ISBN:978-93-84663-07-0

Proceeding of UGC Sponsored
National Conference on

Renewable Energy and Environment

25th to 27th September, 2014

Organized by
Department of Chemistry and Physics
Nya. Tatyasaheb Athalye Arts, Ved. S. R. Sapre Commerce and
Vid. Dadasaheb Pitre Science College Devrukh (Dist. Ratnagiri)

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(NCREE-2014)

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Prof. Sagar Sankpal

Editor

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(Reaccredited with B Grade (CGPA 2.82)

(Mumbai University Best College Award- 2010)

Published By

RUT Printer and Publisher, (MS) India

Renewable Energy and Environment

First edition: Sept. 2014

Price:

ISBN: 978-93-84663-07-0

QR - Code

Distributar: Samarth Book Stationers, Jalna

Published by RUT printer and publisher, 43, Kaushalyaaie, Priyanka Residency, Mantha Chaufulli, Jalna (M. S.) India 431203
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Editorial

Athalye Sapre Pitre College Devrukh has always been on the forefront in organizing different academic, co-curricular and administrative activities to nurture the student's minds and equip them with skills to face the challenges of the real world situations with academic excellence.

UGC sponsored Three Day National Conference on "Renewable Energy and Environment" was jointly organized by the Department of Chemistry and Physics during 25th to 27th September, 2014. The main objective of this conference was to provide platform to researches in the field of Physics, Chemistry, Technology, Economics, Commerce, Geography and Environmental sciences to share problems and prospects in the field of energy and environment and to compile intellectual inputs for the sustainable development of our country.

Protection of the Environment and Climate, and their preservation is a demanding social, scientific and economical task. Utilization of renewable energy, efficient conversions of fossil fuel are not only environmentally and climatically beneficial, they also preserve the finite energy sources. Awareness of this global issue at the grass root level is the need of the hour.

Renewable energy and environment is the subject of global attention. The present scenario between energy generation, consumption and depletion of sources of conventional energy has various impacts on Environment. Conservation of renewable energy sources and protection of environment are the burning issues at the global level. Unless a long term planning is done to handle these issues and make them commercially viable and environment friendly; alternative technologies are developed. The potential of renewable energy sources is enormous as they can in principle meet many times the world's energy demand. Renewable energy sources such as small hydropower, wind, solar, biomass, and geothermal can provide sustainable energy services, based on the use of routinely available, indigenous resources.

I am sure such platforms through national conference will definitely help to promote various academicians, scientist and research students to share and absorb various new ideas which will help our country to overcome fuel crisis and environmental problems.

Prof. Sagar Sankpal

Issue Editor

Contents

Physicochemical Changes in *Trigonella Foenum-Graecum* L during Traditional Preservation

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ABSTRACT

India's flora comprises of 6000 species of plants used for consumption, 1/3rd of which are green leafy vegetables. Green Leafy Vegetables (GLVs) are very good source of nutrients. Ordinary population in India lives below poverty line in rural region and could not afford refrigerator for preservation of green vegetables. Chlorofluorocarbon (CFC) used in refrigerator is one of the green house gas and causes hazardous effect on environment as depletion of ozone layer. Traditional technique used for preservation of leafy vegetables causes severe nutrient loss. So in this experiment, traditional technique was improved with the help locally available eco friendly material for vegetable preservation. *Trigonella foenum-graecum* L. commonly known as fenugreek was preserved by five different treatments and compared with refrigerator and control treatment. Changes in Fenugreek in all treatments were carried out after every 24 hr. During preservation, decrease in fresh weight and increase in dry matter was observed after every 24 hours in all treatments. Treatment 5 is the best alternative to refrigerator; it retains more fresh weight, water soluble reducing sugar, nitrogen and crude protein content than control condition. This improved traditional technology is quite simple and appropriate with respect to the cost of operation, potential for adoption in rural communities and prevention of post harvest loss of *Trigonella* and other vegetables. As this method is environment friendly it is strongly recommended for preservation.

Key Words: crude protein, environment friendly, sugar, preservation, *Trigonella*

INTRODUCTION

Green leafy vegetables are major source of macronutrients and micronutrients and fiber. They also provide carbohydrates and protein, which are needed for normal healthy growth (Salunkhe and Kadam, 1995; Adetuyi *et al* 2008). Most vegetables are composed of 70–90% water and once separated from their source of nutrients (tree, plant, or vine) undergo higher rates of respiration, resulting in moisture loss, quality and nutrient degradation, and potential microbial spoilage (Rickman *et al*.,2007). Though India stands second in vegetables and fruits production, hardly two percent of the produce is processed and 30 - 40 % is being wasted due to lack of processing and preservation infrastructure (Adeyeye, 2002). Kader (1992) estimated the extent of post-harvest losses in fresh fruit and vegetables at 5 -25% in developed countries and 20 - 50% in developing countries.

Postharvest fruit and vegetable are living organisms, undertaking metabolism ceaselessly. Their character such as nutrition, favor and appearance deteriorated during the process of storage and transportation owing to water loss, browning, decay and so on (Terry and Joyce *et al*.,2004). Vegetables can be preserved by different methods such as cooling, freezing, canning, sundrying of fresh leaves, sun-drying of blanched or cooked leaves. Electrification of the rural areas has introduced preservation

 ISBN: 978-93-84663-07-0

technology, including the blanching and freezing of leaves (Tshikalange and Van, 2006). Losses of nutrients from vegetables during drying and cooking have been noted (Kachik *et al*.,1992, Yadav and Sehgal, 1997).

Mepba *et al*., (2007) studied the effects of processing treatments on the nutritive composition and consumer acceptance of some Nigerian edible leafy vegetables. Research was carried out to assess the effects of different processing and preservation methods on the nutritional value of *Amaranths* (Makobo *et al*.,2010). During the post-harvest glut, the loss is considerable and often some of the produce has to be fed to animals or allowed to rot. According to Ndirika and Asota, (1994), the damage that occurs in some bio products is primarily by loss of moisture, change in composition and pathological attack. To extend the shelf life of postharvest fruit and vegetable, some effective measures including low temperature, modified atmosphere packaging etc. have been applied (Xanthopoulos *et al*.,2011, Castagna *et al*.,2013).

In this investigation, a novel technique of vegetable preservation is set as an appropriate preservation technique for rural India. The system of preservation is built by locally available eco-friendly material which costs not more than 200 rupees. It lowers the temperature of vegetables than surrounding. The aim of the work reported here was to study the effect of traditional preservation methods on nutrient contents of vegetables and improve it to solve the crisis of poor nutrition in the rural region.

MATERIALS AND METHODS

Experimental site

Field experiment was carried out from 04 May 2010 to 12 May 2010 in the Research farm located in the Botanical garden of Dr. Babasaheb Ambedkar Marathwada University, Aurangabad. The temperature range during experiment was 44^0C to 25^0C.

Materials

Green leafy vegetable fenugreek was purchased from local Aurangabad vegetable market early in the morning. The vegetable was washed with water and debris and mud was removed. The moisture was removed with the help of blotting paper.

Treatments and Methods

Fenugreek was preserved by eight different treatments. Out of which six treatments are made from locally available earthen components made by potter and are compared with refrigerator and control treatment.

The first treatment is a model composed of earthen structure locally called *math* which is placed under soil surface. Ground is dug and a hollow is created which then filled with sand, coconut fiber etc. *Math* is placed in centre of that material and buried in soil. For cooling of math continuous supply of water is maintained by drip attached to water container. In second treatment all contents are arranged same except *math* replaced by *ranjan* with more thickness. In third treatment an earthen *math* is bounded in a jute sack filled with coconut fiber. The math is insulated from outer surrounding with the help of fiber and continuous supply of water is arranged by drip. In fourth treatment model composed same except math replaced by *ranjan* having more thickness.

The fifth treatment is a model composed of two earthen open mouth cylinders locally called *ranjan*. The bigger *ranjan* is filled with water in which smaller ranjan was kept floating. Due to porous nature of *ranjan* water is evaporated from surface of outer *ranjan.* The heat required for evaporation was taken from inner water due to which the temperature of water gets lowered and water become cooler and cooler. Because of cooling of water the inner smaller *ranjan* also get cooled and temperature of inner space gets decreased. The vegetables are kept in the space so that minimum temperature for preservation is maintained.

In sixth treatment vegetables are preserved in refrigerator (Model Godrej 165 lit.) at 7 ^{0}C. The seventh treatment is controlled condition in which vegetables were kept in *duradi* at room temperature as common preservation method in rural areas. Fresh fenugreek (wt. 3 kg each) was kept in different seven treatments for preservation. Experiment was carried out for eight days.

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ANALYSIS

Changes in weight

During experiment all the vegetables were weighed and decrease in weight was determined after every 24 hrs (1day) for eight days. Dry matter percentage of each vegetable was determined after every 24 hrs in every treatment.

Nutrient Analyses

The percentage of reducing sugar, nitrogen, crude protein was calculated on dry matter basis. Nitrogen (N) was estimated by micro-Kjeldahl method after digesting the sample with Conc. H_2SO_4 (Bailey, 1967) and crude protein (CP) was then calculated by multiplying N value with 6.25 as specified by AOAC, (1995). The dry samples were boiled in distilled water, filtered and amount of water soluble reducing sugars was determined in the filtrate by using Folin-wu tubes (Oser, 1979).

Statistical analyses

All the results were statistically analyzed using analysis of variance (ANOVA) test and treatments means were compared using the least significant difference (C.D., p = 0.05) (Mungikar, 1997).

RESULTS AND DISCUSSIONS

Decrease in fresh weight and increase in dry matter percentage

Observations showed that, there is decrease in fresh weight and increase in dry matter in fenugreek after every 24 hours (Table 1 and 2). Decease in fresh wt. and increase in dry matter in fenugreek is statistically significant among a day compared with next day. During preservation after every 24hrs (in some cases 48hrs.) fenugreek loss moisture significantly in all treatments. From this it get cleared that decrease in fresh wt. and increase in dry matter is significant among subsequent days as well as among treatments also. From the point of view of maximum retention of moisture during preservation Treat.5 and Treat.1 are superior as compared to other treatments. From the point of view of nutrient retention presence of moisture content is very important as many nutrients are lost due to loss of moisture in fenugreek. Extractability of proteins largely depends on moisture content in the crop .There is strong correlation between protein extractability and dry matter content in green plants (Naikwade *et al.*,2012 a).

Nutrient content of fenugreek

Total reducing sugar

In case of fenugreek preservation, initially total reducing sugar % was observed as 1.21 in all treatments (Table 3). After each day increase in sugar level was observed up to fourth or fifth day. Highest total reducing sugar % was observed as 1.62 in Treat.2(1.57) and Treat.5(1.62) on fourth and fifth day respectively, followed by Treat.3 on third day(1.59), Treat.1(1.57) on fourth day. After reaching at peak on fourth and fifth day total reducing sugar % get decreased day by day. At the end of eight days, the highest total reducing sugar % in fenugreek was found in Treat.6 (2.92) followed by Treat.5 (2.58), Treat.3 (1.09), Treat.7(1.07), Treat.1(1.06), and Treat.4(1.05) while lowest in Treat.2(1.02).

While comparing each other, by these observations it can be concluded that maximum total reducing sugar % was observed on fourth and fifth day in fenugreek. At the end of eight th day fenugreek showed highest total reducing sugar % in different methods. Maximum total reducing sugar % was observed by Treat.6 fenugreek. Change in total reducing sugar % in fenugreek was statistically analyzed and found significant among subsequent days as well as among treatments. Losses in total reducing sugar % are significant from first day to eighth day as well as from all treatments to control. The values of total reducing sugar % of Treat.5 and refrigerator are not always significant to each other indicate that Treat.5 preserves total reducing sugar % near to refrigerator.

During preservation by different methods, change in total reducing sugar percentage was observed each day. Increase in sugar percentage was seen day by day up to fourth and fifth day and then decrease in sugar percentage day by day up to eighth day. During preservation starch in plant material is get hydrolyzed into sugar due to which sugar percentage get increased in some extent but after increase up to optimum level sugar percentage get decreased. This type of anomalous behavior was observed. Nutrients are the building blocks of the human body. They enter into the composition of the cells, regulate their

functions and furnish the energy for their work (Severi *et al*.,1997). Similae results were obtained in case of spinach preservation (Naikwade *et al*.,2012 b)

Nitrogen and Crude Protein %

Proteins supply on an average 4 Kcal of energy per g amount consumed. In case of fenugreek, after eight days preservation, (Table 4) the uppermost nitrogen % was found by Treat.6 i.e. 2.67 followed by Treat.5 (2.50) followed by Treat1, Treat.2 and Treat.4 with same amount (2.42) followed by Treat.3 (2.33) and lowest in Treat.7 (2.25). This trend was observed almost similar in all days. Similar trend was observed in case of Crude protein % in which highest value was observed by Treat.6 (16.66) followed by Treat.5 (15.62) followed by Treat1, Treat.2 and Treat.4 with same amount (15.10) followed by Treat.3 (14.58) and lowest in Treat.7 (14.06)(Table 5).

Table 1. Decrease in fresh wt. of Fenugreek by different preservation methods

Duration (Days)	Treatments						
	1	2	3	4	5	6	7
1	60.00	60.00	60.00	60.00	60.00	60.00	60.00
2	55.60	55.12	54.68	54.75	56.84	50.34	35.16
3	53.08	51.32	48.70	49.82	53.63	39.71	22.46
4	49.44	47.33	45.38	47.06	50.20	39.41	16.98
5	46.87	44.32	41.66	45.22	46.35	33.64	12.79
6	38.46	37.28	35.40	37.46	40.69	27.89	10.80
7	33.76	31.63	29.78	32.28	34.71	24.77	9.74
8	27.80	26.45	24.61	26.03	29.84	19.48	8.94

Treatment	S. E.=	2.01		Days	S. E.=	2.15
	C .D. =	3.95			C .D. =	4.22

Table 2. Increase in Dry matter % of Fenugreek by different preservation methods

Duration (Days)	Treatments						
	1	2	3	4	5	6	7
1	11.51	11.51	11.51	11.51	11.51	11.51	11.51
2	12.80	12.90	13.06	13.16	12.46	15.21	22.31
3	14.10	14.46	15.17	14.80	13.86	18.04	32.79
4	15.07	15.90	16.58	15.97	14.96	21.46	42.39
5	16.70	16.58	18.57	17.29	16.89	24.06	54.32
6	19.32	20.94	21.87	20.79	19.54	30.47	69.34
7	23.46	24.86	26.23	24.45	22.93	35.40	78.69
8	27.66	28.94	30.49	29.34	25.86	42.13	89.36

Treatment	S. E.=	4.12		Days	S. E.=	4.40
	C .D. =	8.07			C .D. =	8.62

 ISBN: 978-93-84663-07-0

Table 3. Change in Total reducing sugar % content of Fenugreek by different preservation methods

Duration (Days)	Treatments						
	1	2	3	4	5	6	7
1	1.21	1.21	1.21	1.21	1.21	1.21	1.21
2	1.28	1.30	1.37	1.28	1.32	1.24	1.34
3	1.48	1.47	1.59	1.43	1.41	1.32	1.39
4	1.57	1.62	1.58	1.53	1.54	1.42	1.51
5	1.42	1.46	1.48	1.46	1.62	1.50	1.45
6	1.34	1.24	1.35	1.30	1.56	1.45	1.33
7	1.15	1.10	1.24	1.11	1.36	1.33	1.28
8	1.06	1.02	1.09	1.05	1.18	1.29	1.07
Treatment	S. E.=	0.03651			Days	S. E.=	0.03903
	C .D. =	0.07155				C .D. =	0.07649

Table 4. Decrease in nitrogen % content of Fenugreek by different preservation method

Duration (Days)	Treatments						
	1	2	3	4	5	6	7
1	2.92	2.92	2.92	2.92	2.92	2.92	2.92
2	2.92	2.83	2.92	2.83	2.92	2.92	2.83
3	2.75	2.75	2.67	2.67	2.83	2.83	2.75
4	2.75	2.67	2.67	2.67	2.75	2.83	2.58
5	2.67	2.67	2.58	2.58	2.67	2.75	2.50
6	2.58	2.58	2.58	2.58	2.67	2.75	2.50
7	2.50	2.50	2.42	2.42	2.58	2.67	2.33
8	2.42	2.42	2.33	2.42	2.50	2.67	2.25
Treatment	S. E.=	0.02545			Days	S. E.=	0.02720
	C .D. =	0.04988				C .D. =	0.05332

Table 5. Decrease in Crude Protein % content of Fenugreek by different preservation methods

Duration (Days)	Treatments						
	1	2	3	4	5	6	7
1	18.22	18.22	18.22	18.22	18.22	18.22	18.22
2	18.22	17.70	18.22	17.70	18.22	18.22	17.70
3	17.18	17.18	16.66	16.66	17.70	17.70	17.18
4	17.18	16.66	16.66	16.66	17.18	17.70	16.14
5	16.66	16.66	16.14	16.14	16.66	17.18	15.62
6	16.14	16.14	16.14	16.14	16.66	17.18	15.62
7	15.62	15.62	15.10	15.10	16.14	16.66	14.58
8	15.10	15.10	14.58	15.10	15.62	16.66	14.06
Treatment	S. E.=	0.1590			Days	S. E.=	0.1700
	C .D. =	0.3117				C .D. =	0.3332

 ISBN: 978-93-84663-07-0

While comparing each other, highest percentage of nitrogen and crude protein was found by Treat.6 i.e. refrigerator followed by Treat.5, Treat.1 in fenugreek. However lowest percentage of nitrogen and crude protein was found by control condition Refrigerator showed percentage of nitrogen in fenugreek as 2.67 and percentage of crude protein as 16.66. Results shown that from the point of view of maximum preservation of nitrogen and crude protein, refrigerator was the ideal treatment but it is beyond the purchasing capacity of maximum people in India. So Treat.5 is the best treatment and alternative to refrigerator

As time is passing there is decrease in Nitrogen % and Crude protein % in vegetables but it was not so fast. Change in Nitrogen % and Crude protein % in vegetables was statistically analyzed and found significant after either 24 hrs. or 48 hrs. as well as among treatments. All the treatments show significantly higher Nitrogen % and Crude protein % than control after fourth day onwards till eight th day. Freshly harvested *A. cruentus* showed higher protein content as compared to dried and blanched samples (Makobo *et al*.,2010).

In treatment 5 the internal temperature is reduced due to cooling action. Temperature depression for cooling application is in the range of 2–12 ^{0}C reported in literature (Anyanwu 2004). In an experiment Ndukwu (2011) showed that the evaporative cooler was able to preserve freshly harvested tomato for 19 days before visible colour changes and mould spotting appeared and the weight drastically reduced. The cooler was able to drop the ambient temperature to 10^{0}C and increase the relative humidity of incoming air from 40.3% to 92% for the storage chamber. Low temperature handling and storage have been described as the most important physical method for post-harvest loss control (Seyoum and Woldetsdik, 2004). Temperature of the surrounding air and produce can be reduced by different methods of cooling (Thompson *et al*., 1998). Low temperature and high relative humidity can be achieved by using less expensive methods of evaporative cooling (Seyoum and Woldetsadik, 2000). These cooling methods,except adiabatic cooling, are expensive for small scale farmers, retailers and wholesalers, as they require electric power (Mogaji and Fapetu, 2011). Although, refrigeration is very popular but it has been observed that several fruits and vegetables, for example banana, plantain, tomato etc. cannot be stored in the domestic refrigerator for a long period as they are susceptible to chilling injury (Olusunde *et al*. 2009). Apart from this, the epileptic power supply and low income of farmers in the rural communities' makes refrigeration expensive (Ndukwu,2011).Such a situation doesn't only reduce the national income but also leads to malnutrition and socioeconomic problems.

Loss of nutrients from vegetables can be minimized by storing at low temperature by rural technology methods composed from inexpensive locally available material. Utilization of different rural technology methods for preservation of vegetables may help in improving the strategy for the endemic malnutrition in most underdeveloped and developing countries. Both the government and private sector need to invest much effort in research and extension towards improving and modernizing post-harvest facilities for attaining more efficient market infrastructure and distribution channels. Research and extension activities have to be closely coordinated particularly in the public sector for the benefit of farmers, traders, and consumers and this rural technology must be promoted in India.

