezoelectric energy harvesting cantilever

In this paper in the piezoelectric energy harvesters, the strain energy of vibrations is converted by the piezoelectric material into electrical energy. The harvester is in the form of a piezoelectric cantilever beam with an end-mass as shown in Fig. 3. The piezoelectric layer on the substrate gets stretched and compressed longitudinally during vibrations. The alternating strain in the layer results in alternating charge separation across the thickness of the piezoelectric material. It is assumed that electrodes cover the piezoelectric material completely. Hence, the two parallel electrodes act as equipotential surfaces along the beam length. In order to determine the amount of energy generated by the harvester, a load resistance is connected to the two equipotential surfaces of the harvester. Modelling of such harvesters can be carried out using either Newtonian or Lagrangian approach. Following these approaches, several researchers have proposed piezoelectric energy harvester models[5][6]. An extension of the model to multilayer and multistep harvesters following Lagrangian approach[7]. The equations of motion governing the harvester dynamics.

POWER DEVELOPED BY A HARVESTER

In this paper the power developed by a piezoelectric harvester depends on excitation, equivalent mass, frequency and power factor. As these are in convoluted form, the dependence is delineated based on size, material, composition and inertia.

The power developed by a harvester is determined by noting the amplitude of the alternating voltage across the load resistance R_l . If the voltage drop across R_l is V_0 , the power developed is given by

$$P = \frac{V_0^2}{2R_l} \quad (1)$$

where V_0 is given by the complex quantity.

CONCLUSION

In this paper the conversion mechanism is described by a linear model consisting of a damped spring mass system coupled with an oscillating platform. The proof mass creates a relative motion with respect to the vibrating platform, while the spring stores and discharges potential energy in the vibrating system. Since energy conversion can be considered as a way of dissipating energy, the electrical component where energy conversion phenomenon takes place can be modeled as a damper other than the inherent damping element of the vibrating system. Design of piezoelectric energy harvesters for higher power generation involves selecting the right geometry and piezoelectric material for a given size of the harvester. We have discussed a method to analyze the power generated by a unimorph that can also be extended to bimorphs or multilayer harvesters. The proposed method introduces the fewest possible variables that govern the power developed by a harvester. The power expression obtained from the previous analysis contains the fundamental design parameters including proof mass, electrically induced and total viscous damping factors, amplitude of the source acceleration and the excitation frequency. With the appropriate selection of these parameters maximum energy transformation efficiency should be achieved.

Conflicts of interest: The authors stated that no conflicts of interest.

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Study of Ultra capacitor Electrodes Based On Metal / Metal-Oxide Core/Shell Nano-Heterostructures

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ABSTRACT

This study deals with the fabrication technique used for novel nano-heterostructures (NHs) and to study their electrochemical properties as Ultra capacitor electrodes. The Ni/NiO core/shell and Co-Ni/Co₃O₄-NiO core/shell nano-heterostructures Ultra capacitor electrodes offer the desired properties of macroporosity to allow facile flow of electrolyte, thereby reducing device resistance and nanoporosity with large surface area to allow the kinetics of faster reaction. Here the three different electrode configuration, Ni/NiO core/shell and Co-Ni/Co₃O₄-NiO core/shell nano-heterostructures Ultra capacitor electrodes is studied which exhibits specific capacitances, at a constant current density, high energy, power density, good capacitance retention and long cyclicity. The remarkable electrochemical property of the large surface area nano-heterostructures is described based on the effective nano-architectural design of the electrode with the coexistence of the highly redox active materials at the surface supported by highly conducting metal channel at the core for faster charge transport.

Keywords: Nanostructures, Electrodeposition, core-shell, Renewable Energy, Ultra capacitors.

INTRODUCTION

Diminishing reserves of fossil fuels and severe impacts of burning fossil fuels both on human beings and environment have been increasingly driving the world towards the development of clean and sustainable energy. Transforming natural energy, such as wind, tide, and solar energies can generate large amount of clean and sustainable energy. The development of energy storage devices is extremely important to store the harvested energy for wide applications. Nowadays, ultra capacitors are exhibiting wide applications in electric vehicles, pacemakers, consumer electronic devices and so on. Recently, redox-active transition-metal oxides (TMOs) such as RuO_2 , MnO_2 , Fe_2O_3 , NiO and Co_3O_4 are being described as the emerging electrode materials for Ultra capacitors (UCs) because of their high specific capacitances and excellent reversibility [1,2]. In this context, selections of specific materials as well as the proper nano-engineering design of the electrode are very effective. As the high cost of RuO_2 limits its practical applications, among the other TMOs, Co_3O_4 and NiO could have been an ideal alternative for the UCs electrode because of their high theoretical capacitances, availability, stability and relatively low cost. It is also well studied that the nano-architectures with large active surface area, short ion transport pathway and better electronic conductivity could improve the performance of UCs[4,5]. The unique nano-architecture of the hybrid metal oxides can be used as anticipation with higher specific capacitance as well as high energy and power density of the Co_3O_4 and NiO based UCs. The Ni/NiO and $\text{Co-Ni/Co}_3\text{O}_4\text{-NiO}$ core/shell NHs have redox active oxides with large active surface to serve as the electrode. The thin mixed-oxide layer will provide the short ion transport path, whereas the metal alloy core will act as the fast electron conducting channel to the current collector.