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Ipomoea muricata - a weed source of manure

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ABSTRACT

Grass land vegetation is the source of the organic matter as it consists of various types of weeds as composite. Weeds are the plants grow unnoticed everywhere. The biomass of weeds is giving highest productivity in monsoon and can be used as best source of different types of weed manures. *Ipomoea muricata* is the common weed found, grows luxuriously on waste land. It can be use to prepare manure by various way. In this investigation attempt has been made to study the effect of various types of *Ipomoea muricata* manure with NPK and Control treatment on yield and nutrient uptake of maize crop. The field experiment was conducted in the Botanical garden at Dr. Babasaheb Ambedkar Marathwada university Research farm. The experiment design was randomized block design with six treatments and four replicate of each. The fresh vegetation of *Ipomoea muricata* was collected from different sites of university campus and used for the preparation of Compost (COM), Dry Leaf Manure (DLM), Green Manure (GM) and Mixed (MIX) compost (with equal amount of *Euphorbia prunifolia +Trianthema portulacastrum+Ipomoea muricata).* The maize (*Zea mays*, African Tall) was grown on these manures in the field and compared with fertilizer (NPK) alone and absolute Control (CON). The chemical analysis of *Ipomoea muricata* manure was done. Growth analysis of maize was carried out during 45 and 78 days. Height of plant, Diameter of stem, total number of leaves, 4th leaf analysis as weight, leaf area was recorded. Tallest plant was obtained with the fertilization of DLM treatment. Numbers of total leaves were more in COM followed by DLM, weight, Diameter of stem was maximum in DLM treatment. The 4^{th} upper leaf showed maximum length in COM than CON treatment.

Key words: *Ipomoea muricata ,* manure, maize, weed

INTRODUCTION:

The green revolution brought impressive gains in food production but with insufficient concern for sustainability. The ill-effects of chemicals used in agriculture have changed the mindset of some consumers of different countries who are now buying organic with high premium for health. Policy makers are also promoting organic farming for restoration of soil health and generation of rural economy apart from making efforts for creating better environment. The National Centre of Organic Farming under Ministry of Agriculture is promoting organic farming as facilitator across the country and providing assistance to organic entrepreneurs and farmers (Bhattacharya and Chakraborty, 2005). The main aims of organic farming are to achieve food and nutritional security, to encourage long term maintenance of soil fertility, crop productivity and soil health, to encourage and enhance biological cycles within the farming system, involving microorganisms, soil flora, soil fauna, plants and animals. Use of organic amendments improves the physical properties of the soil. Yin-Po Wang and Chen-Ching Chao (1995) reported that the bulk density, total porosity and aggregate stability of surface soil improved by the organic farming and this can be attributed to the higher organic matter levels of the organic farming soil.

There are some weed species which are largely available can also be used as organic manures. Weed biomass can be utilized to prepare various types of weed manures *viz*: Green manure, Dry leaf

manure, compost, Vermicompost etc. Green, undecomposed plant material used as manure is called green manure. In Karnataka, *Parthenium, Cassia*, *Chromolaena* and *Portulaca* weeds available in large quantity in both eventurated and waste land. Although *Parthenium* is a toxic weed and it can be used for many purposes such as compost and green leaf manure (Biradar *et al.*, 2006). Green manures are an ideal method of sustaining soil fertility in the tropics (Joergensen, 2002, Fageria, 2007). Many studies in Asia (Katyal *et al*., 2001) highlight the value of green manures. Green manuring offers an inexpensive way of improving crop yields and it takes little extra effort.

Just any plant cannot be used as green manure (Dutt and pugh, 1947). According to Agarwal (1965) an ideal green manure crop should be legume but all weeds are not legume. It is true that all the weeds cannot be recommended to use as green manure (Suryawanshi, 1998). Some non leguminous weeds are good source of organic compost. *Cassia serecia* which has been used to control *Parthenium.* It can also be utilize for composting, as this weed produce high biomass (Angadi *et al.,* 1977). Besides, *Chromolaena ordorata* L. is another obnoxious weed fastly spreading in western ghat region is also useful in composting. (Angadi *et al,* 1977). Sunnhemp (*Crotolaria juncea* L.) and *Sesbania sesban* L. Merr. (Shevari) could be utilized profitably if a part of protein is extracted from them and the fiber left after protein extraction is buried into the soil than the whole plant bused as green manure (Jadhav *et al.,* 1979; Jadhav and Joshi, 1982).

The weed plant have 85-90% moisture content, in monsoon it is not possible to carry such bulky biomass from its source place to practical site or farm place. To overcome this problem attempts had been made that whether it can be used through compost formation or by drying it. Drying method will reduce the bulk up to 85-90% and compost preparation up to 43-50%. Thus making the transport comparatively easier and cheaper. If weed biomass is dried under sun in open space again there is possibility of the loss of nutrients from the vegetation. So it is better to dry it in shade that will minimize the loss of nutrients. The weeds being rich in nutrients and C: N ratio is in a very much narrow range as compared to other wastes so it can produce better quality of compost. Earlier work showed that different weeds can be utilized as source of manure (Naikwade and Jadhav 2011, Naikwade *et al*.,2011a).

Ipomoea muricata is common weed found grow luxuriously on waste land. It can be use to prepare manure by various way. In this investigation attempts has been made to study the effect of various types of *Ipomoea muricata* manure on growth of maize as a test crop.

MATERIAL AND METHODS

Field site and experimental design-

A field experiment was conducted in the Botanical garden at Dr. Babasaheb Ambedkar Marathwada University's Research farm. The experiment design was a randomized block design (RBD) with six treatments and four replicates.

Treatments, composting process and plot size-

The fresh vegetation of *Ipomoea* was collected from different sites of university campus during the early hours of the day at 10-20% flowering stage and brought to laboratory, chopped into small pieces (2-3cm) by the traditional iron cutter (wili). The weed plant material was incorporated into the plots at the rate of 13333 kg/ha^{-1} about 15cm deep in the soil as green manure (GM). The same amount of vegetation was used for the preparation of compost (COM) and Dry leaf manure (DLM). For mixed (MIX) compost treatment three weeds i.e. *Ipomoea muricata + Trianthema portulacastrum + Euphorbia prunifolia* (with 1:1:1 proportion) were used. The known weight of plant material were evenly spread in the pits for compost and mixed compost of about 5cm thickness. Above each layer dung slurry and soil added alternately and afterward water was sprinkled in order to maintain the optimal moisture (50-70%) over the material. Finally the pits were closed with cow dung slurry and fine clay to prevent exchange of gases or loss of heat and aerobic decomposition. The manures after 60 days were applied to appropriate plots including fertilizers (100% NPK) and unfertilized control. The samples (100g) of each treatment were randomly collected immediately in duplicate before materials were applied to the plots and kept in oven at 90^{0}C (48 hr.) for dry weight and nutrient analyses.

 ISBN: 978-93-84663-07-0

Application of mineral fertilizers-

The fertilizers were supplied as nitrogen (N), phosphorus (P) and potassium (K) through urea, single super phosphate (SSP) and muriate of potash at the rate of 120, 80 and 40 kg ha^{-1} to all the treatments except absolute Control (CON). Whole amount of P_2O_5 and K_2O was applied as a basal dose at the time of cultivation for all the plots and N was applied in two equal splits at 35 and 57 days after sowing (DAS) to fertilizer treatment. The Maize (Zea mays L. cv. African Tall) produced by Mahendra hybrid Seeds Co. Ltd.; Jalna was sown at the rate of 100 kg ha^{-1}. Plots consisted of nine rows spaced 30 cm apart and with the size of the plot was 3 x 3 m^2. In order to ensure uniform population density and plant to plant spacing within a row per plot was maintained either transplanting extra seedlings or thinning in the dense population area.

Growth analysis-

The morphological and physiological traits of the crop were noted at 45 and 78 DAS as plant height, diameter, number of leaves per plant and its weight, root, stem, and total weight, 4th upper leaf length, width, weight and leaf area per plant was determined by gravimetric method (Shahane and Mungikar,1984; Mungikar, 1986).

Statistical analysis-

All the results were statistically analyzed using analysis of variance (ANOVA) test and treatments means were compared using the least significant difference (CD, P≤0.05) which allowed determination of significance between different applications (Mungikar, 1997, 2003).

RESULTS AND DISCUSSION

Analyses of organic amendments:

Analysis of weed

Table 1. gives the analysis of *Ipomoea muricata* weed and mixed weeds (*Ipomoea muricata + Euphorbia prunifolia + Trianthema portulacastrum*). The Dry matter of *Ipomoea* weed was more 1771 kg/ha and Mixed weed was with less Dry matter 1529 kg/ha. Nitrogen was more in *Ipomoea muricata* weed (44 kg/ha), while mixed weed shows 32kg/ha. Percentage of Ash, P, K and Carbon was more *Ipomoea* weed than mixed weeds while C: N ratio was more in Mix weeds.

Analysis of weed manures:

Table 2. gives the analysis of various manures prepared from *Ipomoea*. The fresh amount of weed used for different manure preparation was same. Dry matter (kg/ha) was found more in the MIX and less in GM. Nitrogen kg/ha was more in MIX compost and DLM with similar values (45 kg/ha) followed by GM and less in COM. Ash and Carbon percent was more in COM followed by MIX, DLM and less in GM. Percentage of P was more in GM followed by DLM, COM and less in MIX compost. K percent was more in GM followed by DLM and less in COM and MIX compost. Various organic feed stocks have been successfully composted with C:N ratios varying from about 17 to 78 (Mc Gaughey and Gotass, 1953) a much narrower range of ratio between 25 to 35 is considered desirable (Hamoda *et al.,* 1998; Schulze, 1962b). the concern at low C: N ratios is the loss of ammonia (NH_3) (Morisaki *et al.,* 1989) but at higher levels slow rates of decomposition can be anticipated (Finstein and Morrris, 1974). In this experiment C:N ratio was more 37.85 in COMP, followed by MIX 35.76, DLM 4.22 and less in GM treatment.

First Growth analysis-

Table 3 indicates the effect of *Ipomoea muricata* weed manure on growth of maize plant after 45 days as plant height (cm), Diameter, total number of leaves per plant, length, width and weight of 4th leaf, leaf area and fresh weight of root, stem and leaves.

Morphological traits:

Table 3 gives the influence of *Ipomoea* manure on growth parameter of maize plant (45DAS). The tallest plant (149cm) was obtained with the fertilization of DLM treatment. followed in order by COM, MIX, GM, NPK over CON plots where soil available nutrients were not adequate to meet the crop demand. Numbers of total leaves per plant were more in COM and DLM followed by MIX, NPK than CON. Fresh weight, Diameter, of stem was more in DLM followed by MIX, COM, GM than NPK and least in control. Fresh weight of total plant was recorded maximum from DLM treatment followed by MIX, COM, GM and

NPK over the CON plots. Similar trend was observed in fresh weight of stem and leaves but in case of root maximum fresh weight was observed in MIX treatment and minimum in control. The 4th upper leaf showed maximum length in COMP, maximum width and weight in MIX treatment and minimum in CON. Maximum leaf area was recorded in COM followed by MIX, DLM, GM, and NPK than CON.

Table 1. Analysis of weeds

Treatments	Fresh wt.kg/ha		Dry Matter		Nitrogen		Percentage				C/N Ratio
	kg/plot.	kg/ha	%	kg/ha	%	kg/ha	Ash	P	K	Carbon	
Ipomoea muricata	12	13333	13.29	1771	2.50	44	15.50	0.53	0.54	8.99	3.60
MIX (*IPO+EUP+TRI*)	12	13333	11.47	1529	2.12	32	13.65	0.48	0.47	7.92	3.80

Table 2. Analysis of *Ipomoea muricata* weed manure

Treatments	Plant height (cm)	Dia meter (cm)	No of Leaves			Fresh weight (gm/plant)				4th Upper Leaf			Leaf area (cm^2)
			Fresh	Dry	Total	Root	Stem	Leaves	Total	Length (cm)	Width (cm)	weight (g)	
COM	147	1.5	9	3	12	7.39	58.6	42.58	108.6	76.23	6.03	6.20	397
MIX	141	1.6	9	1	11	10.57	66.7	47.24	124.5	67.78	7.15	6.94	388
GM	133	1.5	8	2	10	10.4	48.1	39.87	98.37	65.43	5.55	6.31	349
DLM	149	1.7	10	3	12	10.49	69.7	50.36	130.5	74.85	5.85	5.67	361
NPK	118	1.2	8	2	10	4.62	37.1	26.17	67.88	60.6	5.2	3.77	250
CON	90	0.8	5	3	8	1.38	9.63	10.32	21.33	61.9	3.1	2.28	171
SE	**14.07**	**0.17**				**2.82**	**17.1**	**10.60**	**29.07**				**55**
CD	**29.54**	**0.35**				**6.00**	**36.6**	**22.58**	**61.06**				**115**

Table:3 Growth analysis of maize plant : (Age of plant :45 DAS)

Treatments	Fresh wt.kg/ha		Dry Matter		Nitrogen		Percentage				C/N Ratio
	kg/plot.	kg/ha	%	kg/ha	%	kg/ha	Ash	P	K	Carbon	
COM	7.00	7778	70.00	5444.43	0.75	41	48.95	0.13	0.11	28.39	37.85
MIX	7.50	8333	72.36	6029.97	0.75	45	46.25	0.07	0.11	26.82	35.76
GM	12.00	13333	13.29	1771.95	2.49	44	15.50	0.53	0.54	8.99	3.60
DLM	12.00	13333	14.10	1879.95	2.42	45	17.60	0.34	0.52	10.21	4.22

Ghosh and Sharma (1990) reported that application of organic manures increased the height of rice plants. Similar results were observed in case of growth of maize when compost, vermicompost was used (Naikwade *et al*., 2012). Application of various *Ipomoea* weed manures showed a significant increase in plant height. Total number of leaves and leaf area are related to photosynthesis activity. Mauro *et al.* (2001) had explained leaf area index and leaf angle distribution as important parameters for estimating the exchange of energy and gases in vegetative canopies and finally results in better crop yield.

Second Growth analysis:

Table 4 indicates the effect of *Ipomoea muricata* weed manure on growth of maize plant after 78 days

Morphological traits

Table: 4 Growth analysis of maize plant : (Age of plant :78 DAS)

Treatments	Plant height (cm)	Diameter (cm)	No. Of Leaves			Fresh weight (gm/plant)				4th Upper Leaf			Leaf area cm^2)
			Fresh	Dry	Total	Root	Stem	Leaves	Total	Length	Width	weight (gm)	
COM	186	1.6	8	4	12.0	14.8	152.1	43.60	210.5	76.30	6.5	5.78	434.
MIX	231	1.7	9	4	12.0	18.4	156.5	48.89	223.8	79.10	6.93	5.01	399
GM	221	1.6	8	4	11.5	13.2	136.1	44.22	193.5	80.78	6.65	4.74	317
DLM	234	1.7	9	4	13.0	26.3	217.6	58.36	302.3	75.83	7.20	6.63	384
NPK	192	1.6	8	4	11.7	20.1	132.1	70.06	222.3	64.3	7.18	5.41	328
CON	156	1.3	7	4	10.7	8.82	59.42	29.31	97.55	51.1	5.40	2.82	196
SE	27.70	0.16				5.36	45.65	13.78	56.69				50
CD	58.17	0.33				11.4	97.23	29.35	120.7				106

Table.4 gives the morphological traits of maize plant (78 DAS). The tallest plant was obtained with the fertilization of DLM treatment followed in order by MIX, GM and NPK COMP over CON. Numbers of total leaves per plant were more in DLM followed by COM and MIX with same value, NPK and GM than CON. Diameter of stem was more in MIX and DLM followed by COM, GM than NPK and least in control. Fresh weight of total plant was recorded maximum from DLM treatment followed by MIX, NPK, COM, GM over the CON plots. The 4th upper leaf showed maximum length in GM, maximum width and weight in DLM treatment and minimum in CON. Maximum leaf area was recorded in COM followed by MIX, DLM, NPK, and GM than CON. On the basis of statistical analysis it has been observed that all the values of weed manure treatments are significant over control. The results are in accordance with Naikwade *et al*.,(2011b) where growth was enhanced in spinach by weed manure application.

Various organic amendments prepared from *Ipomoea muricata* are the superior than the Fertilizer (NPK) and Control treatments. Based on the data, it reveals that the growth of maize increased significantly due to the application of various types of *Ipomoea muricata* manures. Dry leaf manure amendment is better suitable manure because it balances plant nutrition to meet the need of crops good quality. It improved the nitrogen supplying property to avoid negative effect of excessive use of N on the quality. Dry leaf manure enhanced the growth, nutrient uptake in maize crop, without any adverse effect. Dry leaf manuring is the easier, convenient and safer method of manuring. The preparation of dry leaf manure will minimize the transport problem at a large extent by reducing the bulk. Hence the practice of *Ipomoea* manuring i.e. composting, mix composting and application of Dry leaf manure will certainly helpful to reduce the use of chemical fertilizers and increase the organic area.

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STUDIES ON SEASONAL TREND IN SEA WATER QUALITY OF RATNAGIRI COAST, MAHARASHTRA, INDIA

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ABSTRACT

Coastal areas are ideal locations for many industries, particularly power plants, both nuclear and conventional. Thermal and chemical pollution are two important ecological problems associated with this because of the effluents containing harsh chemicals in drastic levels which may endanger the endemic population of marine life. The present investigation was carried out to assess sea water quality of Ratnagiri coast. Water samples were collected from five selected sampling stations along the coast for the monsoon, pre monsoon and post monsoon period during February 2011 to January, 2012. Various physicochemical parameters such as Temperature, pH, Conductivity, Total Solid (TS), Total Dissolve Solids (TDS), Turbidity, Salinity, Dissolved Oxygen (DO), Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD) and nutrients like sulphate (SO_4^-) phosphate (PO_4^-), Nitrate (NO_3^-) and Ammonia (NH_3) were analyzed to assess the spatial and temporal variation in the quality of sea water. Present study revealed that Ratnagiri coastal water is polluted from diffuse and direct sources of agricultural, urban and industrial pollutants.

Key words*: BOD, COD, Nitrate, Physicochemical, Phosphate, Water quality.*

Introduction:

The marine environment is a complex system mainly influenced by physical, chemical and biological processes. The chemistry and biology of coastal waters are very vulnerable to additions of biodegradable and stable compounds from land. Marine environmental management is assessed by proper assessment of water quality. Marine water quality monitoring is required to predict changes in the quality of a particular marine environment, so that curative or prevention measures can be taken to restore and maintain the ecological balance in the habitats. Estuarine and coastal areas are complex and dynamic aquatic environment (Morris, *et. al*. 1995). Domestic sewage and industrial effluents are discharged in the water courses in and around India in untreated or partially treated form. These, add a variety of pollutants which include certain toxic heavy metals and metalloids (Sankpal and Naikwade, 2012a). The total volume of all discharges from the environs of Mumbai was around 365 million tons (MT) per year (Sabnis, 1984). Similar discharges from the environs of Kolkata are around 350MT every year (Ghose *et al.,* 1973). India is predominantly an agricultural country hence large quantities of pesticides, herbicides, fungicides, etc. are used in agriculture which indirectly causes water pollution.

Hydro biological studies by Ganpati (1960), Sinha and Shrivastava (1992), have shown that urbanization is the root cause of water pollution. Rapid industrialization and tourism related activities in the coastal zone, disposal of municipal wastes, industrial wastes and numerous recreational and commercial activities that not only degrade the quality of coastal water but also pose a serious health hazard to marine biotas and human (Rama Devi *et al*., 1996). Pollution of marine water affect on biodiversity of mangroves and other aquatic flora and fauna (Naikwade and Sankpal 2012, Naikwade *et al*., 2012). The fluxes of trace elements that have been modified biogeochemically in estuaries and coastal

waters are transported to the open ocean and the original composition of seawater is altered (Ackroyd *et al.,* 1986; Saager *et al*., 1997). Nutrients are the dissolved inorganic forms of Sulphate, Nitrates, Phosphates etc. utilized by photosynthetic organisms in the formation of organic matters (Saha *et.al*., 2001). Nitrogen and phosphorus are described as being biolimiting elements because the concentrations of these elements limit biological growth (Ghosh *et. al.,* 1992).

Ratnagiri district is one of the most important maritime districts of the state with the coastal belt extending to about 200 Km. Ratnagiri is an important coastal area of Maharashtra with average rainfall about 2500 mm. Most of the activities in this area are connected with sea. Recently several chemicals, pharmaceuticals companies and some power plants are grown up along the coastal region. Developmental activities like Konkan Railway Project, Enron electricity project, proposed marine highway, Cargo Ports are attracting more tourism industries in this region which directly or indirectly causes Environmental Pollution. The marine area is presently receiving water with a variety of effluents which may be potentially contaminating, including elevated levels of pollutants (Agard *et al.,* 1988). Very little work is done on the spatial and temporal quality of water of Ratnagiri coast. The present study evaluates the influence of various physicochemical parameters on coastal water quality of Ratnagiri coast.

Material and Methods:

For the present study, five sampling sites were chosen along the Ratnagiri coast (shown in table no.1). Water samples for physical and chemical parameter determination were collected monthly from the sampling station with the help of clean plastic container well cleaned with non-ionic detergent, rinsed with tap water and finally washed with deionized water prior to usage. The samples were collected during high tides. Monthly samplings were made during forenoon from February 2011 to January, 2012 for three season's viz. monsoon, post-monsoon and pre-monsoon. While collecting samples contamination of the sample was avoided with any foreign material. Collected samples were brought to laboratory and stored to the refrigerator at 4^{o}C temperature. Selected physicochemical parameters such as Temperature, pH, Conductivity, total Solid (TS), Total dissolve solids (TDS), Turbidity, Salinity, Dissolved Oxygen (DO), Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD) and nutrients like sulphate (SO_4^-) phosphate (PO_4^-), Nitrate(NO_3^-) and Ammonia(NH_3) were analyzed according to APHA (1995), Trivedy and Goel (1986) and Strickland and Parsons (1972). Atmospheric and surface water temperatures were measured using thermometer. Turbidity measured using Nephelometer. Salinity was estimated with a hand refractometer. pH value was measured using pH meter. Dissolved oxygen was estimated by the modified Winkler's method. BOD and COD were measured by titration method. The nutrients viz. Sulphate, Phosphate, Nitrate, and Ammonia were determined using UV-Visible spectrophotometer.

Results and Discussions:

Physico-chemical Parameters

The climate of Ratnagiri is typical of monsoon regions. The surface water temperature varied from 21^{o} C to 25^{o} C. While low temperatures were recorded in post monsoon, high temperatures were recorded in pre-monsoon season (Summer). The recorded high value during summer could be attributed to high solar radiation (Ajithkumar *et al.,* 2006; Ashok Prabu *et al*., 2008; Rajkumar *et al*., 2009). The temperature plays a crucial role in physical-chemical and biological behavior of aquatic system.

Salinity value decreases in monsoon period and higher in pre and post monsoon season.The high value of salinity was recorded 5.55mg/l at station S1 in pre monsoon while low value was 1.76 mg/l recorded at station S5 in monsoon season due to the heavy rainfall and discharge of river water. High evaporation rates in the presence of low freshwater inflow can lead to higher values of salinity. (Balasubramanian and Kannan, 2005; Sridhar *et al*.,2006; Asha and Diwakar, 2007).

Table No.1 : longitude and altitude of selected sites along the coast

Sr. No.	Name of the sites	Longitude and Latitude
S1	Kasarwelly	17^0 03'10.04" N 73^0 17'10.56" E
S2	Sadamirya	17^0 02'16.53" N 73^0 16'25.56" E
S3	Mirya	16^0 59'32.93" N 73^0 16'40.98" E
S4	Bhatye	16^0 58'48.00" N 73^0 17'37.90" E
S5	Ranpar	16^0 59'32.93" N 73^0 17'10.52" E

Table No 2: Physicochemical parameters along the study sites during monsoon season.

Parameters/Sites	S1	S2	S3	S4	S5	Mean	SD
Temperature(^{0}C)	23.22	23.57	23.47	23.67	22.78	23.34	0.356
pH	6.65	6.46	6.7 0	7.38	7.15	7.27	0.428
Conductivity (mS/ cm)	16.82	16.92	16.91	16.28	16.42	16.67	0.299
TS (g/l)	39.72	40.24	39.61	39.43	39.98	39.8	0.318
TDS (g/l)	48.54	48.30	49.19	48.73	48.52	48.66	0.335
Turbidity (NTU)	6.16	6.27	6.73	7.03	6.92	6.62	0.389
Salinity(mg/l)	1.86	2.10	1.92	1.82	1.76	1.892	0.130
DO(mg/l)	7.95	7.96	8.02	7.89	8.23	8.01	0.131
BOD(mg/l)	0.65	0.67	0.62	0.56	0.65	0.63	0.043
Nitrate (mg/l)	16.67	16.77	20.25	21.12	21.27	19.22	2.312
Sulphate (g/l)	3.32	3.82	3.62	3.81	3.28	3.57	0.259
Phosphate (mg/l)	0.27	0.23	0.19	0.24	0.23	0.23	0.029
Ammonia (mg/l)	0.06	0.09	0.04	0.05	0.06	0.06	0.018

Table No 3: Physicochemical parameters along the study sites during pre monsoon season.

Parameters/Sites	S1	S2	S3	S4	S5	Mean	SD
Temperature(^{0}C)	25.72	25.17	25.47	25.37	24.98	25.34	0.283
pH	7.45	7.86	7.78	7.78	7.95	7.76	0.189
Conductivity (mS/ cm)	17.82	17.12	17.81	17.58	17.32	17.53	0.307
TS (g/l)	33.62	34.24	34.51	34.23	34.28	34.18	0.331
TDS (g/l)	42.34	43.30	42.69	42.33	42.542	42.64	0.398
Turbidity (NTU)	5.86	5.67	5.83	6.03	5.92	5.86	0.132
Salinity(mg/l)	5.55	5.13	5.17	5.44	5.43	5.34	0.184
DO(mg/l)	7.15	7.15	7.0	7.09	7.72	7.22	0.285
BOD(mg/l)	0.95	0.84	0.87	0.72	0.86	0.85	0.082
Nitrate (mg/l)	11.21	11.29	10.82	11.06	12.02	11.28	0.451
Sulphate (g/l)	3.27	3.15	3.17	3.15	2.97	3.14	0.108
Phosphate (mg/l)	0.09	0.11	0.07	0.08	0.08	0.09	0.015
Ammonia (mg/l)	0.01	0.04	0.03	0.02	0.03	0.03	0.011

 ISBN: 978-93-84663-07-0

Table No 4: Physicochemical parameters along the study sites during post monsoon season.

Parameters/Sites	S1	S2	S3	S4	S5	Mean	SD
Temperature(^{0}C)	21.62	21.82	21.27	21.45	21.18	21.468	0.260
pH	6.62	6.18	6.23	6.42	6.23	6.336	0.183
Conductivity (mS/ cm)	15.42	15.62	15.92	15.72	15.78	15.692	0.187
TS (g/l)	32.26	32.32	32.87	32.43	32.35	32.446	0.245
TDS (g/l)	39.26	39.82	38.98	39.72	39.82	39.52	0.380
Turbidity (NTU)	5.11	4.98	4.92	4.82	4.92	4.95	0.106
Salinity(mg/l)	3.55	2.23	2.12	2.34	2.18	2.48	0.601
DO(mg/l)	6.45	6.34	6.53	6.35	6.37	6.408	0.081
BOD(mg/l)	0.54	0.56	0.61	0.51	0.52	0.548	0.040
Nitrate (mg/l)	13.67	13.47	13.72	14.53	13.82	13.842	0.405
Sulphate (g/l)	2.92	2.92	2.86	2.91	2.91	2.904	0.025
Phosphate (mg/l)	0.11	0.14	0.13	0.12	0.14	0.128	0.013
Ammonia (mg/l)	0.06	0.05	0.05	0.06	0.06	0.056	0.005

Table No 5: Correlation between Physicochemical parameters along the study sites during monsoon season.

	Temp.	pH	Conductivity	TS	TDS	Turbidity	Salinity	DO	BOD	Nitrate	Sulphate	Phosphate	Ammonia
Temp.	1												
pH	-0.14	1											
Conductivity	0.19	-0.97	1										
TS	-0.30	-0.55	0.40	1									
TDS	0.21	0.16	0.07	-0.70	1								
Turbidity	-0.08	0.87	-0.79	-0.48	0.43	1							
Salinity	-0.13	-0.25	0.20	-0.17	-0.24	-0.63	1						
DO	-0.89	0.16	-0.17	0.39	-0.05	0.31	-0.33	1					
BOD	-0.47	-0.75	0.64	0.87	-0.52	-0.70	0.18	0.42	1				
Nitrate	-0.20	0.83	-0.72	-0.48	0.51	0.98	-0.61	0.42	-0.63	1			
Sulphate	0.91	-0.04	0.05	-0.06	0.07	0.11	-0.47	-0.66	-0.41	-0.03	1		
Phosphate	-0.16	0.07	-0.22	0.02	-0.66	-0.42	0.81	-0.27	0.10	-0.47	-0.32	1	
Ammonia	0.04	-0.49	0.30	0.87	-0.88	-0.58	0.02	-0.05	0.65	-0.65	0.21	0.33	1

 ISBN: 978-93-84663-07-0

Table No 6: Correlation between Physicochemical parameters along the study sites during Pre monsoon Season

	Temp.	pH	Conductivity	TS	TDS	Turbidity	Salinity	DO	BOD	Nitrate	Sulphate	Phosphate	Ammonia
Temp.	1												
pH	-0.93	1											
Conductivity	0.84	-0.71	1										
TS	-0.57	0.82	-0.28	1									
TDS	-0.43	0.45	-0.69	0.38	1								
Turbidity	0.08	-0.05	0.40	-0.04	-0.88	1							
Salinity	0.31	-0.51	0.38	-0.71	-0.85	0.70	1						
DO	-0.70	0.48	-0.47	0.02	-0.10	0.18	0.33	1					
BOD	0.37	-0.51	0.30	-0.51	0.03	-0.46	0.13	0.12	1				
Nitrate	-0.71	0.44	-0.58	-0.08	0.00	0.08	0.32	0.98	0.13	1			
Sulphate	0.92	-0.87	0.59	-0.55	-0.10	-0.20	0.07	-0.83	0.29	-0.77	1		
Phosphate	-0.15	-0.04	-0.65	-0.35	0.67	-0.68	-0.23	-0.04	0.11	0.15	0.19	1	
Ammonia	-0.74	0.82	-0.74	0.74	0.87	-0.59	-0.86	0.16	-0.22	0.18	-0.52	0.32	1

Table No 7 Correlation between Physicochemical parameters along the study sites during Post monsoon season

	Temp.	pH	Conductivity	TS	TDS	Turbidity	Salinity	DO	BOD	Nitrate	Sulphate	Phosphate	Ammonia
Temp.	1												
pH	0.20	1											
Conductivity	-0.71	-0.71	1										
TS	-0.51	-0.39	0.81	1									
TDS	0.21	-0.28	-0.15	-0.67	1								
Turbidity	0.47	0.46	-0.74	-0.40	-0.32	1							
Salinity	0.76	-0.38	-0.14	0.04	0.01	0.25	1						
DO	-0.35	0.15	0.27	0.72	-0.98	0.28	-0.07	1					
BOD	-0.01	-0.38	0.40	0.76	-0.73	0.18	0.53	0.76	1				
Nitrate	-0.33	0.28	0.21	0.05	0.21	-0.72	-0.58	-0.27	-0.56	1			
Sulphate	0.57	0.36	-0.79	-0.99	0.72	0.32	0.03	-0.78	-0.77	0.02	1		
Phosphate	-0.16	-0.96	0.55	0.13	0.46	-0.34	0.31	-0.31	0.18	-0.35	-0.12	1	
Ammonia	-0.27	0.65	-0.38	-0.56	0.29	0.00	-0.83	-0.31	-0.85	0.56	0.51	-0.49	1

Variation in the pH value can affect the rate of biological reactions. The pH of coastal water responds to changes in dissolved carbon dioxide concentration, alkalinity, hydrogen ion concentration and

in a small way to temperature. The decomposition of organic matter in the presence of dissolved oxygen increases the carbon dioxide content of water and lowers the pH. In present study the pH value remains alkaline throughout the year. pH value varied from as low 6.18 in the late monsoon period and high as 7.95 in summer. The recorded high pH values might be due to the influence of seawater penetration and high biological activity (Balasubramanian and Kannan, 2005).

Total Solids value observed high during monsoon period i.e. 40.24 g/l at S2 while lowest in post monsoon period i.e. 32.26 g/l at S1. While total dissolve solids varies between 39.26 to 49.19 g/l. Higher values were observed during monsoon and lower during post monsoon period. The conductivity of an aqueous medium is an indication of its ability to conduct an electric current. The conductivity of seawater in any season is determined by the presence of total concentration ions, mobility, valence, relative concentrations and the temperature of the system.

Conductivity of surface water varied in the range 15.42-17.82mS/cm.

The causes of seawater turbidity include waste discharge, urban run-off, bottom feeders that stir up sediments, wave and current actions (especially in less deep areas). Turbidity shows higher value during monsoon period and lower during post monsoon period. Higher value 7.03 NTU at S4 while lower 4.82 NTU at same site.

Oxygen solubility varies inversely with salinity and water (Saravanakumar *et al*., 2008). Dissolved oxygen consumption and production are influenced by plant and algal biomass, light intensity and water temperature. In present study DO varied from 6.34 to 8.23 mg/l. The low values are found in post monsoon when temperature is high. Highest values are found in monsoon period. Coastal discharges of wastes rich in organic carbon from sewage treatment plants and other industries are produced in large quantities in urban population centers, and can substantially reduce dissolved oxygen concentrations.

The BOD value is high during pre monsoon period i.e. 0.95 mg/l at S1 compared to the post monsoon 0.51 mg/l at S4. These BOD values are in the range normally recorded for healthy costal water. The low value indicates low organic pollution in study area. Biochemical Oxygen Demand (BOD) depends on temperature, extent of biochemicalactivities, concentration of organic matter and such other related factors. Maximum value of BOD was observed in Premonsoon period due to the maximum biological affinity at elevated temperature and low in winter (Ghavzan, *et. al.*; 2006) due to reduced flow of riverine water.

The chemical characteristics of seawater provide an insight into the existing health status of the marine environment. Nitrate ions (NO_3^-), ammonia (NH_4^+, NH_3), phosphate ions (PO_4^{3-}) and sulphate ions (SO_4^{2-}) are the ionic forms of the essential nutrients nitrogen, phosphorous and sulphur respectively, which are essential to growth and reproduction of plants and animals. Generally, nutrients enter the marine environment through urban storm water run-off, irrigation drainage, agricultural run-off, etc. via creeks, rivers and estuaries.

Aquatic species depend on the surrounding water to provide their nutrients. Although a wide variety of minerals and trace elements can be classified as nutrients, those required in most abundance by aquatic species are nitrate and phosphate (Peavy *et.al.,* 1985). While nitrogen and phosphorus occur in nature and are critical to plant life in the marine environment, too much of the nutrients cause an excessive growth of phytoplankton and other organisms, which deprive marine life including fish and plants of oxygen.

Nitrogen exists in water both as inorganic and organic species, and in dissolved and particulate forms. Inorganic nitrogen is found both as oxidized species nitrate (NO_3^-) and nitrite (NO_2). During pre-monsoon period, Nitrate values ranged from11.21 to 12.02 mg/l, while during post-monsoon period it was 13.47 to 14.53 mg/l and in monsoon period 16.67 to 21.27 mg/l. The concentration of nitrate is very high during monsoon season. Levels of nutrients, such as nitrogen, affect the overall health of an aquatic ecosystem and can have both positive and negative effects, depending on their concentrations (Caffrey *et al*., 2003). Presence of NO_3^- ion could be due to the anthropogenic sources like domestic sewage, agricultural wash offs and other waste effluents containing nitrogenous compounds.

During pre-monsoon, the phosphate values ranged from 0.07 to 0.09 mg/l and 0.11 to 0.14 mg/l during post-monsoon and 0.14 to 0.27 mg/l during monsoon period. L. Mathew and Pillai (1990) reported that the higher concentration of phosphate in coastal waters might be enriched by freshwater drainage. The addition of super phosphates applied in the agricultural fields as fertilizers and alkyl phosphates used in households, as detergents can be other sources of inorganic phosphates during the season (Bragadeeswaran *et al.,* 2007).

Sulphate value observed higher during monsoon region while lower during post monsoon period. Value ranger form 3.27 mg/l to 2.97 mg/l during pre monsoon, 2.86 to 2.92 during post monsoon and 3.28 to 3.82 during monsoon period.

The occurrence of the different forms of ammonia depends on pH value of the coastal water. In this study observed concentration of ammonia was less than nitrate and phosphate. Ammonia concentration was minimum in pre monsoon period and maximum was observed in monsoon period. Lower concentration of ammonia indicates minimal influence of industrial effluents.

Correlation Analysis:

For the purpose of further discussion, correlation analyses were performed on the water physicochemical parameters to see how they all relate with each other during the period of this study. The study of correlation reduces the range of uncertainty associated with decision making. The correlation coefficient analysis was done by using VBA Analysis tools and the data were depicted in Table Nos 5, 6 and 7. Correlation between two parameters provides a strong indication for a single reason for their variation.

During monsoon season the high positively correlated ($p < 0.01$) value was found between the Turbidity and pH (0.87), Nitrate and pH (0.83), Sulphate and Temperature (0.91), TS and BOD (0.87), TS and Ammonia (0.87), Nitrate and Turbidity (0.98 and Phosphate and Salinity (0.81). Strong negative correlation observed between DO and Temperature (-0.89), Conductivity and pH (-0.97), Turbidity and Conductivity (-0.79), TS and TDS (-0.70), TDS and Ammonia (-0.88) and BOD and Turbidity (-0.70).

During Pre monsoon season the temperature shows high positive correlation with Conductivity and sulphate (0.84 and 0.92), pH with TS and Ammonia (0.82 and 0.82), TS with Ammonia (0.74), Ammonia with TDS (0.87) and DO with Nitrate (0.98) while high negative correlation was observed between Temperature with pH, DO and Nitrate (-0.93, -0.70,-0.71) pH with Conductivity and Sulphate (-0.71, -0.87), Conductivity with ammonia (-0.74), TS with Salinity (-0.71), TDS with Turbidity and Salinity (-0.88,-0.85), Salinity with Ammonia (-0.86), DO with sulphate (-0.83) and Nitrate with sulphate (-0.77).

In post monsoon season the temperature shows high positive correlation with salinity (0.76), pH with TS with DO and BOD (0.72 and 0.76) and DO with BOD (0.76) while high negative correlation was observed between Temperature with Conductivity (-0.71) pH with Conductivity and Phosphate (-0.71, -0.96), Conductivity with Turbidity and Sulphate (-0.74, -0.79), TS with Sulphate (-0.99), TDS with DO (-0.98), Turbidity with Nitrate (-0.72), DO with Sulphate (-0.78), BOD with sulphate and Ammonia (0.77, -0.85).

The sample sites were selected depending upon the industrial activities taken place around the coast. This study reveals that all sites show higher fluctuation in physicochemical parameters. Waste water discharge from sewage and industries are major component of water pollution in Ratnagiri coast (Sankpal and Naikwade, 2012 b). The impact of waste from power plant also plays an important role in sea water pollution (Govindraju *et. al.,* 2011).

The health of Ratnagiri coastal water is at verge of pollution. All the hydrographical and physicochemical parameters studied showed noticeable seasonal as well as spatial variations. Several parameters shows significant high value which is attributed due to direct discharge of effluent from chemical industries which are located along the coast. Proper precautions should be taken by pollution controlling authority to avoid further pollution of Ratnagiri coast. Appropriate management strategies are needed to ensure the sustainable development and management of coastal areas and their resources.

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Use of Algae as Source of Biofuel

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ABSTRACT

Economic, environmental and energy security concerns resulting from excessive reliance on petroleum are forcing the world over to shift to alternatives like biofuel. Microalgae have been described as nature's very own power cells and could provide alternatives to petroleum-based fuels without competing with crops. Research is being undertaken to uncover novel microalgal compounds that could provide alternatives to those from petrochemical sources. The oil they produce can then be converted into liquid fuel such as biodiesel. Since they do not need herbicides and pesticides algae appear to be a high potential feedstock for biofuel production. The real advantage of microalgae over plants lies in their metabolic flexibility, which offers the possibility of modification of their biochemical pathways (e.g. towards protein, carbohydrate or oil synthesis) and cellular composition. There are a variety of ways to produce biofuel with algae. Biofuel can be produced from various sources, but yield estimates are significantly higher for algae than for any other crop. Producing algal biofuel exploits the ability of algae to produce oils using only sunlight, carbon dioxide and water. Microalgae accumulate oil as nonpolar storage lipids, such as triacylglycerides. Oils from algae can yield biodiesel through transesterification and gasoline (petrol) or jet fuel through distillation and cracking. Biofuels made from renewable resources could be a more sustainable alternative, particularly if sourced from organisms, such as algae, that can be farmed without using valuable arable land. Climate change mitigation, economic growth these concerns have increased the interest in developing second generation biofuels produced from non-food feedstock such as algae, which potentially offer greatest opportunities in the longer term.