METHODOLOGY

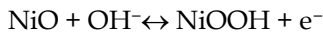
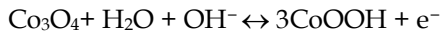
The electrode containing high density ordered arrays of 1D Ni/NiO and $\text{Co-Ni/Co}_3\text{O}_4\text{-NiO}$ core/shell nano-heterostructures can be designed and studied with the help of controlled high temperature oxidation of Ni and Co-Ni nanowires which are

grown via template assisted electrodeposition technique by using the highly ordered nanoporous anodic aluminium oxide (AAO) as a template [6]. The unique feature of this technique is that individual nano-heterostructure in the electrode has its own contact with the current collector (Au), which results the enhanced charge transfer kinetics[7,8]. Materials characterization should be done by field emission scanning electron microscopy (FESEM), energy-dispersive x-ray spectroscopy (EDS), transmission electron microscopy (TEM), and energy filtered TEM (EFTEM)[10]. The electrochemical properties of the samples can be obtained by cyclic voltammetry (CV) and galvanostatic (GV) charge/discharge tests by using software controlled conventional three-electrode electrochemical cell [11].

RESULTS AND DISCUSSION

The field emission scanning electron microscopy (FESEM) image of the Ni/NiO and $\text{Co-Ni/Co}_3\text{O}_4\text{-NiO}$ core/shell nano-heterostructures (NHs), have uniform diameter which indicates that the surface of NHs are very rough and porous, which will increase the active surface area of the electrodes. the energy-dispersive x-ray spectroscopy (EDS) spectrum confirms the presence of Ni and O in the Ni/NiO core/shell NHs, Co , Ni and O in the $\text{Co-Ni/Co}_3\text{O}_4\text{-NiO}$ core/shell NHs. The transmission electron microscopy (TEM) micrograph of Ni/NiO and $\text{Co-Ni/Co}_3\text{O}_4\text{-NiO}$ core/shell NHs, gives the formation the uniform nano-layer. The energy filtered TEM (EFTEM) micrographs of the Ni/NiO and $\text{Co-Ni/Co}_3\text{O}_4\text{-NiO}$ core/shell NHs, indicates the formation of a good quality NHs with uniform chemical composition. Electrochemical properties of the Ni/NiO and $\text{Co-Ni/Co}_3\text{O}_4\text{-NiO}$ core/shell nano-heterostructures electrode can be obtained by cyclic voltammetry (CV) and galvanostatic (GV) charge/discharge method by using a three-electrode system, where the nano-heterostructures as working electrode should be dipped in 1 M KOH aqueous solution at room temperature.

The Ag/AgCl and Pt can be used as reference and counter electrodes, respectively. The redox peaks for all scan rates are associated with the surface or near surface based Faradic reactions. The equations are:



The charging process involves the oxidation of Co^{2+} and Ni^{2+} into Co^{3+} and Ni^{3+} , respectively, with the movement of the corresponding electrons towards the current collector (Au) through the electrode; while discharging involves subsequent reduction of metal ions from +3 state to +2 state followed by the electron transport in reverse direction. The increase of current with increasing scan rate is quite obvious because during fast scanning diffusion layer cannot extend far from the electrode surface, thus facilitating higher electrolyte flux towards the electrode leading to

higher value of current which is in contrary to the case at lower scan rates where the large width of the diffusion layer significantly reduces the electrolyte flux and hence the current. The energy and power densities can be calculated by the respective formulas. The energy density of the Ni/NiO and Co-Ni/Co₃O₄-NiO core/shell NHs electrode decreases. The Ni/NiO and Co-Ni/Co₃O₄-NiO core/shell NHs also exhibit excellent electrochemical cycling stability. Such high stability of the electrode can be accounted for the higher mechanical integrity which can sustain significant structural distortion during repetitive charging/discharging process and also non-dissolution of active material within the electrolyte.

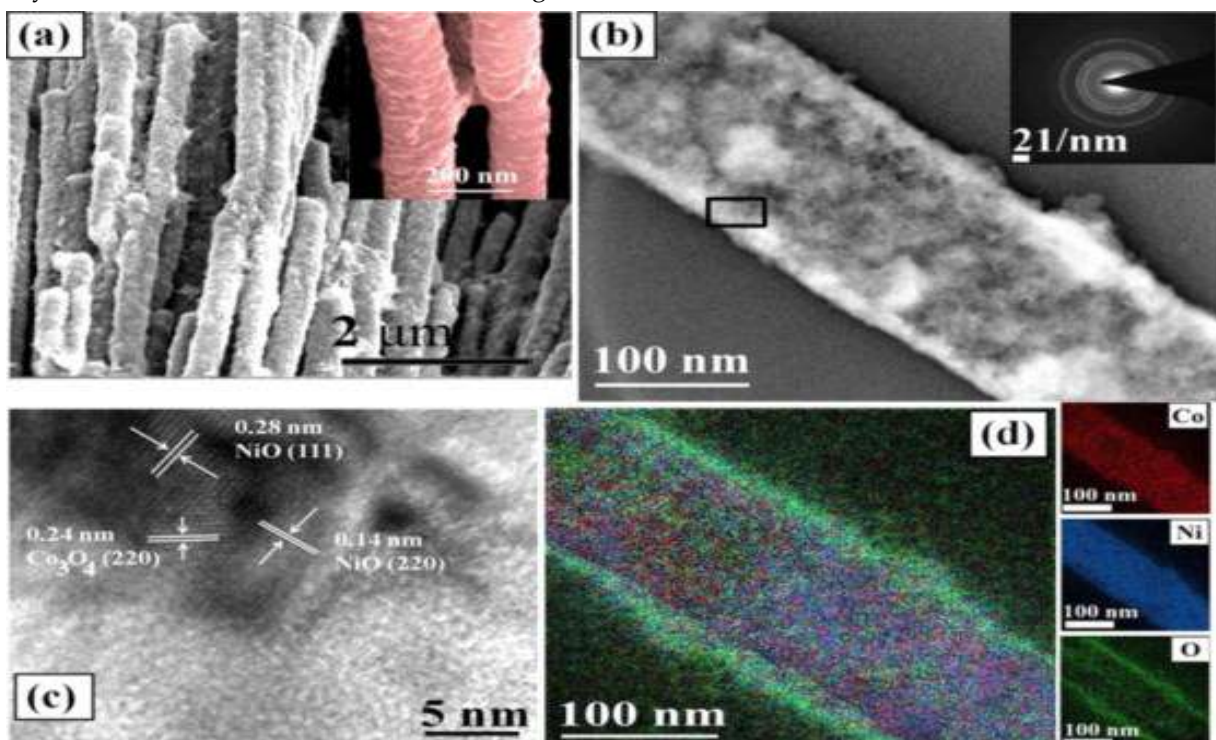


Figure 1. (a) FESEM micrographs, (b) TEM and SAED pattern, (c) HRTEM image, and (d) EFTEM micrographs of the Co-Ni/Co₃O₄-NiO core/shell nano-heterostructures[9]

CONCLUSION

In conclusion, Ni/NiO and Co-Ni/Co₃O₄-NiO core/shell nano-heterostructures with remarkable ultra capacitance properties can be achieved. The nano-heterostructures can be fabricated by combining simple electrochemical deposition of Ni and CoNi nanowires followed by controlled oxidation. The unique nano-architectural design of the nano-

heterostructures electrode having a large rough surface area coupled with the presence of highly redox active materials with short ion diffusion path can be grown on the highly conducting metal channel facilitating the faster charge transport helps to achieve enhanced electrochemical properties suitable for the ultra capacitor applications.

Conflicts of interest: The authors stated that no conflicts of interest.

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Substrate Temperature Dependent Properties of Spray Deposited CdTe Thin Films

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ABSTRACT

Semiconducting CdTe thin films have been deposited on amorphous glass substrate using a spray pyrolysis technique. The preparative parameters have been optimized to obtain good quality and stoichiometric thin films. Binary chalcogenides with appropriate bandgap energy have been attracting a great deal of attention because of their potential applications in photovoltaics. CdTe in the form of thin films is prepared at different substrate temperatures by a simple and economical spray pyrolysis technique. The photoelectromical characterization shows that both short-circuit current (I_{sc}) and open-circuit voltage (V_{oc}) are at their optimum values at the optimized substrate temperature of 250°C. The SEM studies reveal the compact morphology with large number of grains.

Keywords: Spray pyrolysis, Cd chalcogenides thin films, PEC Cell, SEM.

INTRODUCTION

Cadmium telluride is a one of the II-VI compound semiconductor and is a potential candidate as a photovoltaic material because of its optimum band gap of (~1.5 eV) and high absorption coefficient in the visible region [1-2]. It has many applications such as photovoltaic cells, laser window, p-n diode, Gamma ray detector etc. [2-5]. The deposition of II-VI semiconductor sulphides and selenides by spray pyrolysis was first investigated by Chamberlin and Skarman [6] and that of cadmium telluride films by Boone et al. [7] and Jordan et al. [8].