Key Words: Algae, biofuel, energy, production, strategy

INTRODUCTION

Steady increase in oil price and diminishing sources of petroleum products added many problems not only for people of underdeveloped countries but also for developed countries in the world. Biofuel could be the possible solution for this problem (Demirbas, 2000; Kinney and Clemente, 2005). Economic, environmental and energy security concerns resulting from excessive reliance on petroleum are forcing the world over to shift to alternatives like biofuel (Federico, 2005). Biofuels are solution to issues such as sustainable development, energy security and a reduction of greenhouse gas emissions etc

In addition biofuels are less polluting than their fossil fuel. Environmental concerns and the desire to be less dependent on imported fossil fuel, have intensified worldwide efforts for production of biodiesel from different sources such as biofuel crops, vegetable oils, sugar producing crop and algae. India is a huge importer of crude oil and spends about Rs. 1,200 billion of foreign exchange every year to meet 75% of its oil needs (Anand, 2006). This has affected its balance of payment adversely, especially after the unprecedented rise in crude oil prices. Economic, environmental and energy security concerns resulting

from excessive reliance on petroleum are forcing countries the world over to shift to alternatives like biofuels in the form of ethanol and biodiesel (Farrell *et al*.,2006).

Biofuel production worldwide scenario

World energy scene is undergoing a period of transition. As the inevitability of exhaustion of fossil fuels is becoming increasingly intensive, efforts are on to find and use substitute form of energy. Biodiesel is a fast-developing alternative and is viable and sustainable fuel. With the provision of addition of 5-10% of ethanol in petrol and diesel in most of the crude oil importing countries, there has been a substantial rise in ethanol production in last few years.

Biofuels in general have often been categorized as first and second generation. The first generation biofuels are the fuels which are produced from conventional agricultural crops by well-established technologies such as biodiesel from oil crops and ethanol from sugar and starch producing crops. The second-generation biofuels on the other hand are produced from the agricultural waste, algae etc. Biomass resources supply over 14% of the world's energy needs (Demirbaş and Demirbaş, 2003; McKendry, 2002).

The assessment of sustainable biomass resource potential plays a major role in planning future energy activities of any country where biomass is the main renewable energy source (Perera *et al*.,2003). There are several reports in which thousands of plant species that produce enormous amount of hydrocarbons have been identified and recommended for cultivation as bio-energy crops (Roth *et al*.,1982; Marimuthu *et al*.,1988; Chynoweth 2004). There are several reports of plant species evaluated for their potential as an alternate source of energy and hydrocarbon (Buchanan *et al*.,1978, Carr *et al*.,1985; Carr and Bagby, 1987; Roth *et al*.,1982; Wang and Huffman 1981). Research is being undertaken to uncover novel microalgal compounds that could provide alternatives to those from petrochemical sources. Microalgae can be grown in large bioreactors and continually harvested unlike crops or macro algae. They could be grown using the waste CO2 from industrial processes, power stations or waste treatment plants. The oil they produce can then be converted into liquid fuel such as biodiesel.

Research on renewable oils as diesel fuel was conducted at least 100 years ago but the interest lagged because of cheap and potential supplies of petroleum tools. Presently, the known world wide resources are predicted to be conserved in about 40 years (William, 2006). Feared shortages of petroleum fuels due to rapid depletion and increased pollution due to increased green house gas emission (CO_2, NO_2, CFCs, SO_2) and rapid depletion of ozone layer and stringent emission norms have rekindled interest in renewable oil fuels.

Biofuel Strategy for India

India is the second most populous country in the world and meeting its energy requirements in a sustainable manner continues to be a major challenge. The world annual biodiesel production is about 3,500 million liters (William, 2006). India consumes more than 250 million tonnes of fossil fuels every year. This comprises of approximately 40 million tonnes of diesel. India is ranked fifth in the world after China, Japan, Russia and the U.S. in terms of fossil fuel consumption. In India the Planning Commission, Government of India launched "National Mission on Biodiesel" with a view to find a cheap and renewable liquid fuel based on vegetable oils (Shukla, 2005). Domestic supply of crude oil meets only about 22% of the demand for surface transportation in India, while the rest is being met from imported crude. As a result there will be tremendous savings to the country's foreign exchange reserve. Algae can be used as source of biofuel in India also. In countries where algae are not utilized to the fullest extent, it is needed to exploit algae instead of letting this potential energy resource rot away. This is true in India and there is already a report by Rao *et al.* (1978) supporting such possibilities. Lately, an identical approach has been reported by Rantenbach (1981).

Algae to energy options

Algae are a diverse group of eukaryotic photosynthetic organisms that constitute over 40,000 species. They can be single-celled (unicellular) or multicellular such as seaweed. Microalgae have been described as nature's very own power cells and could provide alternatives to petroleum-based fuels without competing with crops. Since algae do not need herbicides and pesticides (Brennan and Owende

2010), it appears to be a high potential feedstock for biofuel production. The sea bed system for seaweed cultivation in China has not changed much since it was invented in the 1950s, although options for modernization have been identified (Tseng 2004). Some countries, such as Chile, are important seaweed producers, but rely completely on the harvesting of natural populations (Vásquez 2008). There are a variety of ways to produce biofuel with algae. Figure 1 provides an overview of the options, which are explained in detail in FAO (2009).

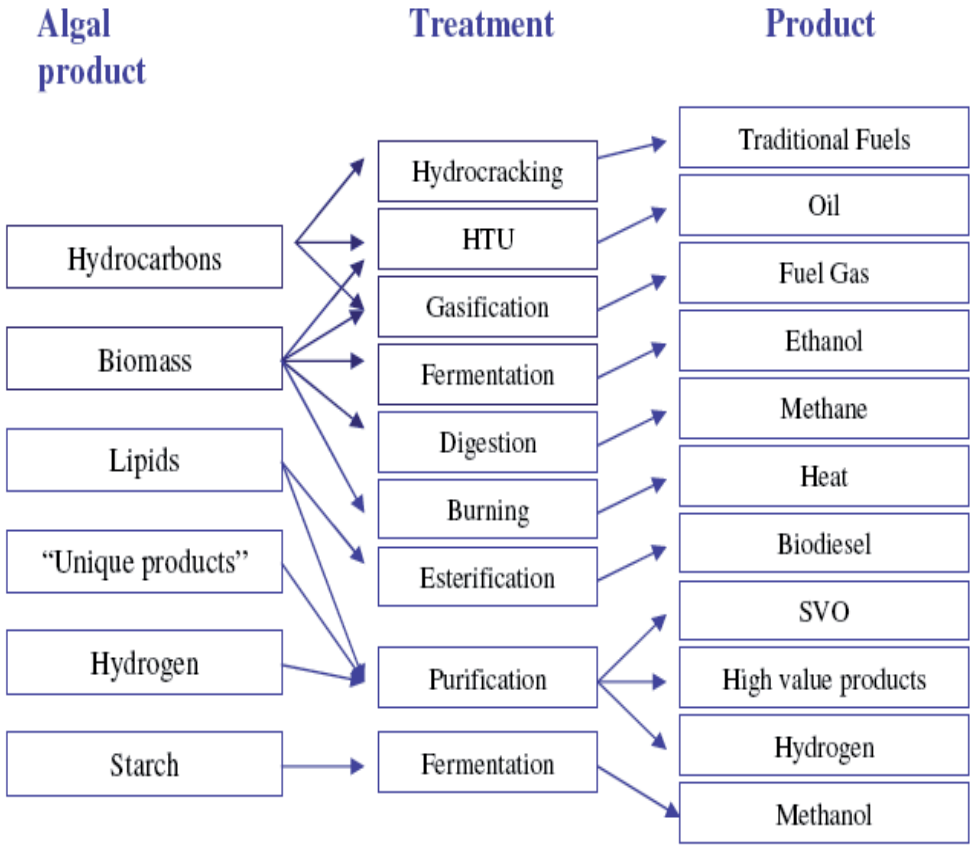

Fig.1. Overview of algae to energy options (FAO 2010)

Biofuel production from Algae

Biofuel can be produced from various sources, but yield estimates are significantly higher for algae than for any other crop. Producing algal biofuel exploits the ability of algae to produce oils using only sunlight, carbon dioxide and water. Microalgae accumulate oil as nonpolar storage lipids, such as triacylglycerides (Guschina and Harwood, 2006). The photosynthetic and cellular membranes of algae also contain polar lipids, such as glycolipids, phospholipids and sterols. Oils from algae can yield biodiesel through transesterification (Amin, 2009), and gasoline (petrol) or jet fuel through distillation and cracking (Luo *et al*.,2010). Algae are almost ideal as organisms for developing the highly productive and robust crop strains that are essential for economically viable biofuel production.

Moreover, algal cultivation can use the large amount of non-arable land available for development without displacing food production, and its relatively high demand for water can be met by using low-quality sources such as waste or salt water (Wigmosta *et al*.,2011). In agricultural production, microalgae are cultivated in open ponds, with sunlight driving photosynthetic growth. This method uses non-arable land, consumes large amounts of CO2 during the biomass production phase and, in principle, is extraordinarily scalable limited only by space and capital costs. But growing algae efficiently and

sustainably in fully exposed outdoor ponds is difficult and suitable cultivation systems and practices are still under development.

Industrial production uses similar processes to industrial microbial fermentation in which yeast or bacteria are used as biorefining agents to produce food, beverages or high-value biotechnology products. For algae, production is driven by sunlight (in a photobioreactor) or reduced carbon sources such as sugar (in a fermentation reactor). Fermentation occurs in complete darkness and is identical to that of bacteria or yeast, which, as mature industrial technologies, have many of the systems and processes needed for algal fermentation already in place (Georgianna and Mayfield, 2012). Fig.2 give details of integrated algal production with various co products.

Photosystems within algae have evolved in response to their natural environments, and photosynthetic complexes are often remodeled in response to light, temperature or nutrient limitations (Moseley, *et al*. 2002) . Photosynthesis eliminates the need for costly organic carbon sources. However, media that can support a rich algal growth still require nutrients in the form of nitrogen, phosphorus and potassium, which are expensive (Rosch *et al*.,2012) and in the case of phosphorus limited (Gilbert, 2009). The cost can be managed by locating algal ponds or bioreactors near nutrient-rich wastewater streams, or by using feed sources such as anaerobic digester waste effluents (Yang *et al*.,2011).Efforts to improve photosynthetic efficiency have not been specific to algae; as a strategy, it has been proposed for increasing the yield of land plants to keep pace with increasing food demand where usable crop land is limited (Zhu *et al*.,2010) The genomes of most chloroplasts are capable of high rates of homologous recombination, and targeting specific genes in these organelles is not difficult in most species. Optimizing antenna size is also being considered in production systems as a potential means to limit the effect of shading and improve overall photosynthetic efficiency (Ort *et al*.,2011 Beckmann, *et al*. 2009) Strain development and process engineering are needed to make algal biofuels practical and economically viable (Georgianna and Mayfield, 2012).

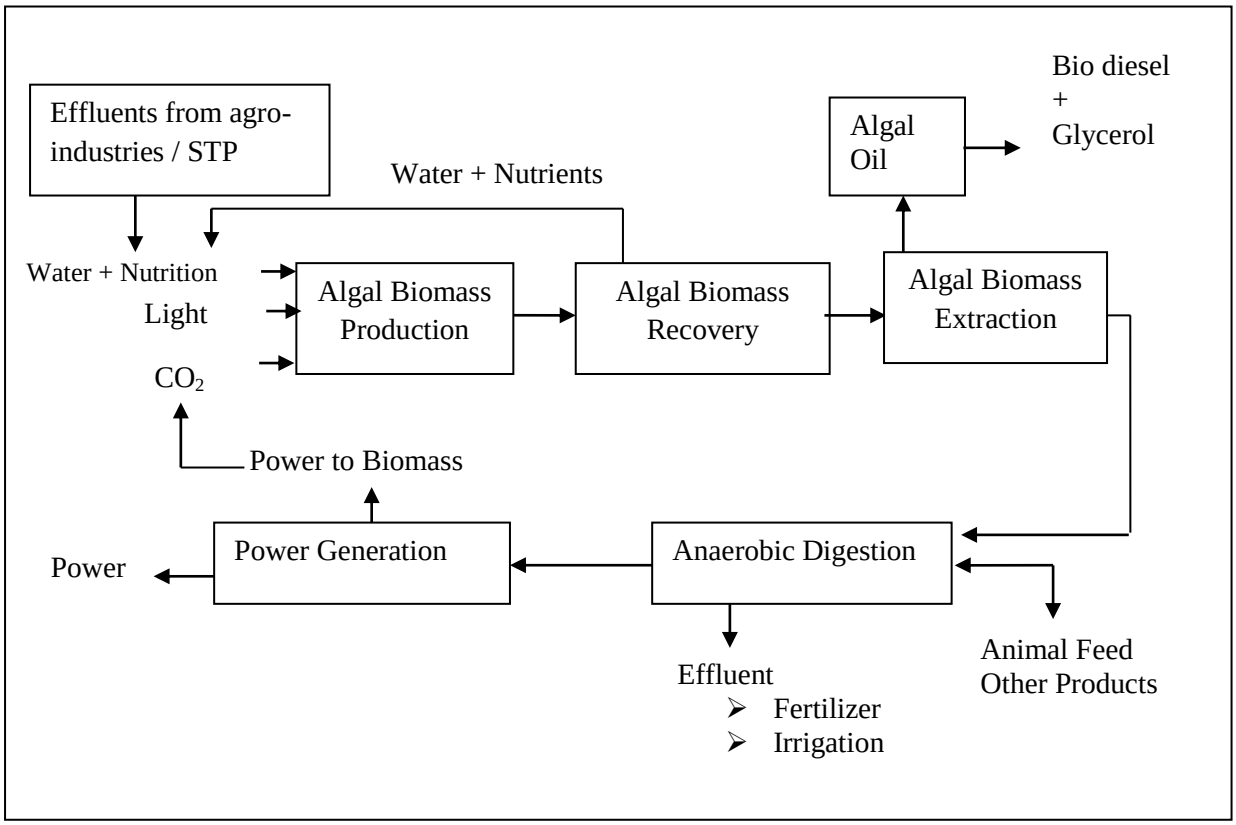

Fig.2. Integrated algal production concept with various co products (Khan, Rashmi *et al*.,2009)

Crop protection is essential for outdoor pond systems and closed bioreactors. Pathogens of algae are extraordinarily diverse and include viruses, bacteria, fungi and other eukaryotes (Gachon *et al*.,2010). It is found that the rate of biogenic methane gas production by marine strain methanogenic bacteria at 50% wet algal thalli amendment is greater by 33.4% on comparison with results of freshwater cattle manure strain methanogenic bacteria under similar experimental conditions. The proportion of methane gas content in this biofuel-gas is ca. 58%, while the remaining gases are CO_2 (major portion), H_2S, NH_3,N_2 and O_2 (Sivalingam 1982). Biodiesel production from algal oils has received most attention since algae can contain potentially over 80% total lipids, (while rapeseed plants, for instance, contain about 6% lipids). Under normal growth conditions the lipid concentration is lower (<40%) and high oil content is always associated with very low yields. For microalgae, most commercial operations are located in China, Taiwan and India (Bunnag 2009).

Table 1 shows comparison of properties of microalgal oil, conventional disel fuel and ASTM biodiesel standard.

Properties Biodiesel from	**microalgae oil**	**Diesel oil ASTM biodiesel**	**standard**
Density (kg/L)	0.90	0.864 0.838 0.84	0.90
Viscosity (mm2/s, cSt at 40°C)	5.2	1.9-4.1	3.5-5.0
Flash point (°C)	115	75	min 100
Solidifying point (°C)	12	50 to 10	-
Cold filter plugging point (°C)	-11	-3.0 (max -6.7)	0 to -15
Acid value (mg KOH /g)	0.374	max 0.5	max 0.5
Heating value (MJ/kg)	41	40-45	-
H/C value	1.81	1.81	-

Table1. Comparison of properties of microalgal oil, conventional diesel fuel and ASTM biodiesel standard (Bunnag 2009) Macroalgae (seaweeds) are also being proposed for biofuels (methane, ethanol, butanol) production but their cultivation is fundamentally different from microalgae. The problem of algae oil productivity is that, with a few exceptions (e.g.,*Nannochloropsis*), Algae do not produce and store large amounts of triglycerides while actively growing. The first attempt to produce microalgae oil (lipids) production took place in Germany during and after world war II. It was observed that many species of green algae, when grown with nitrogen limitation, accumulated oil within their cells, reaching up to about 70% of dry weight. Although algae biomass with high oil content could be obtained, it could be produced only at relatively low productivity, no higher at any rate than N"sufficient cultures, which produced much more total biomass. This conclusion has been reached repeatedly over the past sixty years of research (e.g., Shiffrin and Chisholm, 1981) and remains a central issue in the algae biofuel field today. The first attempt to mass culture microalgae came about 1950, with two small (about 100 m^2 each) closed bag"type closed photobioreactors (PBRs) set"up on the rooftop of a building at MIT.

The major problem with algae biofueis the cost of production. It will be difficult to for algae biofuel to compete favorably with fossil fuels under current market conditions for the foreseeable future. Aquatic Species Program (ASP) in 1980. The ASP continued until 1996 with the goal of developing cost"effective algae biofuels production (Sheehan *et al*., 1998). The premise for this effort was that algae were uniquely able to produce high amounts of soils, and algae oil could become competitive with fossil fuels (based on work by Oswald and Golueke, 1960; Benemann *et al*.,1978). It was observed that *Nannochloropsis*, a marine alga with high constitutive triglyceride (oil) content, could be stressed with N limitation in batch culture to increase lipid productivity when light intensity was also increased. However, attaining high algae oil productivity (measured in g oil/m^2 day) remains an unsolved problem and an active area of research.

Biodiesel has many advantages such as Use of bio-diesel will reduce emission and air pollution substantially as Bio-diesel contains very insignificant or almost no sulfur and has excellent emission results as against normal diesel. Bio-diesel flash point is very high, which makes it safe for storage and transportation. Its calorific value and cetane index are comparable with diesel. Use of biodiesel will the gap of increasing demand and diesel shortage created by depleting reserves of fossil fuels. Moreover, Bio-diesel is renewable source of energy. There can be CDM benefits (Carbon Credit) for plantation, biogas generation and use of biodiesel.

Climate change mitigation, economic growth these concerns have increased the interest in developing second generation biofuels produced from non-food feedstock such as microalgae, which potentially offer greatest opportunities in the longer term. Biofuels made from renewable resources could be a more sustainable alternative, particularly if sourced from organisms, such as algae, that can be farmed without using valuable arable land. Both micro and macro algae can be successively used as source of biofuel and many other sources of energy. The real advantage of microalgae over plants lies in their metabolic flexibility, which offers the possibility of modification of their biochemical pathways (e.g. towards protein, carbohydrate or oil synthesis) and cellular composition. In countries like India where algae are not utilized to the fullest extent, it is needed to exploit algae instead of letting this potential energy resource rot away. For getting more benefits integrated algal production concept with various co products must be followed. However, attaining high algae oil productivity remains an unsolved problem and an active area of research. Research must be carried out to develop cost effective algae biofuels production so that algae oil could become competitive with fossil fuels.

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Green Marketing and Sustainable Development Challenges and Opportunities: A Case Study of Mumbai City in Maharashtra

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ABSTRACT

In the modern era of liberalization, privatization and globalization it has become a challenge to keep the customers as well as consumers in fold and even keep our natural environment safe and that is the biggest need of the time. Consumers are also aware of the environmental difficulties like; global negative impact on nature. Green marketing is a phenomenon which has developed particular important in the modern market and has emerged as an important concept in India as in other parts of the developing and developed world, and is seen as an important strategy of facilitating sustainable development. In this research paper, main emphasis has been made of green product marketing. Data has to be collected from multiple sources of evidence, in addition to books, journals, websites, and news papers. It explores the main issues in adoption of green marketing practices. The paper describes the current Scenario of Indian mall market and explores the challenges and opportunities businesses have with green marketing. Why consumers are adopting it and future of green marketing and concludes consumer's attitude toward that green product marketing is something that will continuously grow in both practice and demand.

KEYWORDS: Environmental pollution, Green Product Marketing, Globalization,

INTRODUCTION

The negative consequences on the environment due to companies' and human activities have led companies to develop eco-friendly products. Remind that "Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (iisd.org). This definition appeared for the first time in 1987, in the Brundtland report also called: Our Common Future. Grant defines sustainability as "the idea that environmental (and ethical) objectives are not incompatible with ongoing economic prosperity" (2007, p. 2). The consumption of eco-friendly products and consumers 'attitudes towards these products has led to the development of the green marketing mix "which preserves environmental resources and at the same time deliver value added products and services" (Datta and Ishaswini, 2011, p. 126).