Rastogy and Balkrishnan [9] studied electrodeposited CdTe films for their growth structure and composition. R.F. sputtered n-CdTe film has been used to fabricate Schottky barrier junction with Ag metal [10]. K. Vamshi et al. [11] have reported the effect of electric field on CdTe thin films deposited using spray pyrolysis. The chemical spray pyrolysis is a technique for depositing polycrystalline films of oxides, binary and ternary chalcogenides, and superconducting oxide thin films [12]. The II-VI compound semiconductors of the type AX (A= Cd, Zn, Pb etc. and X= S, Se, Te etc.) have widely been studied [13-16]. The properties of Cd-chalcogenide thin films have been studied by other investigators [17-26,30-36].

The present study deals with the preparation of CdTe thin films at various substrate temperatures on preheated glass substrates by a simple and low-cost spray pyrolysis technique. The films have been characterized by photoelectrochemical (PEC), scanning electron microscopy (SEM).

METHODOLOGY

1 Preparation of CdTe thin films

The thin films CdTe were deposited onto a bare glass and the fluorine doped tin oxide (FTO) coated glass substrates at different substrate temperatures. The precursor solution to be sprayed was prepared by appropriate volumetric proportion of aqueous cadmium chloride (CdCl_2) and Tellurium dioxide (TeO_2) dissolved in hydrazine hydride, NH_4OH and HCl being used to form clear spraying solution with optimized pH value. Hydrazine hydride served as a reducing agent to obtain Te^{2-} ions [27]. The pH, concentration and the spray rate of the precursor solution were optimized to be 10.5, 0.01 M and 1.5 ml min^{-1} respectively. The films were deposited at various substrate temperatures from 225 to 300°C at the interval of 25°C in order to obtain good quality, stoichiometric and uniform CdTe thin films.

2 Characterization

The PEC cell consisted of CdTe thin film as an active photoelectrode, polysulphide solution (1 M NaOH + 1 M Na_2S + 1 M S) as an electrolyte and graphite as a

counter electrode. The short circuit current (I_{sc}) and open circuit voltage (V_{oc}) were measured with respect to the substrate temperature for optimizing the preparative parameters. The surface morphology of the spray-deposited CdTe thin films on glass substrate was carried by SEM model Cambridge Stereos can 250-MK3 assembly and model XL-30 in series with 4000 X magnification.

RESULTS AND DISCUSSION

1 Deposition of CdTe thin films and effect of substrate temperature on the film formation

TeO_2 was added to a solution of ammonium hydroxide (NH_4OH), which was used as a solvent. TeO_2 takes few hours for complete dissolution. Hydrazine hydrate ($\text{N}_2\text{H}_4 \cdot \text{H}_2\text{O}$) acts as a reducing agent for Te^{4+} ions and supplies six electrons to convert Te^{4+} to Te^{2-} . Dilute HCl was also added at this stage, which shifts chemical equilibrium in the appropriate direction, thereby avoiding the precipitate formation at a later stage. Solution thus prepared was mixed with aqueous solution of CdTe, which resulted in a slightly milky solution. Furthermore, the pH was well below the desired value required for preparing stoichiometric thin films. Hence the pH was increased by adding few more drops of NH_4OH . Then this clear solution was used as the precursor. The solution was immediately sprayed onto the preheated glass substrates before formation of precipitate. In the spray pyrolysis technique, the clear precursor solution of CdTe was sprayed onto the preheated hot glass substrates, pyrolytic decomposition of solution occurs thereby resulting in well-adherent pale brown CdTe thin films. Every sprayed droplet reaching the surface of the hot substrate undergoes pyrolytic decomposition and breaks into its constituent components. The solvent and other volatile components get evaporate in the form of vapors and the only desired compound containing the required chemical species deposits on the surface of substrate in thin film form. The depositions of CdTe thin films were carried out at various substrate temperatures in the range 225-300°C using 0.01 M solution. It was observed that the lower substrate temperatures (<225°C) favor non-uniform and easily detachable film formation. The temperature might be insufficient

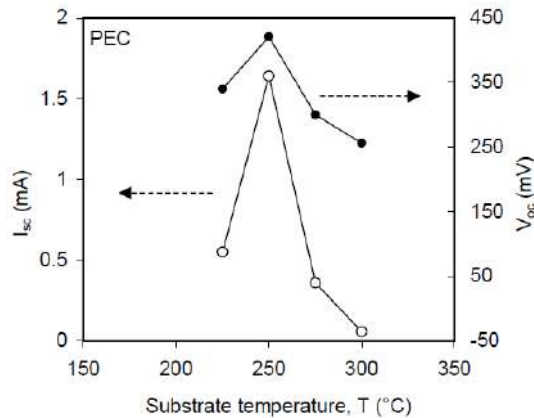


Fig. 1.

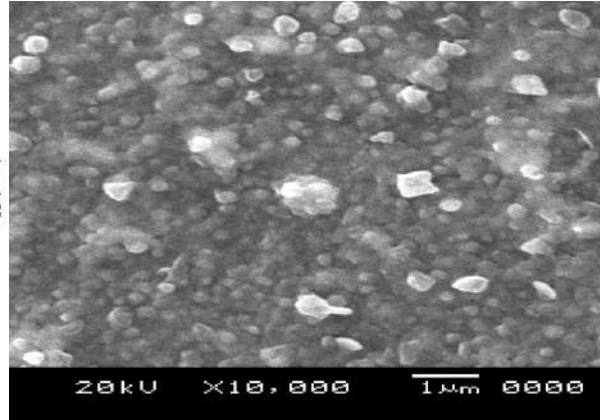


Fig. 2.

Fig. 1. Variation of I_{sc} and V_{oc} with substrate temperature for CdTe thin film based polysulphide PEC solar cell.
Fig. 2. Scanning electron micrographs of spray-deposited CdTe thin films at optimized substrate temperature (T250).

in this case, to decompose the sprayed droplets of the mixed solution. At higher substrate temperatures (>300°C) also the films resulted with non-uniformity and pinholes. This could be due to the higher evaporation rate of the initial ingredients from the surface of the hot substrates. However, the CdTe thin films deposited at intermediate substrate temperatures are uniform and adherent to the glass substrates. The films are faint brown in colour.

2 Photoelectrochemical (PEC) studies

The quantities such as short circuit current (I_{sc}) and open circuit voltage (V_{oc}) of the PEC cell obtained with each CdTe thin film are observed to be comparatively maximum at optimized substrate temperature of 250°C as shown in Fig. 1. The comparatively higher values of I_{sc} and V_{oc} at optimized substrate temperature may be due to the relatively maximum stoichiometry of the compound at that temperature.

3 SEM studies

Fig. 2 shows the surface morphology of the spray-deposited CdTe thin films on glass substrates at optimized substrate temperature of 250°C. The micrograph reveals that the substrate is well covered with large number of densely packed more-or-less spherical grains.

CONCLUSION

The deposition of semiconducting CdTe by spray pyrolysis technique is feasible. The films deposited at optimized substrate temperature 250°C, concentration 0.01 M and exhibiting good photovoltaic activity.

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Conflicts of interest: The authors stated that no conflicts of interest.

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Application of VAM Fungi to increase Groundnut (*Arachis hypogea* L.) production

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ABSTRACT

The purpose of this research was to investigate the use of VAM (Vesicular Arbuscular Mycorrhiza) fungi species to increase Groundnut production. A pot culture experiment using sterile, potassium deficient soil was conducted to the study with VAM fungi *Acaulospora laevis*, *Glomus fasciculatum* and *Glomus mossae* individually as well as their combination and control in respect to groundnut production. It was observed from result that combination of all VAM fungi shows significant increase in yield followed by *Glomus mossae* treatment. It was also observed that all individual and combination treatments shows more production as compared to control.

Keywords VAM fungi, *Acaulospora laevis*, *Glomus mossae* and *G. fasciculatum*, *Arachis Hypogea*.

INTRODUCTION

Groundnut is one of the important oilseed crops of India, growing in the semi-arid tropic region. VAM fungi forms symbiotic relationship with roots of higher plants and beneficial to both fungi and host plant [1,2]. AM fungi enhance plant growth mainly through nutrient uptake. In mycorrhizal colonization, there are reports of increased uptake of Phosphorous and other micro and macro - nutrients which are available in less quantities in the soil [3,4,5]. The increased plant growth has been observed by some workers due to VAM [6,7,8]. The present study was undertaken to evaluate role of VAM fungi in the growth of groundnut crop plants.

METHODOLOGY

The culture of *Acaulospora laevis*, *Glomus fasciculatum* and *Glomus mossae* was procured from 'Center for Natural Biological Resources and Community Development, Bangalore'. The seeds of groundnut were obtained from Mahatma Phule Krishi Vidyapeeth (MPKV), Rahuri, District- Ahmednagar. The culture was mass multiplied on root stock of the Guinea pig grass and maize as a host plant. The seeds of uniform size and free from visible defects were selected for the study. The three VAM fungi *Acaulospora laevis*, *Glomus fasciculatum* and *Glomus mossae* were used for mycorrhizal treatment as individual and in combination as shown in the table. The soil selected for experiment with pH 8.24 was oven sterilized. The earthen pots with size 25 centimeter diameter, sufficient depth and proper drainage were selected for the experiment. Pots were filled with 7 kg of sterilized mixture of soil sand and farm yard manure (FYM). Nonsterile soil, sand and FYM were filled in the earthen pot as a control. Every mycorrhizal treatment was carried out in 10 pots separately and control was with 5 pots. In each pot 15 gramm soil containing VAM spores were placed below the groundnut seed. The plants were sufficiently irrigated and grown for further

observation. The observations was recorded for production of the crop after harvesting.