History

We need things consumed, burned up, worn out, replaced, and discarded at an ever-increasing rate » is a Victor Lebow's quotation (an American retail analyst from 1948) cited in The Green Marketing Manifesto (Grant, 2007, p. x (10)). This sentence is no longer at issue……since about thirty years, environmental concerns such as the global warming and the resource exhaustion have been important issues. Indeed, according to the OECD, in 2050, the world energy demand will be 80% higher than actually, leading to a 50% rise of greenhouse gases emissions. Due to this realization consumers and companies have started to change their habits. "the marketing of products that are presumed to be environmentally safe" (retailing definition) as "the development and marketing of products designed to minimize negative effects on the physical environment or to improve its quality" (social marketing definition) and finally as "the efforts by organizations to produce, promote, package, and reclaim products in a manner that is sensitive or

responsive to ecological concerns" (environments definition).Companies have using green marketing for many reasons such as green policies

Problem discussion

The deterioration of the environment led to the adoption and the development of consciousness of consumers' attitude towards eco-friendly products in order to preserve the planet (Luck et al., 2009, p. 2). They therefore, deem it expedient to take measures towards protecting the environment which has become their personal attitude towards eco-friendly foods (Solomon, 2010, p. 209). Consumers patronize the products and their aims are to make sure the contribution is supporting sustainable environment and contribution the guiding of the climate change (Hartmann & Apaolaza-Ibáñez, 2006, p. 676).

Research gap

Many literatures and surveys which examine the consumer behavior cover on different subjects and disciplines and determine the factors influencing the green marketing attitudes towards purchase of the products

Purpose of our study

The main purpose of conducting the research is to identify the factors used by firm and from consumers to influence them to purchase Eco-friendly products. We analyzed these factors according to the consumers' point of view, which influence them and which lead them to develop attitudes towards the purchase or not of eco-friendly products. The difference models of attitude will be used to analyze the perceptions of the consumers which will link with the other factors.

Delimitations

This paper only focuses on few aspects of each factors used by companies that can have an influence on green products' purchase and what are consumers' attitudes towards these products. However in our study we will focus on green products sold in supermarket such as food, cosmetic/healthcare products cleaning product and others.

According to the AMA, the price is "the formal ratio that indicates the quantities of money goods or services needed to acquire a given quantity of goods or services (marketing power.com).

So the following hypotheses tested:

H1a- A significant and positive relationship exists between Product and attitudes towards green products.

H1b- A significant and positive relationship exists between Price and attitudes towards green products.

H1d- A significant and positive relationship exists between Place and attitudes towards green products.

H3- A significant and positive relationship exists between Satisfaction and attitudes towards green products.

H4- A significant and positive relationship exists between consumers' attitude towards green products and purchase of green products.

Data analysis

To what extent do you agree or disagree with the following statements about the eco-friendly products:

Eco-friendly products

Eco-friendly products	Strongly Disagree	Disagree	Undecided	Agree	Strongly agree
Are good for the environment	07	09	11	11	92
Are healthy	6	7	9	7	101
Have a good quality / performance	05	12	7	11	95
Have a better quality / performance than conventional products	3	3	6	16	108
Have a good taste and / or good smell	5	11	9	25	80
Have reasonable price	4	2	8	12	104
Are accessible/available in the supermarket	13	7	05	12	93

Data analysis

We selected randomly 130 customers from Mumbai mall and asked them the above mentioned questions. Majority of them strongly agree that eco-friendly products and good environment are closed related to each other (70 percentages) Secondly question which are related to healthy and eco-friendly products. 77 percentage customers are strongly agreed on that there was strong relationship between health and eco-friendly products. Thirdly 61 per cent customers' wants their product should be from good quality which gives benefits for their good health Fourthly 92 per cent want they are interested in purchasing those good which are good tested as well as good smell.

Fifthly 80 per cent said that along with eco- friendly product they are interested want to purchase those goods which are in reasonable price and lastly they are purchasing that product which is easily available in the mall due to their busy schedule.

So the following hypotheses tested:

H1a- A significant and positive relationship exists between Product and attitudes towards green products. Accepted

H1b- A significant and positive relationship exists between Price and attitudes towards green products. . Accepted

H1d- A significant and positive relationship exists between Place and attitudes towards green products. . Accepted

H3- A significant and positive relationship exists between Satisfaction and attitudes towards green products. . Accepted

H4- A significant and positive relationship exists between consumers' attitude towards green products and purchase of green products. Accepted

Attitudes and purchase intention

Our survey shows that the value-expressive function from the functional theory of attitudes does not matter in the purchase intention of green products Indeed people do not buy green products for self-esteem reasons such as "I feel trendy when I buy this type of product" so people do not buy green product because they want to show to others that they are trendy or other. Our value-expressive variable can also be also linked to ego defensive function, such as people do not buy green products to protect from others (they buy them because they are good for the environment. Thus this result confirms Therese's findings that consumers' intentions are more unselfish, such as preserve the earth and there are not only selfish reasons (2011, p 1070)

Conclusion

Green product marketing is a tool for protecting the environment for the future generation. It has a positive impact on environmental safety. Because of the growing awareness among customers, companies and governments of environmental protection, there is an emergence of a new product market which is the green market. For companies to survive in this market, they need to go green in all aspect of their business. Consumers want to identify themselves with companies that are green compliant and are willing to pay a premium for a greener life style. As such, green marketing is not just an environmental protection tool but also, a marketing planning.

Suggestions

From the data analysis it was found that customers are more interested to purchased eco. Friendly goods so government should be follow strict rules and regulation of producing eco-friendly goods. Local sourcing only played a major role for Company It became clear that sustainability does not come into play when it comes to pricing. This indicates that premium prices due to sustainability might be less common than many consumers still believe.

 ISBN: 978-93-84663-07-0

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Green synthesis of 1,4-Dihydropyridenes

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ABSTRACT

Amberlyst-15 catalyzed, environmentally friendly synthesis of 1,4-dihydropyridines via one pot multicomponent coupling of cinnamaldehyde, aniline and β-keto esters under solvent free condition at room temperature has been reported. Amberlyst-15 is a selective, thermally stable, reusable, heterogeneous solid acid catalyst to afford the corresponding 1,4-dihydropyridines in excellent yields. Advantages of the present method include, rapid generation of product, simple workup and recyclability of the catalyst.

Keywords: Amberlyst-15; Solvent-Free; Multicomponent; 1,4-Dihydropyridine

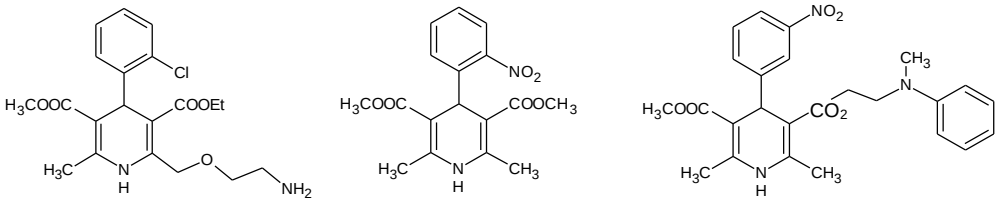
Introduction

Expeditious synthesis of diverse sets of complex molecules with atom economy without natural disturbances is the significant and fundamental approach of medicinal and synthetic organic chemistry and one of the key paradigms of modern drug discovery. Recently, in synthetic methodology emphasis is given on to design, develop and employ novel synthetic routes which will generate diverse oriented libraries of complex molecules avoiding toxic reagents, excess solvents, expensive purification methods and economically and ecologically safe process. Since last decade, multi-component and domino reactions have become major platform in the organic synthesis. The MCR and domino reactions are highly flexible, convergent and atom efficient processes of high exploratory power that minimizes solvent consumption and maximize atom efficiency. MCR based processes are therefore contribute to a sustainable use of resources and form the perfect basis of modular reaction sequences composed of simple reactions that achieve in a minimal number of steps, a high degree of both complexity and diversity for a targeted set of scaffolds (Orru et al. 2010).

1,4-Dihydropyridines (1,4-DHPs) and their derivatives are important class of bioactive molecules in the field of drug and pharmaceuticals (Kumar et al. 2008). These compounds are well known as calcium channel modulators and have emerged as one of the most important classes of drugs for the treatment of hypertension (Rovnyak et al. 1995).Various clinically used cardiovascular agents (Kappe et al. 1997; Buhler et al. 1987) such as nifedipine, nicardipine, amlodipine and other related derivatives are dihydropyridyl compounds effective in the treatment of hypertension. 1,4-Dihydropyridine derivatives possess a variety of biological activities such as HIV protease inhibition (Hilgeroth 2002; Hilgeroth and Lilie 2003), MDR reversal (Avendano and Menendez 2002; Avendano and Menendez 2004; Boumendjel et al. 2005), radioprotection (Donkor et al. 1998), vasodilator (Atwal et al. 1991), antitumour, bronchodilator and hepatoprotective activity (Atwal et al. 1990). Moreover DHPs also act as NADH mimics for the reduction of carbonyl compounds and their derivatives (Rueping et al. 2006). In human body the main metabolic route of dihydropyridine drugs involve their oxidation to pyridines catalyzed by cytochrome-450 in liver (Guengerich et al 1986).

Due to the potential importance of 1,4-dihydropyridyl compounds from a pharmaceutical, industrial and synthetic point of view, various methods for their preparation has been reported (Maiti et al. 2003; Su et al. 2005; Lu et al. 2000; Hu et al. 1998; Reddy et al. 2003; Ramalinga 2001). Hantzsch reaction is very useful in dihydropyridine synthesis but N-substituted, 5-unsubstituted or 5,6-unsubstituted dihydropyridines cannot be synthesised by Hantzsch reaction protocol. Ishar et al. have synthesised some

N-aryl-5,6-unsubstituted-1,4-dihydropyridines via a regioselective cycloaddition of 1-aryl-4-phenyl-1-azadienes with allenic esters (Ishar et al. 2001). Recently, Mene´ndez et al. synthesised 5,6-unsubstituted dihydropyridines (Sridharan et al. 2007) but even using inert/anhydrous conditions the products were isolated in moderate yields (61 to 74%). Similar multi-component reactions for the synthesis of substituted piperidines, dihydropyridones and tetrahydropyrans were also recently reported (Devi et al. 2007; Clarke et al. 2007). Some of the reported methods are efficient to synthesize 1,4-dihydropyridene derivatives but some methods are time consuming, generate moderate yield, require toxic organic solvents and costly reagents. In order to get the desired product without use of toxic organic solvents and hazardous reagents, avoiding laborious work and to develop energy saving and rapid synthetic method is need of hour. In the line of green synthetic route, here in, we report the amberlyst-15 catalyzed efficient and rapid synthesis of 1,4-dihydropyridine under solvent free condition.;



Amlodipine **Nifedipine** **Nicardipine**

Figure1. Derivatives of 1,4-dihydropyridine as cardiovascular agents

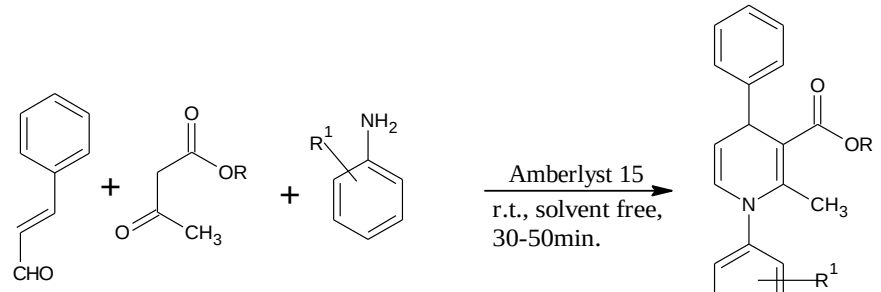
Experimental

Materials and Method

The essential chemicals were purchased from Sigma -Aldrich and Merck and were used without further purification. Melting points were recorded on digital melting point apparatus EQ730 Equiptronics and are uncorrected. NMR spectra were recorded on a 200 MH_Z Bruker instrument using TMS as internal standard in $CDCl_3$ solvent (chemical shift in δ, ppm are expressed as down field from TMS). IR spectra were obtained in potassium bromide wafers on Bruker ALPHA FT-IR Spectrometer. The purity of the compounds was monitored by TLC on silica gel coated aluminium plates (Merck) as adsorbents and UV light as visualizing agent.The reactions were performed at room temperature 25^0C to27^0C.

Synthesis of 1,4-dihydropyridene derivatives

In a mixture of β-ketoester(1mmol), cinnamaldehyde (1mmol) and aniline (1mmol), Amberlyst 15 DRY (10mg) was added. The reaction mixture was stirred on magnetic stirrer at room temperature for the time specified in the table 4. The reaction was monitored by TLC. After completion of the reaction, the reaction mixture was dissolved in ethyl acetate and filtered.The catalyst was separated from it.



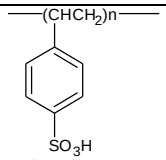
R= Me, Et

1 2 3 4a-4j

Scheme 1. Synthesis of 1,4-dihydropyridine

Table 1: Physical properties of Amberlyst 15 DRY (Rao et al. 2012).

Physical form	Opaque beads
Ionic form as shipped	Hydrogen
Concentration of acid sites	≥ 4.7 eq/Kg
Water content	≤ 1.5% (H+ form)
Fines content	< 0.300 mm: 1.0% max
Shipped weight	610 g/L (38 lbs/ft)
Surface area	$45m^2/g$
Average pore diameter	250 °A
Swelling	
60 to 70% (dry to Water)	
10 to 15% (dry to hexane)	
10 to 15% (dry to toluene)	
15 to 20% (dry to ethylene dichloride)	
30 to 40% (dry to ethyl acetate)	
60 to 70% (dry to ethyl alcohol, 95%)	
15 to 20% (dry to phenol)	
3 to 5% (dry to benzene)	



Amberlyst-15

Figure 2.

Table 2: Effect of solvent over synthesis of 1,4-dihydropyridine in presence of Amberlyst 15

Entry	Solvent	Time (min)	Yield %
1	Water	140	NR
2	Ethanol	120	85
3	Methanol	110	86
4	Dichloromethane	70	83
5	Acetonitrile	130	65
6	Tetrahydrofuron	120	64
7	Tolune	140	60
8	**Solvent free**	**30**	**91**

NR= No Reaction; Reaction condition: Ethyl acetoacetate (1mmol), cinnamaldehyde (1mmol), aniline (1mmol) and amerlyst 15 (10mg).

The solvent was removed under reduced pressure. The separated catalyst was washed with ethyl acetate (2x5ml) and dried. The crude product was purified from silica gel column chromatographywhich afforded 4a-4j in good to excellent yield.

Spectral data:

2-Methyl-1,4-diphenyl-1,4-dihydropyridine-3-carboxylic acid ethyl ester (4a)

IR (KBr, cm^{-1}): 1695, 1565, 1222; ^{1}H NMR ($CDCl_3$, 200MHz, δ): 1.18(t, 3H, CH_3), 2.23(s, 3H, CH_3), 4.13(q, 2H, OCH_2), 4.88(d,1H, CH), 5.12(dd, 1H, CH), 6.19(d, 1H, CH),7.21-7.43(m, 10H, ArH); ^{13}C NMR ($CDCl_3$, 50MHz, δ): 14.5, 19.2, 42.1, 61.1, 103.1, 107.8, 126.4, 127.9, 127.4, 128.1, 128.9, 156.2, 170.2.

1-(4-methylphenyl)-2-methyl-4-phenyl-1,4-dihydropyridine-3-carboxylic acid ethyl ester (4b)

 ISBN: 978-93-84663-07-0

IR (KBr, cm^{-1}): 1690, 1568, 1221; ^{1}H NMR ($CDCl_3$, 200MHz, δ): 1.16 (t, 3H, CH_3), 2.22(s, 3H, CH_3), 2.44 (s, 3H, CH_3), 4.13(q, 2H, OCH_2), 4.89(d,1H, CH), 5.11(dd, 1H, CH), 6.18(d, 1H, CH), 7.12(d, 2H, ArH), 7.22-7.44(m, 7H, ArH); ^{13}C NMR ($CDCl_3$, 50MHz, δ): 14.4, 19.4, 23.6, 41.1, 60.1, 102.1, 107.9, 126.5, 127.5, 128.0, 128.8, 131.0, 130.7, 137.6, 142.0, 147.9, 149.4, 168.9.

1-(4-Chlorophenyl)-2-methyl-4-phenyl-1,4-dihydropyridine-3-carboxylic acid ethyl ester (4d)

IR (KBr, cm^{-1}): 1691, 1565, 1224; ^{1}H NMR ($CDCl_3$, 200MHz, δ): 1.19(t, 3H, CH_3), 2.21(s, 3H, CH_3), 4.11(q, 2H, OCH_2), 4.80(d,1H, CH), 5.10(dd, 1H, CH), 6.14(d, 1H, CH), 7.14-7.41(m, 9H, ArH); ^{13}C NMR ($CDCl_3$, 50MHz, δ): 14.8, 19.3, 40.1, 60.2, 102.8, 108.1, 126.3, 127.8, 128.4, 130.0, 130.5, 134.6, 142.3, 147.6, 149.1, 169.1.

1-(4-Methoxy-phenyl)-2-methyl-4-phenyl-1,4-dihydropyridine-3-carboxylic acid methyl ester (4g)

IR (KBr, cm^{-1}): 2944, 1685, 1569, 1424; ^{1}H NMR ($CDCl_3$, 200MHz, δ): 1.58(s, 3H, CH_3), 3.43 (s, 3H, OCH_3), 3.55 (s, 3H, OCH_3), 4.53 (s, 1H, CH), 6.19(d, 1H, CH), 6.91-6.99 (m, 2H, ArH), 7.11-7.32 (m,7H, ArH); ^{13}C NMR ($CDCl_3$, 50MHz, δ): 12.9, 41.1, 51.3, 102.1, 107.6, 114.5, 126.4, 126.9, 127.3, 127.6, 127.8, 129.9, 130.1, 130.6, 145.2,148.0, 159.4, 167.9.

Result and discussion

Recently, several research articles have been published on amberlyst-15 catalyzed synthetic methodologies. The heterocyclic compounds like indole-pyrazole (Farhanullah et al. 2004), quinoline (Rei-Shen et al. 2008), heteroaryl dipyromethanes and tetrapyrazollylporphyrils (Farhanullah 2009), cis-2,4diaryl thiochromanes (Guha et al. 2012), 2,4,5-trisubstituted and 1,2,4,5-tetrasubstituted-1H-imidazoles (Pandit et al. 2011) have been recently synthesized in good to excellent yield using amberlyst catalyst. Along with this, esterification, transesterification, Michael addition, aza-Michael addition, Prins cyclization, Friedel-Crafts alkylation, acylation, metal free hydroarylation, hydroalkylation, halogenation, protection of carbonyls, amines, deprotection of acetals, acetates, cleavage of epoxides, crossed-aldol condensation, etc. reactions are successfully performed in presence of amberlyst-15 catalyst. Amberlyst-15 hydrogen form macro reticular resin is a cation exchanger, strongly acidic and having operating pH range is 0.14. It is heterogeneous reusable acid catalyst. It serves as an excellent source of strong acid. It has been used in various acid catalyzed reactions. It is easy to measure, safe to use, and readily removed at the end of the reaction. The research community is interested in amberlyst catalyst owing to its selective properties, acidic nature, reusability, environmentally benign character and commercial availability. On account of versatile properties of amberlyst-15, and in order to study the efficiency of it, we have loaded this catalyst (10 mg) for synthesis of 1,4-dihydropyridine from ethyl acetoacetate (1mmol) cinnamaldehyde (1mmol) and aniline(1mmol) as model reaction. Initially, we have used various solvents. In aqueous media the model reaction was carried out for three hours at room temperature, but pale yellow solid was separated which was further not converted into desired product (monitored by TLC). The same reaction was carried out in different solvents (Table 2), but it led to moderate yield or needs longer reaction time. When the reaction was performed without solvent, we have obtained good to excellent yield. Encouraged with this result, we have carried out reaction of cinnamaldehyde with derivatives of aniline and2-ketoester. The results are shown in Table 4.

Initially, we have used different amounts of catalyst such as 5 mg, 10 mg, 15 mg, 20 mg and 25 mg. The maximum yield was obtained at 10 mg. After completion of the reaction, the catalyst was washed with ethyl acetate and dried. To study the reusability of the catalyst, it was reused for four times (Table 3). It was found that there was no any appreciable loss in the yield. It proves that amberlyst-15 catalyst can be reused several times without any appreciable loss in its activity.