RESULTS AND DISCUSSION

The influence of VA mycorrhizal fungi on yield (production) of groundnut was significant in combination and also in individual treatment as compared to control. The results in respect to Table - 1 revealed that combine treatment of *Acaulospora laevis*, *Glomus fasciculatum* and *Glomus mossae* shows maximum yield 19.9 gm (40.14%) followed by *Glomus mossae* 18.9 gm (33.09%), combination of *Acaulospora laevis*, and *Glomus mossae* 18.6gm (30.98%) , *Acaulospora laevis* 18.4 gm (29.57%), *Acaulospora laevis*, *Glomus fasciculatum* 18.2gm (28.16%), *Glomus fasciculatum* and *Glomus mossae* 18 gm (26.76%) and *Glomus fasciculatum* 17.3 gm (21.83) as compared to control having 14.2 gm weight of the pod at the time of harvesting.

Results of the experiment confirms various reports on enhanced plant growth due to AM inoculation to medicinal plants [9,10,11] and forest tree species [12] Similar observations were noted by Patterson *et al* [13] and on *Vigna unguiculata* (L) Walp varieties Pusa 51 by Arumugam *et al* [14].

Table 1

Sr. No.	Parameter	
	Weight of the pod (gm)	Percentage
Control	14.2	
<i>Acaulospora laevis</i>	18.4	29.57
<i>Glomus fasciculatum</i>	17.3	21.83
<i>Glomus mossae</i>	18.9	33.09
<i>Acaulospora laevis</i> + <i>Glomus fasciculatum</i>	18.2	28.16
<i>Acaulospora laevis</i> + <i>Glomus mossae</i>	17.2	30.98
<i>Glomus Fasciculatum</i> + <i>Glomus mossae</i>	18	26.76
<i>Acaulospora laevis</i> + <i>Glomus fasciculatum</i> + <i>Glomus mossae</i>	19.9	40.14

Acknowledgement:

We are thankful to 'Center for Natural Biological Resources and Community Development, Bangalore', Karnataka for providing VAM inoculum culture and Mahatma Phule Krishi Vidyapeeth (MPKV), Rahuri, District- Ahmednagar for providing Groundnut seeds and Principal, S. S. G. M. College, Kopargaon for his constant encouragement.

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Travelling wave solutions of potential KdV equation through tanh-coth method

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ABSTRACT

In this work, establish travelling wave solutions of the potential kdv equation using travelling wave transform and tanh-coth method. Through tanh-coth method, we obtained travelling wave and kink solutions of the potential kdv equation. Applied method proved to be reliable, effective and easy in handling a large number of nonlinear partial differential equations (PDE's).

Keywords : Tanh-coth method, potential kdv equation, travelling wave solution, kink solution.

INTRODUCTION

Travelling waves propagating in homogeneous media have attracted considerable attention of researcher in recent years. Finding exact solutions of nonlinear dispersive and dissipative equations is an important subject. Many researchers developed and used several new methods for finding solutions of such nonlinear PDE's. which based on some previous methods. The tanh-coth method is improved tanh method and extended tanh method. the inverse scattering method, the backland transformation method, sin-cosine method, tanh-sech method, Hirota's bilinear technique, Adomian decompositiopn method are some another methods that are used to handled non linear PDE's.

In solid physics, plasma physics, fluid dynamics etc., the potential kdv equation is written as

$$v_t + \alpha v_x^2 + v_{xxx} = 0 \tag{1}$$

The potential kdv equation is obtained from the pioneer

model kdv equation by using transformation $v = \vartheta_x$ and integration once.

The tanh-coth method:

The wave variable

$$z = x - ct$$

convert the PDE

$$Q(v, v_x, v_t, v_{xx}, v_{tt}, v_{xxx}, \dots) = 0 \quad (2)$$

to ordinary differential equation(ODE)

$$R(v, v', v'', v''', \dots) = 0 \quad (3)$$

Integrating equation (3) as long as terms contain derivatives and the constant of integration consider as zero.

Introducing a new independent variable

$$Y = \tanh(\mu z), \quad \text{where } z = x - ct$$

and μ is wave number.

In tanh-coth method used the finite expansion

$$v(x, t) = S(Y) = \sum_{i=0}^N a_i Y^i + \sum_{i=1}^N b_i Y^i \quad (4)$$

where N is positive integer and its value to be determined in most of cases. By substituting (4) in Ode (3), obtained value of N by balance method. Usually balance the highest order nonlinear terms with the linear terms of highest order using the following scheme

- $v \rightarrow N$
- $v^2 \rightarrow 2N$
- $v^r \rightarrow rN$
- $v' \rightarrow N + 1$
- $v'' \rightarrow N + 2$
- $v^{(r)} \rightarrow N + r$
- $(v')^2 \rightarrow (N + 1)^2$
- $(v')^r \rightarrow (N + 1)^r$
- $(v'')^2 \rightarrow (N + 2)^2$
- $(v'')^r \rightarrow (N + 2)^r$

Applications:

The potential kdv equation is

$$v_t + \alpha v_x^2 + v_{xxx} = 0 \quad (5)$$

Substitute the wave variable

$$z = x - ct \text{ in (5).}$$

We look for a travelling wave solution in the form

$$v(x, t) = v(z) = v(x - ct) \quad (6)$$

where c is the speed of soliton.

Substitute (6) in (5), we have

$$-cv' + \alpha(v')^2 + v''' = 0 \quad (7)$$

Balancing the nonlinear term $(v')^2$, that has exponent $(N + 1)^2$, with the highest order derivative term v''' , that has the exponent $N + 3$, this gives

$$(N + 1)^2 = N + 3$$

$$N^2 + 2N + 1 = N + 3$$

$$N = 1, -2$$

Case (i) Let $N = 1$

Then by tanh-coth method formula (4), the method admits the substitution

$$v(x, t) = S(Y) = a_0 + a_1 + b_1 Y^{-1} \quad (8)$$

As $Y = \tan(\mu z)$

Therefore,

$$\frac{d}{dz}(\cdot) = \mu(1 - Y^2) \frac{d}{dY}(\cdot)$$

$$\frac{d^2}{dz^2}(\cdot) = -2\mu^2 Y(1 - Y^2) \frac{d}{dY}(\cdot) + \mu^2(1 - Y^2)^2 \frac{d^2}{dY^2}(\cdot)$$

$$\frac{d^3}{dz^3}(\cdot) = 2\mu^3(1 - Y^2)(3Y^2 - 1) \frac{d}{dY}(\cdot) - 6\mu^3 Y(1 - Y^2) \frac{d^2}{dY^2}(\cdot) + \mu^3(1 - Y^2)^3 \frac{d^3}{dY^3}(\cdot)$$

Hence,

$$\begin{aligned} v' &= \frac{d}{dz}(v) \\ &= \mu(1 - Y^2) \frac{d}{dY}(v) \\ &= \mu(1 - Y^2)(a_1 - b_1 Y^{-2}) \end{aligned} \quad (9)$$

$$\begin{aligned} v''' &= \frac{d^3}{dz^3}(v) \\ &= 2\mu^3(1 - Y^2)(3Y^2 - 1) \frac{d}{dY}(v) - 6\mu^3 Y(1 - Y^2) \frac{d^2}{dY^2}(v) + \mu^3(1 - Y^2)^3 \frac{d^3}{dY^3}(v) \\ &= 2\mu^3(1 - Y^2)(3Y^2 - 1)(a_1 - b_1 Y^{-2}) - 6\mu^3 Y(1 - Y^2)(2b_1 Y^{-3}) + \mu^3(1 - Y^2)^3(-6b_1 Y^{-4}) \end{aligned} \quad (10)$$

Putting (9) and (10) in equation (7), we have

$$-c \mu(1 - Y^2)(a_1 - b_1 Y^{-2}) + \alpha \mu^2(1 - Y^2)^2(a_1 - b_1 Y^{-2})^2 + 2\mu^3(1 - Y^2)(3Y^2 - 1)(a_1 - b_1 Y^{-2}) - 6\mu^3 Y(1 - Y^2)(2b_1 Y^{-3}) + \mu^3(1 - Y^2)^3(-6b_1 Y^{-4}) = 0$$

$$-c \mu(a_1 - b_1 Y^{-2}) + \alpha \mu^2(1 - Y^2)(a_1 - b_1 Y^{-2})^2 + 2\mu^3(3Y^2 - 1)(a_1 - b_1 Y^{-2}) - 6\mu^3 Y(2b_1 Y^{-3}) + \mu^3(1 - Y^2)^2(-6b_1 Y^{-4}) = 0$$

$$-c \mu a_1 + c b_1 \mu Y^{-2} + \alpha \mu^2(a_1 - b_1 Y^{-2})^2 - Y^2(a_1 - b_1 Y^{-2})^2 + 2\mu^3(3Y^2 - 1)(a_1 - b_1 Y^{-2}) - 6\mu^3 Y(2b_1 Y^{-3}) + \mu^3(1 - Y^2)^2(-6b_1 Y^{-4}) = 0$$

$$\begin{aligned} &(-c \mu a_1 + 2a_1 b_1 - 6b_1 \mu^3 - 2a_1 \mu^3 + \alpha \mu^2 a_1^2) + (c \mu b_1 - 2\alpha \mu^2 a_1 b_1 - b_1^2 + 2b_1 \mu^3) Y^{-2} + (-a_1 + 6a_1 \mu^3) Y^2 + (\alpha \mu^2 b_1^2 - 6b_1 \mu^3) Y^{-4} \\ &= 0 \end{aligned} \quad (11)$$