The products obtained were purified from silica gel column chromatography and characterized by IR, ^{1}H-NMR and^{13}C NMR spectra. The pure yield obtained was in the range 85-91% which is comparatively higher than the reported methods.

Table 3: Recycle of Amberlyst-15 DRY

Entry	Recycle time	Yield %
1	0	91
2	1	90
3	2	90
4	3	88
5	4	87

Reaction condition: Ethyl acetoacetate (1mmol), cinnamaldehyde (1mmol), aniline (1mmol) and amerlyst-15 (10mg). Catalyst recycled four times, no appreciable loss in its activity.

Table 4. Amberlyst 15 catalyzed synthesis of 1,4-dihydropyridine derivatives.

Entry	R	R^1	Time (min)	Yield (%)*
4a	Et	H	30	91
4b	Et	4-Me	40	86
4c	Et	4-OH	35	88
4d	Et	4-Cl	40	87
4e	Et	4-OMe	35	91
4f	Me	H	50	89
4g	Me	4-OMe	40	90
4h	Me	4-OH	45	87
4i	Me	4-Me	50	85
4j	Me	4-Cl	45	86

* Isolated yield

Conclusion:

In conclusion, we have developed a simple, efficient, environmentally friendly, and improved protocol for the synthesis of 1.4-dihydropyridine derivatives over Amberlyst-15 DRY catalyst with good to excellent yields. The simplicity of the method is that, ease of workup, ease of separation, recycling and reuse of the catalyst, owing to its heterogeneous nature and excellent yields of the products satisfy the protocols of the green chemistry and make the present methodology ecologically safe.

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Organic Transformations Using Green Alternatives For Clean Environment

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ABSTRACT:

The 20th century has been highly successful for chemistry and society has come to depend on the products of chemical industry to maintain our current standard of living and improve our quality life. Organic Chemistry has provided valuable materials in the form of pharmaceutical, food products, textiles cosmetics, dyes, paints, and agrochemicals. Over six million different organic compounds have been characterized and every year thousands of new organic compounds are added as a result of discovery in nature or preparation in the laboratory. However, this widespread manufacturing and application of chemical products has resulted in an adverse impact on the environment causing depletion of ozone layer, pollution of river, lakes, even ground water, pesticide residue in food and water damage to ecosystems etc. The awareness of environmentally friendly termed as Green Chemistry has become Global Problem. Advantage of the 21st century, the public is equally aware of the hazardous substances used and generated by chemical process which cause different types of pollution.

Green Chemistry is an important part of a multidisplinary area. The goal of green chemistry is to change the conventional chemistry and thus to design synthetic methodology which uses Green alternatives that reduces or eliminates the use or generation of toxic waste by products, solvents and associated product. After application of principles of Green Chemistry, conventional procedure are redesigned as well as new and efficient Green Methods are developed for many useful Organic Transformations.These Green synthetic methodology which uses ecofiendly alternatives to Hazardous Chemical Process and Chemical substances are called as Green Alternatives which are discussed in this research article.

Keywords: *Green alternative, Environmental chemistry, Green Chemistry, Pollution, etc.*

Introduction

Role of chemistry is unavoidable. We eat chemical, we are made of chemicals, we are surrounded by chemicals. All of these things are true because chemistry is the science of matter, all things are chemicals. Organic compounds also have socio-political relevance to our world. The synthetic product serves as drugs medicines, plastics, pesticides, paints and fibers. Quality of life has improved due to the discovery of above valuable products.

Various scientific developments in the 20th century brought about various benefits to the mankind. But all this was responsible for a number of environmentally problems at the global levels. The word Green Chemistry was coined by Paul T. Anastas, which means the judicious use of chemistry for prevention of pollution. The term Environmental Chemistry and Green Chemistry are two different aspects of environmental pollution studies. The former is the study of chemical pollutants in natural environment while the latter is an attempt to design chemical products and processes to reduce the harmful effects which cause to the environment. Green chemistry useful to reduce pollution at source , where as environmental chemistry focuses on the study of pollutant chemicals and its effect on nature. Green chemistry helps to maintain clean environment for sustainable development.

Developments of simple ,safe,ecofriendly and economically synthetic routes for widely used organic compound by using Green Alternative is one of the major challenges in organic synthesis. Green chemistry has a central issue in both Academic and Industrial research in 21st century and development of environmental friendly and clean reactions have become the goal of the present day organic chemist. Therefore, development of Green Methods in useful organic transformations is desirable.

Green alternatives

Chemists all over the word are motivated towards the development of ecofriendly and economically synthetic routes for widely used organic compounds. Most of the pharmaceuticals or agricultural chemicals are the result of organic synthesis. Conventional method which are used to carry out organic synthesis, requires number of steps in which additional reagents, solvents and catalyst are used. During the synthesis of desired product , some waste materials is generated , the disposal of which causes problems and environmental pollution. Conventional method are modified by using green alternative for organic transformation. In this article green alternatives to solvent, reagents, feedstock, alternative source of energy were described

1. Green Solvents

The solvent selected for a particular reaction should not have any environmental pollution and health hazard. As far as possible the reaction should be performed in aqueous phase. Conventional method now been replaced by safer green solvents like ionic liquids, supercritical CO_2 fluid, water. These are the basis of many chemical technologies that have reached commercial development.

The use of water as a solvent for carrying out organic reactions was non existent till about the middle of the century. Due to adverse effect of organic solvent on environment, chemist have been trying to carry out organic reactions in aqueous phase .the advantage of using water as a solvent is its cost, safety and simple operation e.g. Miachael reaction-2-methylcyclopentane 1,3-dione when reacted with vinyl ketone in water gave an adduct without the use of a basic catalyst. The adduct further cyclises to give a 5-6 membered fused ring system. In this reaction, use of water as a solvent gave better yield and pure compound compared to a base.

2. Green Reagent

Reagents are chemical agents that act upon feedstock's in synthesis. A reagent may be partly or even fully incorporated into a product or it may act to produce a chemical change in the feed stock. Selection of the right reagent for a reaction is made on the basis of efficiency availability and its effect on environment. The selection of a particular reagent versus another for same transformation can affect the nature of by products ,percentage yields.

Ex.conventional methylation reaction –employ methyl halides or methyl sulfates. The toxicity of these compounds and their environmental consequences render these synthesis somewhat undesirable. Alternative green reagent for methylation is dimethylcarbonate in which no inorganic salts are produced.

3. Green Feed Stock

The utilization of benign, renewable feed stock is need for addressing the global depletion of resources. Biobased product hold great promise for achieving the goals of sustainable developments and implementing the principles and industrial ecological and green chemistry. Most synthesis make use of petrochemicals which are nonrenewable .Petroleum refining also requires considerable amounts of energy. It is therefore important to reduce the use of petrochemicals by using alternative starting material, which may be of agricultural / biological origin e.g. Glucose is an excellent feed stock to synthesis a of a variety of chemicals using the biochemical pathway. This route helps to minimize the use of carcinogenic starting materials such as benzene.Synthesis is carried out in water. e.g. Conversion of glucose to adipic acid-a raw material in the manufacture of Nylon 66 fiber.

4. GREEN CATALYST

The use of higher temperature, expensive metal precursors, catalyst that are harmful to environment and longer reaction times, are drawbacks of conventional methods. Therefore other inexpensive catalyst were used, which does not cause environmental problems.Synthetic Organic transformations using green catalyst such as organic catalyst, biocatalyst, PTC can be carried out under solvent free conditions or using green solvents. Catalyst are used in small amounts and can carry out a single reaction many times. They can enhance the selectivity of a reaction, reduce the temperature of transformation, reduce reagent based waste and avoid unwanted side reactions leading to a clean technology. Modern catalysis built on three classes, Biocatalysis, Metal/Metal free heterogeneous catalysis.

CONCLUSIONS

Green chemistry is applied and must involve the successful implementation of more environmentally friendly chemical process and product design. Environmentally benign synthesis or green chemistry seeks to incorporate environmental awareness during the designing of synthetic process. The basic concept is that it is far better to develop a synthetic strategy that avoids the use of hazardous material than to face clean up, containment and waste disposal. The Green chemistry revolution provides an enormous number of opportunities to discover and apply new synthetic approaches using green alternative to traditional solvent, catalyst, feed stock, reagents.

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Removal of Methylene Blue Dye from Aqueous Solution using Corn cob as an Adsorbent

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Abstract

The colored textile effluents have a lot of chronic effect on human life .The presence of colour for effluents are due to the utilization of different dyes in textile industry. In the present work easily available low cost adsorbent i.e. corn cob was used to remove methylene blue dye from effluent. Methylene blue dye is selected because it is not easily degradable and is toxic in nature. The effect of different parameters like pH, contact time, adsorbent dose, and temperature were studied .The result showed that 80% dye was removed when pH = 9 and contact time is 120 minutes. When the temperature increases from 298Kto 308K the adsorption capacity also increases. The Freundlich and Langmuir adsorption isotherm were studied. The amount of adsorption increases with increasing adsorption dose, contact time, p^H and temperature. The ultrasonic velocity of the dye solution was also studied. The result showed that, the velocity increases with adsorption. The kinetic study shows that pseudo second order model is more fitted than pseudo first order model. This effect is observed due to swelling of the structure of the adsorbent which enables large number of dye molecules adsorbed on adsorbent body.

***Keywords*:** Adsorption, Methylene blue dye, Corn cob, Adsorption Isotherms, Adsorption Kinetics.

Introduction

Textile industries always use dyes and pigments to color their products. Color removal from textile effluent is a major environmental problem (Arivoli and Hema, 2007). Many dyes and their break down products are toxic for living organisms (Bhatt and Parvez, 2011) and thus affecting aquatic ecosystem. Dyes have a tendency to produce metal ions in textile water produces micro toxicity in the life of fish. There are many physical and chemical methods for the removal of dyes like coagulation, precipitation, filtration, oxidation, and flocculation. But these methods are not widely used due to their high cost. Adsorption technique (Ferro, 2007) is the best versatile method over all other treatments. Therefore the proposed work will undertake using agriculture waste like corncob for removing dye material from aqueous solution (Garg et al. 2004; Juang et al. 1997; Karabulut, 2000; Khare et al. 1987).

Materials and methods

Corn cob was washed with distilled water and dried in an oven at 120^0 C. It was then sieved through sieve no. 100 (150µm). The BET surface area of corn cob was 41.m^2/gm. obtained from BET technique. Methylene blue dye used was from Finer chemicals Ltd.

The X-ray diffraction study of saw dust was carried out by X-ray Fluorescence Spectrometer (Philip model PW 2400). The morphological and XRD study clearly indicates that the adsorbent is porous and amorphous in nature (Figure 1).

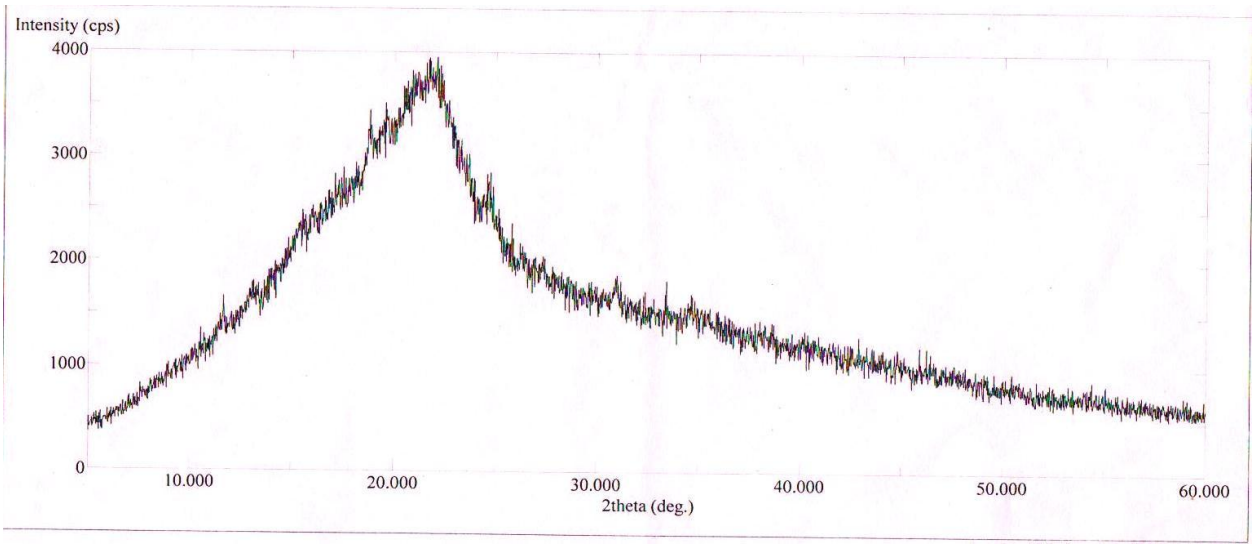


Fig.1: X-ray diffraction pattern of corn cob

The IR spectrum of corn cob was also studied (Figure 2).

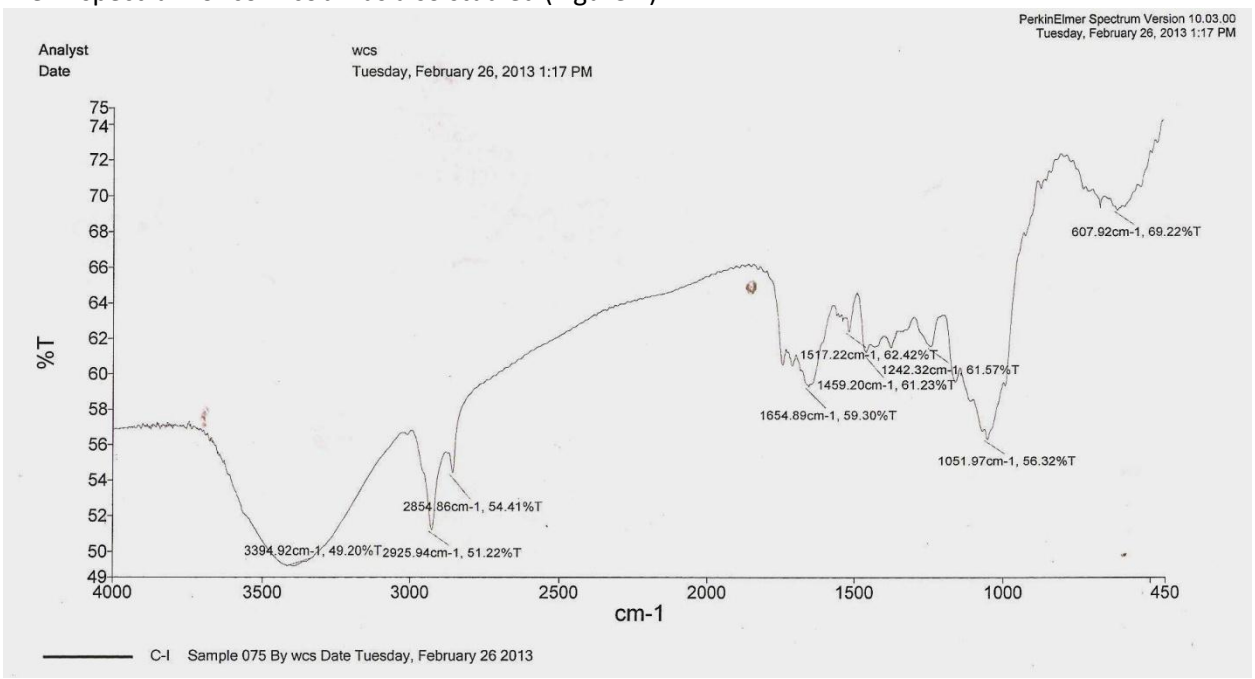
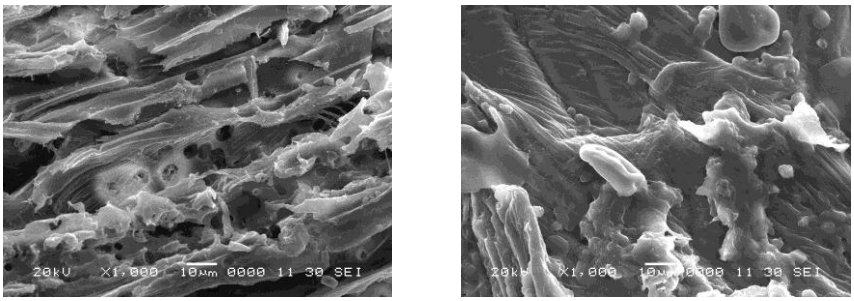


Fig.2: IR spectrum of corn cob

From the **SEM** analysis it was found that there were holes and cave type openings on the surface of adsorbent which would have more surface area available for adsorption (Khatri and Singh 1999) as shown in photographs (Figure 3).



Before adsorption **After adsorption**

Fig. 3: Scanning electron micrograph (SEM) of the corn cob

Experimental Procedure:

Batch adsorption experiments were conducted by shaking 150 ml of dye solution having concentration (50mg/l) i.e. 50 ppm with different amount of adsorbent and having different p^H values, at different temperatures as well as different time intervals. The adsorbent was then removed by filtration and the concentration of dye was estimated spectrophotometrically at λ_{max}= 600 nm. The amount of dye adsorbed was then calculated by mass balance relationship equation,

$$q_{e=}\frac{C_o - C_e}{X}$$

Where,

C_o= Initial dye concentration

C_e= Equilibrium dye concentration

q_e= Amount of dye adsorbed per unit mass of adsorbent.

X = Dose of adsorbent.

Results and Discussions:

For getting highest amount of dye removal various factors were optimized.

Effect of contact time:

In order to know minimum amount of adsorbent for the removal of maximum amount of dye, the contact time was optimized. The results showed that the extent of adsorption is rapid at the initial stage, after 120 minutes the rate of adsorption is constant. About 80% dye was removed. (Fig.4)

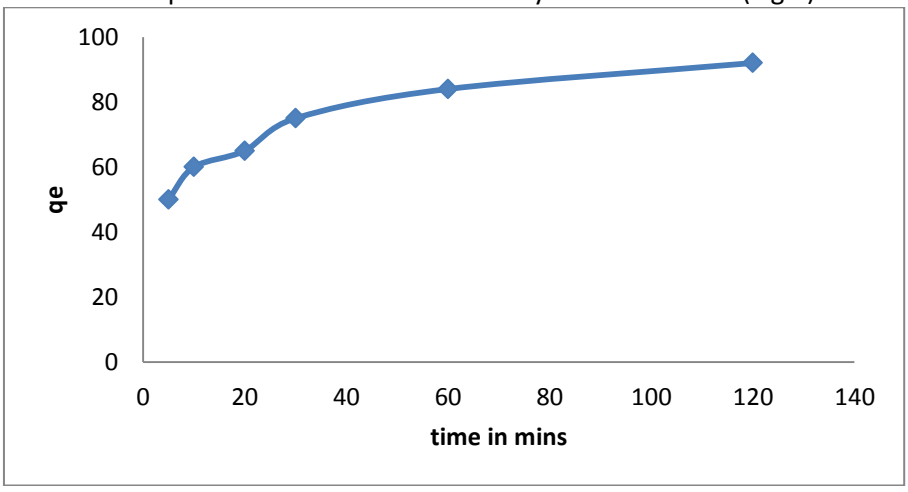


Fig.4: Effect of contact time

Effect of p^H:

From Figure 5 *it* reveals that when p^H of the dye solution increases from 3 to 9 the percentage of dye removal also increases. At p^H= 9, adsorption is maximum. By further increase in p^H adsorption decreases slightly (Mallipudi et al. 2013).

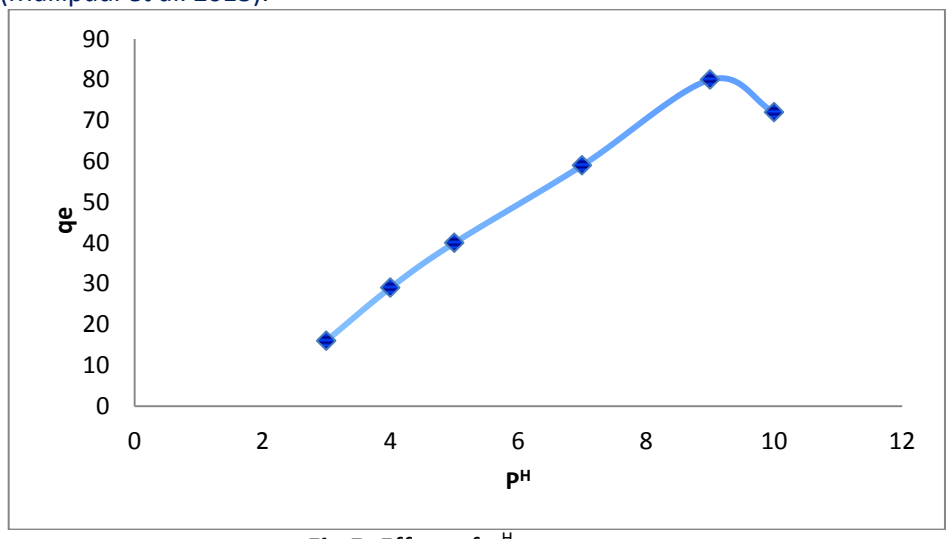


Fig.5: Effect of p^H

Effect of adsorbent dose:

The different adsorbent doses were studied from the range 0.5gm to 7.0 gm from the results, it is clear that the optimum dose is 1gm/150ml. (Fig.6). By further increase of adsorbent dose, the removal of adsorbent decreases due to some of the adsorption sites remains unsaturated during the process (Mane and Bhusari 2012; McKay et al. 1986; Nagada et al. 2007; Namasivayam and N. Kanchanna 1993).