This gives

$$\begin{aligned} -c \mu a_1 + 2a_1 b_1 - 6b_1 \mu^3 - 2a_1 \mu^3 + \alpha \mu^2 a_1^2 &= 0 \\ c \mu b_1 - 2\alpha \mu^2 a_1 b_1 - b_1^2 + 2b_1 \mu^3 &= 0 \end{aligned} \quad (12)$$

$$-a_1 + 6a_1 \mu^3 = 0$$

$$\alpha \mu^2 b_1^2 - 6b_1 \mu^3 = 0$$

From this, we obtained the following sets of solutions.

(i) $a_0 = R$, where R is any constant

$$\mu = \frac{\sqrt{c}}{2}, c > 0, a_1 = \frac{3\sqrt{c}}{a}, b_1 = 0$$

(ii) $a_0 = R$, where R is any constant

$$\mu = \frac{\sqrt{c}}{2}, c > 0, a_1 = 0, b_1 = \frac{3\sqrt{c}}{a}$$

This gives two solutions from (8),

$$\begin{aligned} \text{(i) } v_1(x, t) &= R + \frac{3\sqrt{c}}{a} Y \\ &= R + \frac{3\sqrt{c}}{a} \tanh(\mu z) \\ &= R + \frac{3\sqrt{c}}{a} \tanh\left(\frac{\sqrt{c}}{2}(x - ct)\right), \text{ where } c > 0 \end{aligned}$$

This is kink solution.

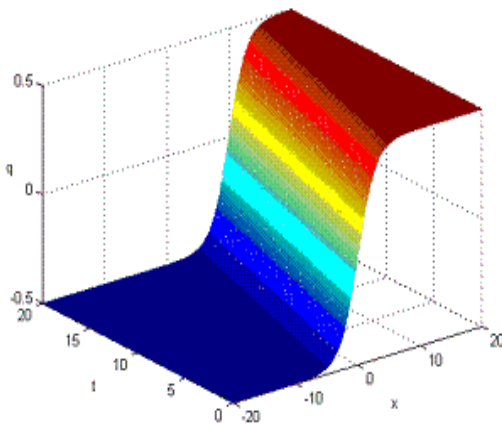


Fig.-1: Kink solution $v_1(x, t)$ for $a=0.5$, $c=1.5$, $R=0$

$$\begin{aligned} \text{(ii) } v_2(x, t) &= R + \frac{3\sqrt{c}}{a} Y^{-1} \\ &= R + \frac{3\sqrt{c}}{a} [\tanh(\mu z)]^{-1} \\ &= R + \frac{3\sqrt{c}}{a} \coth(\mu z) \\ &= R + \frac{3\sqrt{c}}{a} \coth\left(\frac{\sqrt{c}}{2}(x - ct)\right), \text{ where } c > 0 \end{aligned}$$

This is travelling wave solution.

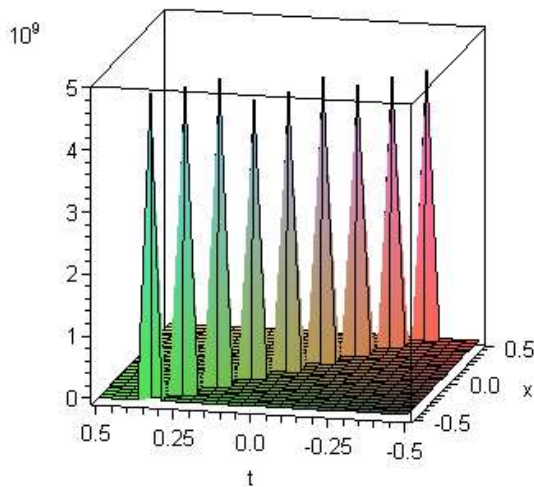


Fig. -2: Travelling wave solution $v_2(x, t)$ for $a=0.5, c=1.5, R=0$

If $N = -2$, then one can obtain another some special type sets of solutions.

CONCLUSION

In this paper, we obtain the kink solution and travelling wave solution of the potential kdv equation by using tanh-coth method. Using travelling wave transformation the nonlinear partial differential equation is transformed into ordinary differential equation. The used tanh-coth method is effective, reliable and gives multiple solutions. This work emphasized that tanh-coth method is powerful technique to solve nonlinear partial differential equation that admits travelling wave and solitary wave solutions..

Conflicts of interest: The authors stated that no conflicts of interest.

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