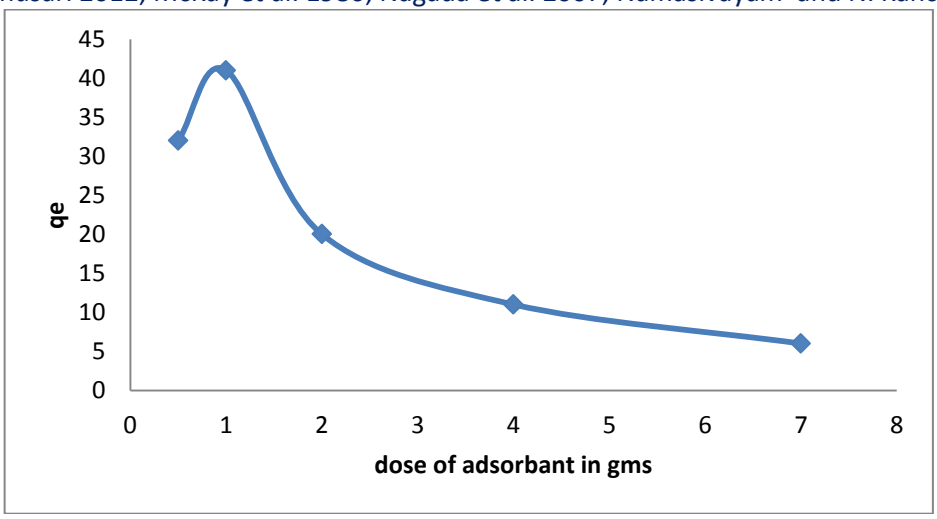


Fig.6: Effect of adsorbent dose

Effect of temperature:

The perusal of Figure 7 it is clear that adsorption capacity of adsorbent increases with increase in temperature, due to increase in the mobility of dye ions. Increasing temperature also causes a swelling effect within the internal structure of adsorbent. So that large number of dye molecules can easily penetrate through it (Nigam et al. 2000; Nimkar et al. 2014).

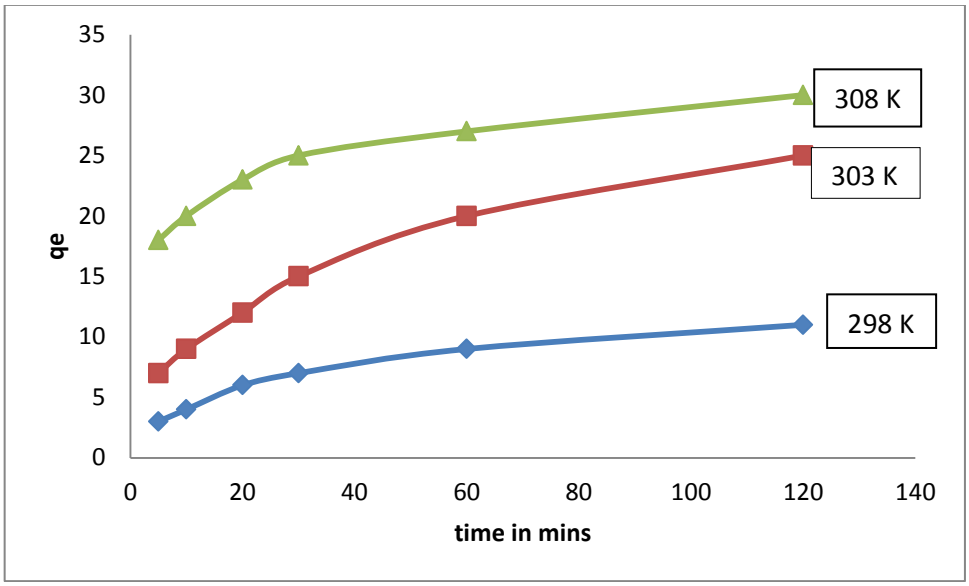


Fig. 7: Effect of contact time

Adsorption Isotherm:

Langmuir Isotherm:

In order to study the adsorption of dye according to Langmuir isotherm, following equation was used

$$\frac{C_e}{q_e} = \frac{1}{Q_m \times b} \times \frac{C_e}{Q_m}$$

Where

C_e =Dye concentration at equilibrium (mg/ L)

q_e =Amount of dye adsorbed on the adsorbent (mg/g)

b =Langmuir constant

A graph of C_e/ q_e against C_e was plotted.

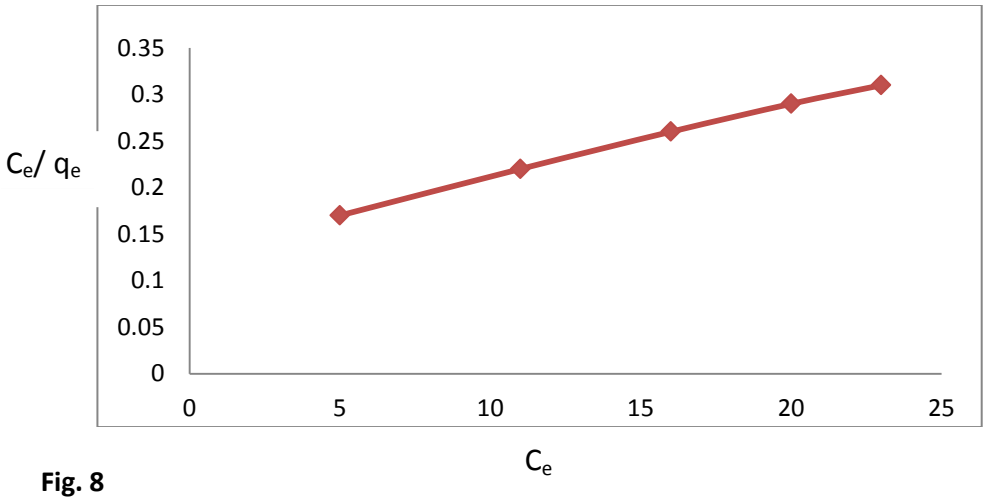


Fig. 8

The correlation factor is closely related to unity, which indicates that the Langmuir isotherm model is applicable (Nimkar et al. 2014; Parvathi et al. 2009; Paul et al. 2011). The formation of monolayer takes place on the surface of the adsorbent (Sarioglu et al. 2006; Sen et al. 1987).

Freundlich isotherm:

1. To study the Freundlich isotherm the following equation was used (Singh et al. 1994).

$$\log \quad q_e = \log \quad K_f + \log \frac{C_e}{n}$$

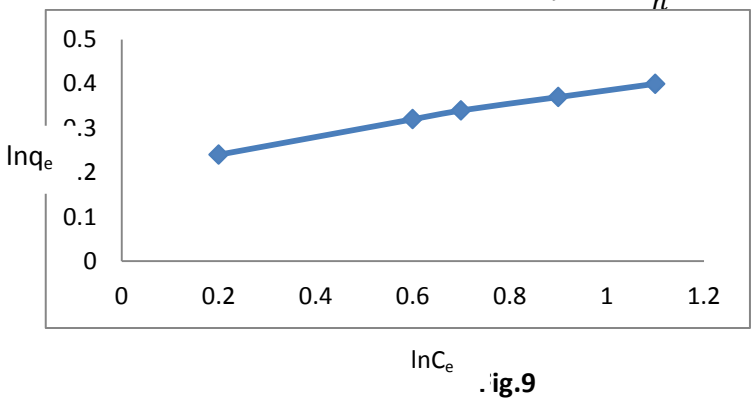


Fig.9

The graph of $\ln q_e$ against $\ln C_e$ was plotted. From the slope, the value of n and correlation factor can be calculated. The value of correlation factor is closely related to one. So it indicates that the Freundlich isotherm also satisfied. The value of n is greater than 1. So the Freundlich adsorption develops appropriately (Figure 9).

Adsorption kinetics:

Pseudo 1st order model:

The pseudo 1st order kinetics model is used to understand the kinetic behavior of the system (Theng et al. 1995; Thievarasu et al. 2011; Yasin et al. 2007). It is given by the equation.

$$\frac{dq}{dt} = k_i (q_e - q_t)$$

A graph of $\ln(q_e - q_t)$ vs time was plotted.

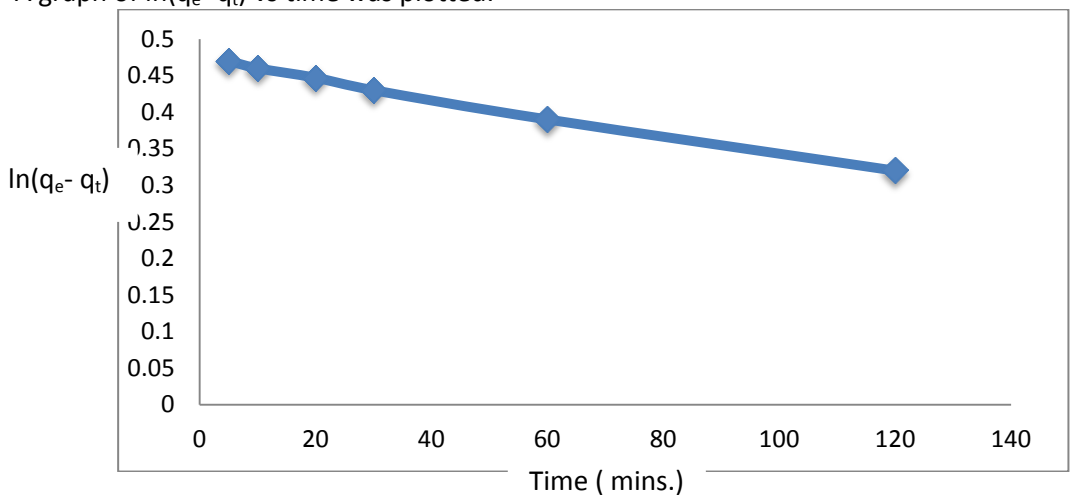


Fig. 10

Slope (K_i) (correlation coefficient)	Intercept (q_e) (Max. adsorption capacity)	Correlation Factor
-0.00129	0.45	-0.92

Pseudo 2nd order kinetics:

The pseudo 2nd order kinetic model was studied using equation

$$\frac{t}{q_e} = \frac{q^2{}_e}{k_2} + \frac{t}{q_e}$$

Where q_e = dye adsorbed at equilibrium
q_t = dye adsorbed at time t

A graph of t/q_t against time was plotted.

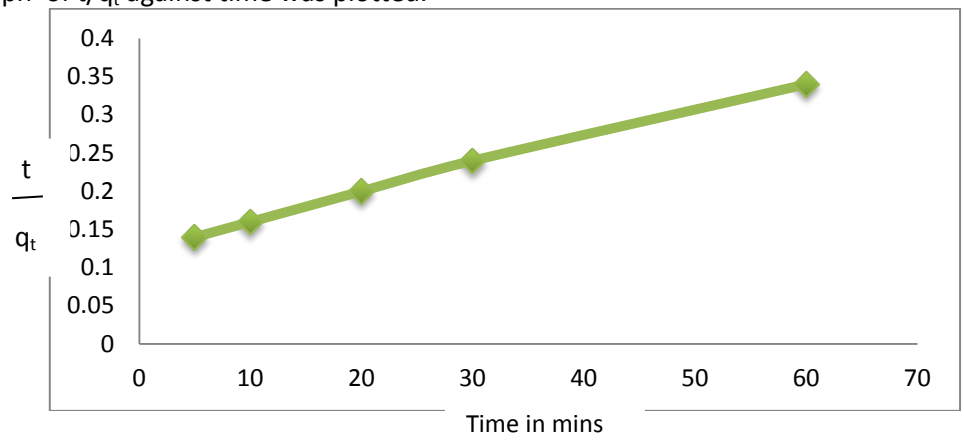


Fig. 11

Slope (K_2)	Intercept (q_e)	Correlation factor
0.00353	0.127	0.99

In case of pseudo 1st order kinetic model, the value of slope and correlation factor are negative. While in case of pseudo 2nd order kinetic model, the value of slope and correlation factors are positive. Which implies that, the system is more fevourable for pseudo 2nd order kinetics.

Conclusion:

Corn cob acts as abetter effective low cost adsorbent for the removal of basic dye like Methylene blue.Batch adsorption was shown that yield of adsorption increases by increasing adsorbent dose, contact time,p^H,and temperature.The fittness of Langmuir model shows that there is a formation of monolayer on the adsorbent surfaces. Similarly Freundlich isotherm also develop appropriety.

Acknowledgement

Authers are thankful for the financial support to University Grants Commission Western Regional office Ganesh khind, Pune, India under Minor Research Project [File no-47-140/12(WRO)].

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A 2-D Numerical Investigation of Manifold Induced Flow Maldistribution in Multi-Channel Heat Exchanger

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ABSTRACT

Flow maldistribution is referred to as uneven distribution of fluid inside the core of heat exchanger. In general all Heat exchangers undergo performance detoriation due to flow maldistribution. In the present work flow maldistribution has been numerically investigated on 2-d u-type plate heat exchanger model using FLUENT software. The effect of Reynolds number and area ratio which is the ratio of channel area to header area on maldistribution is investigated on 2-d plate model. The effect of both parameters has been studied by calculating the non-uniformity for different cases. The 2-d numerical result has been validated with the analytical result and it is in good agreement with the analytical result. From the results obtained for both 2-d it was found that maldistribution increases with increase in Reynolds number. The results of 2-d model indicates that maldistribution can be reduced by decreasing the area ratio .Thus the present study can be used to design plate type heat exchangers for better distribution of fluid without creating the actual model

Keywords: Multi-channel heat exchanger; tubes; channels; flow maldistribution

Introduction

Heat exchangers in general and multi channel heat exchanger in particular undergo performance deterioration due to flow maldistribution. The common assumption in the design of heat exchanger is that the fluid is uniformly distributed from the main header to the individual channels. However, in practice, flow maldistribution is more common and significantly reduces the idealized heat exchanger performance. Flow maldistribution is defined as non-uniform distribution of the mass flow rate on one or both fluid sides in any of the heat exchanger ports and/or in the heat exchanger core (Tereda *et al*. 2007). In this paper Experimental results have been presented to analyze the flow and pressure distribution in a plate heat exchanger by measuring local port pressure distribution in a plate heat exchanger. Flow rate in channel and channel pressure drops are evaluated by measuring the pressure inside the inlet and exit ports at different locations for different port dimensions. The measurements indicate the existence of non-uniform flow distribution that increases with flow rate and decreases with port diameter. Results clearly show that it is important to consider the flow maldistribution for better design of plate heat exchangers. Bobbili *et al*, performed an experimental study on the port flow maldistribution in small and large plate package heat exchanger (Bobbili *et al*, 2006). The overall pressure drop has been measured and found that it is a function of flow rate, cross sectional area ratio of channel to port and number of channels per fluid. It suggested a non dimensional channel velocity to measure the deviation of particular flow rate from the mean channel flow rate based on channel pressure drop and mean channel pressure drop. Iulian Gherasim, experimentally investigated hydrodynamic and thermal fields in a two channel chevron plate heat exchanger for laminar and turbulent conditions (Gherasim *et al*, 2011). The qualitative influence of Reynolds number on friction factor and nusselt number were presented in this study. An analytical study on flow distribution and pressure drop in PHEs for both U-type and Z-type arrangements was presented by Bassiouny and Martin (Bassiouny and Martin, 1984). It gives velocity and pressure distributions in both

intake and exit conduits. In their analysis, a general characteristic parameter, m^2, which determines the flow behavior, has been derived using the mass and momentum balance formulations. The flow distribution tends to be uniform for low values of m^2. Prabhakara Rao *et al*, presented a steady-state analysis on the effect of flow distribution to the channels on the thermal performance of PHEs using the flow distribution relations by Bassiouny and Martin (Prabhakara rao *et al* 2002). In this study, it was considered that the heat transfer coefficient inside the channels is a function of the fluid velocity in the particular channel, whereas in the case of uniform flow distribution, the heat transfer coefficient is uniform over all the channels. It was seen that the effectiveness of heat exchanger reduces considerably with increase in the maldistribution parameter m^2 given by Bassiony and Martin. Xiao-Hong et al, performed a numerical and experimental study on corrugated plate heat exchanger and presented temperature, pressure and the velocity field (Xiao-Hong *et al*, 2010). From the velocity vector it was shown that there is dead zone at the inlet and the outlet port where the fluid flow is very low departing from the corrugation. Ying-Chi Tsai et al, created a real size two cross corrugated channel and investigated a hydrodynamic characteristics and flow in the channel (Ying-Chi Tsai et al, 2009, ZhenHua *et al*. 2008). This study also agrees with the previous study that flow becomes turbulent for channel Reynolds number as low as 400. It showed the variation of the flow maldistribution parameter with the channels Reynolds number however the study focused more on pressure drop analysis no conclusion can be drawn on the flow maldistribution as only two channels were considered for the study.

From the literature review it was found that flow maldistribution in multi-channel heat exchanger is critical and considerably reduces the performance of heat exchanger. In plate heat exchanger plate, flow maldistribution depends on flow rate, cross-section area ratio of channel to port and number of channels per fluid. Large number of study is available on enhancement of heat transfer coefficient on shell side of shell and tube heat exchanger. There is no study available for tube side flow in shell and tube heat exchanger hence it is imperative to study the tube side flow in shell and tube heat exchanger. Flow maldistribution exists on the tube side of shell and tube heat exchanger as fluid in the tubes are non-uniformly distributed from inlet header which requires a detailed study to improve flow distribution inside each tubes.

Objective

The objective of the present study is to numerically investigate the flow maldistribution in multi channel heat exchanger. The project aims at numerical investigation of manifold induced flow maldistribution using FLUENT software. In this project single phase flow is considered for the investigation of port to channel flow maldistribution using fluent software. The present work aims to study the effect of Reynolds number on flow maldistribution for plate heat exchanger model and the effect of change in Area ratio which is the ratio of channel area to the header area.

Problem definition

A 2-d plate type model with inlet header, 8 channels and outlet header having u-configuration has been created in ANSYS design modeller to study the flow maldistribution problem. Four different 2-d models having area ratio 0.2143, 0.25, 0.2857 and 0.3333 are used for the 2-d analysis of flow distribution.

Mathematical model and numerical implementation

The flow in both 2-d and 3-d model is assumed to be incompressible, steady state, viscous laminar without body force for 2-d problem and with body force for 3-d problem. Mathematical model for the present problem consist of following governing equations.

The governing equations for 2 –plate model are

Continuity equation

$$\frac{\partial u}{\partial x} + \frac{\partial v}{\partial y} = 0 \qquad (1)$$

Momentum Equation in X-direction

$$\rho u\frac{\partial u}{\partial x}+\rho v\frac{\partial u}{\partial y}=-\frac{\partial p}{\partial x}+\mu\left[\frac{\partial^2 u}{\partial x^2}+\frac{\partial^2 u}{\partial y^2}\right] \quad (2)$$

Momentum Equation in Y-direction

$$\rho u\frac{\partial v}{\partial x}+\rho v\frac{\partial v}{\partial y}=-\frac{\partial p}{\partial x}+\mu\left[\frac{\partial^2 v}{\partial x^2}+\frac{\partial^2 v}{\partial y^2}\right] \quad (3)$$

Boundary conditions for the 2-d plate type model is as follows
Inlet condition-constant velocity
Outlet condition-constant pressure
Wall condition-no slip and adiabatic wall condition

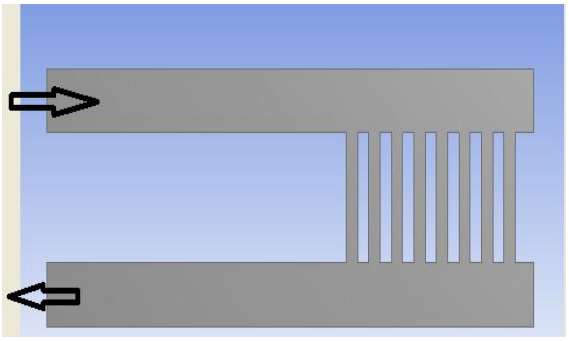

Fig.1. 2-d plate type model with A/R=0.2143

Results and Discussions

In 2-d plate analysis volume flow rate at each channel has been calculated for Reynolds number 48, 72, 96, 120, 144, 168 and 192. Variation of flow rate has been plotted on graph for different Reynolds number.

Grid independence test for 2-d model

In order to check the dependency of grid size on numerical result, three different grid size having i.e.166132, 60100 and 27387 elements were used to calculate the channel velocity in plate type model. Results with three elements size is shown in **Figure 3**.

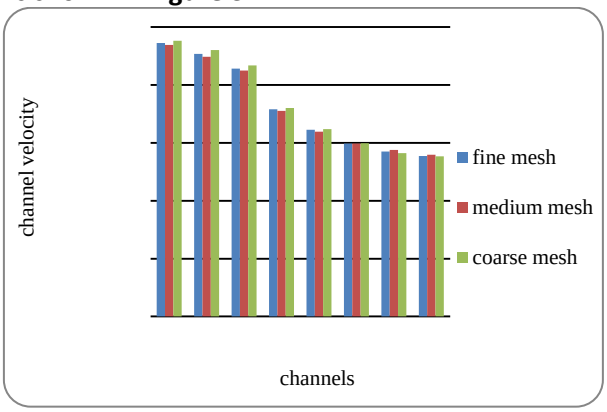

Fig. 3. Channel velocity with A/R=0.3333 and Re=48

From the grid independence test it was found that the difference between channel velocity obtained with the three grids elements used were less than 2% .Hence to reduce the computational cost, grid with 27387 elements were used for the further analysis.

Validation of 2-d numerical result

Numerical result obtained with 2-d plate model is validated with the analytical result by Bassiouny and Martin which is shown in **Fig. 4**.

From Bassiouny and Martin, non-dimensional channel velocity is given by

$$u_c = \frac{nA_c}{A} m \frac{cosh(1-z)}{sinhm}$$

This expression of velocity in each channel has been used to validate the present study which obtains the results using the FLUENT software.

It can be seen from the **Fig. 4**, the maximum difference between FLUENT result and analytical result is less than 7% which means that the fluent result is in good match with the analytical result obtained.

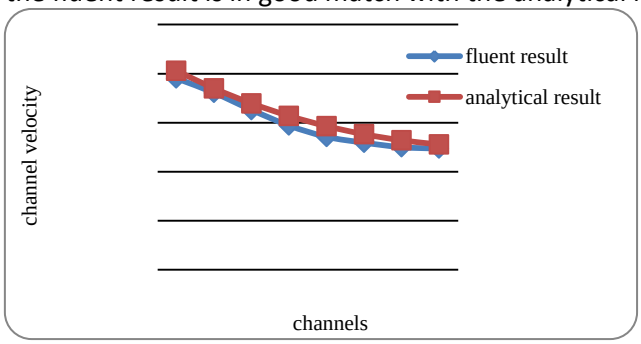

Fig.4. Channel velocity with A/R=0.3333 and Re=48

Effect of A/R and Re number on flow maldistribution

Figure 5, shows the velocity contour with A/R =0.3333 and Re= 48.

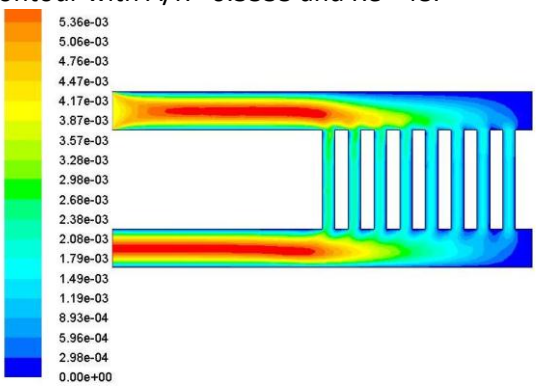

Fig.5. velocity contour with A/R=0.3333 and Re=48

Variation of maldistribution with Reynolds number having different area ratio is shown in **Figure 6**.

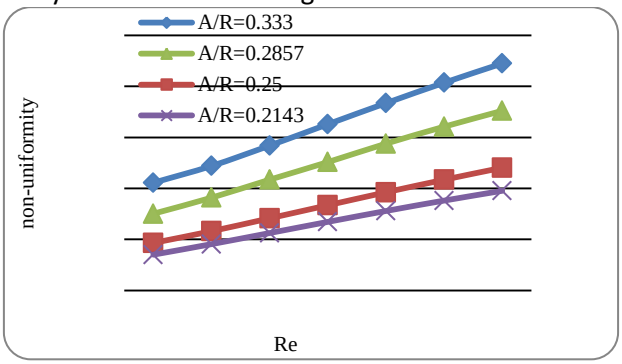

Fig.6. non-uniformity v/s Re number

It is observed from the **Fig 6** that for the same Re, maldistribution decreases with decrease in area ratio. When the area ratio is decreased from 0.3333 to 0.2857, the reduction in non-uniformity is large compared to reduction in non-uniformity when area ratio is decreased from 0.2857 to 0.25. Further the reduction in non-uniformity is still less when area ratio is decreased to 0.2143.

Conclusion

From the present study, following conclusions can be drawn.

In plate type model, flow maldistribution increases with increase in Re number.
It was also found that maldistribution decreases with decrease in area ratio where area ratio is the ratio of branch area to header area.
A detailed study is required for the flow distribution on the tube side of shell and tube heat exchanger model as the maldistribution exists on the tube side which significantly reduces the heat exchanger performance.

Nomenclature

A	Area of header (m^2)
A_c	Area of channel (m^2)
A/R	Area ratio i.e. ratio of channel area to header area
u_c	non-dimensional channel velocity
u	velocity component in X-direction (m/s)
v	velocity component in Y-direction (m/s)
z	velocity component in Z-direction (m/s)
m	maldistribution parameter
z	non-dimensional distance of channel
μ	Dynamic viscosity (pa-s)

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Chemical durability and X-ray diffraction study of Sodium Borate Glasses

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ABSTRACT

Sodium borate glasses of the series of xNa_2O – (100– x) B_2O_3 (x=25, 30, 35, 40, 45) have been prepared by melt-quench technique. The glass samples were characterized using X-ray diffraction (XRD) and Chemical degradation (Corrosion) techniques. The X-ray diffraction pattern confirms the amorphous nature of the glass samples. Chemical degradation studies of the glass samples were carried out in 10% HCl and 10% NaOH. The dissolution rate was seen to be higher in acidic medium as compared to alkaline medium.

Key words: XRD, Corrosion test, Glass composition, Sodium borate glasses.

Introduction

Glasses are receiving consideration attention due to their unique properties like hardness, good strength, transparency and excellent corrosion resistance. Research in glass gained much interest now a day due to the increasing applications in engineering and technological fields. Borate glasses are of technological interest because they have various applications in phosphors, solar energy converters and are moisture resistant etc.

Pure boron trioxide (B_2O_3) is a very good glass former, covalently bonded, with interesting physicochemical properties (Zhang *et al.,* 1991). Pure B_2O_3 forms a glass by itself and forms binary borates with many oxides. While pure B_2O_3 only consist of 3-coordinated 'B_3' boron at standard pressure, the addition of cations make 'B_4' boron structures. This is basically because it is more energetically favourable to form BO_4 tetrahedra than to break B-O-B bridges and give non bridging oxygen. This is discussed in detail by Wright, Vedishcheva and Shakhmatkin (Wright *et al*., 1997).

In the glass science mixed alkali effect (MAE) is not much understood phenomenon (Maass *et al*.,1992; Swenson *et al*., 2003) and contain more than one type of modifying cation (Isard *et al*., 1969; Day *et al.,* 1976). Boron oxide (B_2O_3) usually occurs in the glassy form which is virtually in capable of direct crystallization. Pure boron trioxide (B_2O_3) is a very good glass former, covalently bonded with interesting physico chemical properties. It exhibit unique structural features and attracts because of it simple composition which consists of planar BO_3 triangle (Ardelean *et al*., 2006**;** Shashidhar *et al*., 2008).

Experimental

Glass preparation

The Sodium borate glasses of various compositions were prepared by melt quench technique. The chemicals were used $NaNO_3$, H_3BO_3 of AR grade. These chemicals were thoroughly mixed and ground for 30-40 min in a mortar pastel and then the charge 30g was melted in alumina crucible using muffle furnace for 4-5 h at temperature ranging from 900-1100°C depending on composition.

Glasses with compositions,

$xNa_2O – (100– x) B_2O_3$ (x = 25, 30, 35, 40, 45..)

XRD- Analysis

Prepared glasses were characterized by X-ray diffraction technique to check amorphous nature of glasses, using X-ray diffractometer with Cu-Kα radiation. The XRD patterns were recorded in the 2θ range 20-80 degree with scanning rate 1°/min.

Chemical durability (Corrosion Test)

The result of the corrosion test for the polished samples of sodium borate glasses were carried out in 10% NaOH and 10% HCl solutions at room temperature for 1 h to 6 h of exposure are monitored.

Results and Discussion

XRD Study

The X-ray diffraction patterns of all the prepared Sodium borate glass samples show no sharp Bragg's peak, but only a broad diffuse hump around low angle region, this is clear indication of amorphous nature of glass structure is shown in following figure.

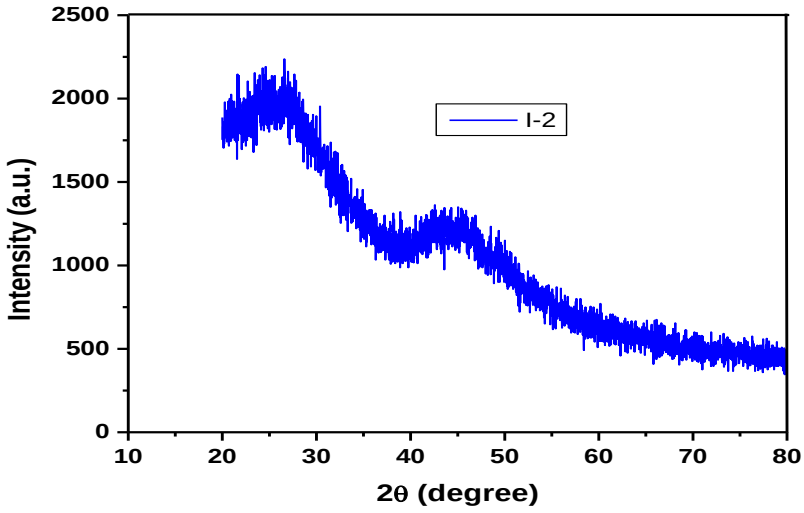


Fig.1. XRD pattern of a sodium borate glass system

Corrosion Test

The result of the corrosion test for the polished samples of sodium borate glasses were carried out in 10% NaOH and 10% HCl solutions at room temperature for 1 h to 6 h of exposure are shown in table 1 and table 2.

Table 1: Weight loss observed in 10% HCl for 1 to 6 hrs of exposure of xNa_2O – (100– x) B_2O_3 glasses

Sr. No.	Glass Code	Composition X mole% of Na_2O	Wt. loss in 10% HCl g/cm^2					
			1 h	2 h	3 h	4 h	5 h	6 h
1	I-1	25	0.44	0.60	0.90	1.12	1.28	1.39
2	I-2	30	0.49	0.71	0.94	1.18	1.31	1.40
3	I-3	35	0.56	0.76	0.99	1.26	1.40	1.49

 ISBN: 978-93-84663-07-0

Table: 2 Weight loss observed in 10% NaOH for 1 to 6 hrs of exposure of $xNa_2O – (100– x) B_2O_3$ glasses

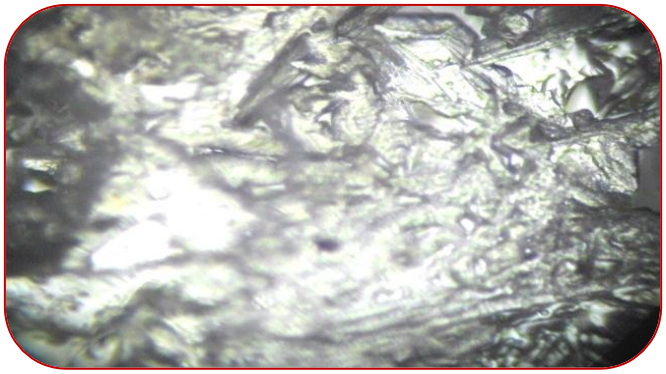
Sr. No.	Glass Code	Composition X mole% of Na_2O	Wt. loss in 10% NaOH g/cm^2					
			1 h	2 h	3 h	4 h	5 h	6 h
1	I-1	25	0.09	0.018	0.050	0.075	0.087	1.01
2	I-2	30	0.014	0.020	0.035	0.076	0.090	1.02
3	I-3	35	0.021	0.024	0.041	0.079	0.092	1.04

In 10% HCl solution, the rate of dissolution for glass I-3 i.e. $35Na_2O$-$65B_2O_3$ is maximum and for glass I-1 i.e. $25Na_2O$-$75B_2O_3$ is less in all the studied glass samples of sodium borate glasses.

In 10% NaOH solution, the dissolution rate is very slow, for I-1 glass than the other. From the studies of chemical degradation it came to notice that the rate of dissolution of I-1 glass in both i.e. in 10% HCl and in 10% NaOH is low in comparison to other investigated sodium borate glasses.

In 10% HCl solution, the rate of dissolution of for glass I-3 i.e. $35Na_2O$-$65B_2O_3$ is maximum and for glass I-1 i.e. $25Na_2O$-$75B_2O_3$ is less in all the studied glass samples of sodium borate glasses.

The investigated glasses contain group I (Periodic Table) fluxes i.e. Na and glass former B_2O_3, which help to improve the chemical resistance hence the rate of dissolution in NaOH solution is slower than in HCl. The typical photographs of investigated glasses of 35% Na_2O content glass samples for various time of exposure in 10% HCL at 20X magnification are shown in photographs I-A and I-B.



I-A. Typical photographs of 35% Na_2O content glass samples for various time of exposure in 10% HCL at 20X magnification.

I-B. Typical photographs of 35% Na_2O content glass samples for various time of exposure in 10% NaOH at 20X magnification.

 ISBN: 978-93-84663-07-0

The result of the corrosion test for the polished samples of sodium borate glasses was carried out in 10% NaOH and 10% HCl solutions at room temperature for 1 h to 6 h of exposure are shown in Figures 3.2 and 3.3.

The dissolution rate was seen to be higher in acidic medium as compared to alkaline medium.

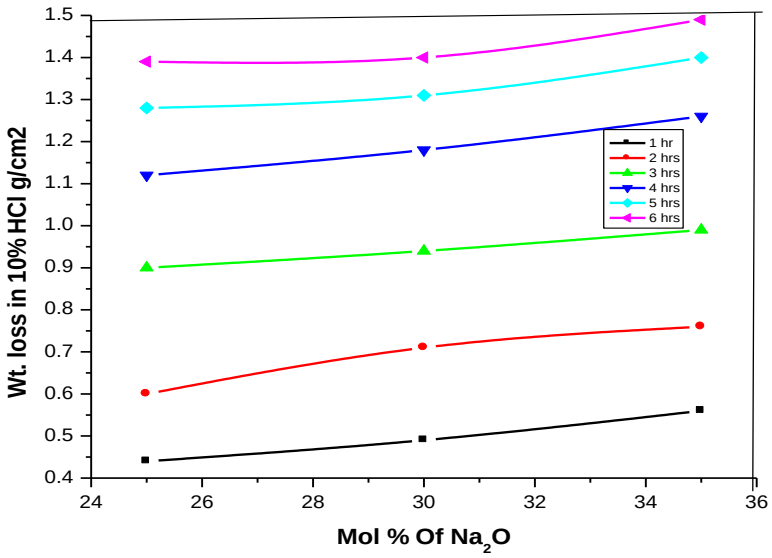


Fig.3.2. Plot of weight loss versus Na_2O content at various time of exposure in 10% HCL.

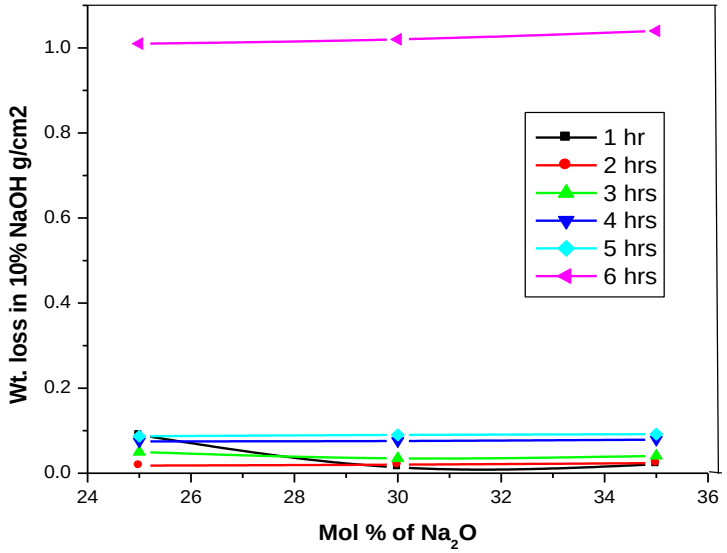


Fig.3.3. Plot of weight loss versus Na_2O content at various time of exposure in 10% NaOH.

Conclusion

Sodium borate glasses of the series of $xNa_2O - (100- x) B_2O_3$ (x=25, 30, 35, 40, 45..) have been synthesized by melt quenching method. The dissolution rate was seen to be higher in acidic medium as compared to alkaline medium at room temperature. The XRD pattern of glasses confirms the amorphous nature of glasses.

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Temporal and Spatial Analysis of Noise Levels: Case Study of Western Railways in Mumbai City

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ABSTRACT

Noise pollution is the disturbing or excessive noise that may harm the activity or balance of human or animal life. Since, railways rely on electricity for their survival, there is not much of air, water or land pollution that they can lead to, but, there are indications of it triggering noise pollution. The noise pollution that is being discussed here is not only dependent on the trains and their honks, but the hoard of people who gather on the railway stations have a major contribution to it too. The contemporary paper, thus tries to analyse the relationship between noise levels and railway stations with the help of an added element- time. This element is imperative because, there are certain peak hours when the crowd on the stations is maximum and certain off hours, when it is minimum. The spatial element will help in comparing the noise levels between the junctions and other stations. The findings of the paper represent higher noise levels at the junctions as compared to other railway stations and the same is found between 8:30 am and 11:30am and 4:30pm and 7:30pm than the rest of the day. A small survey will be conducted to know what people residing besides railway stations and tracks think about the noise levels due to trains

INTRODUCTION

Noise pollution is the disturbing or excessive noise that may harm the activity or balance of human or animal life. The source of most outdoor noise worldwide is mainly caused by machines and transportation systems. Poor urban planning may give rise to noise pollution. Indoor noise can be caused by machines, building activities, and music performances, especially in some workplaces. In Mumbai- the city of dreams, railways are considered as the 'lifeline of the city' owing to its inexhaustible importance and usage by its citizens. Although it serves the city and its hinterland and has helped in the development of the city and beyond, it has some negative bearings too. Since, railways rely on electricity for their survival, there is not much of air, water or land pollution that they can lead to, but, there are indications of it triggering noise pollution. The noise pollution that is being discussed here is not only dependent on the trains and their honks, but the hoard of people who gather on the railway stations have a major contribution to it too. The contemporary paper, thus tries to analyse the relationship between noise levels and railway stations with the help of an added element- time. This element is imperative because, there are certain peak hours when the crowd on the stations is maximum and certain off hours, when it is minimum. The spatial element will help in comparing the noise levels between the junctions and other stations. The findings of the paper represent higher noise levels at the junctions as compared to other railway stations and the same is found between 8:30 am and 11:30 am and 4:30 pm and 7:30 pm than the rest of the day. A small survey will be conducted to know what people residing besides railway stations and tracks think about the noise levels due to trains.

LITERATURE REVIEW

Continuous movement of vehicle causes traffic noise. It affects not only those who are moving but those too who live near the roads, railway lines, stations and airports. There has been a gradual increase in traffic noise in recent years due to increased density of vehicles. According to some estimates**, (Singh et al., 1984)**, traffic noise level in Delhi is 90 dB and in Mumbai it is 95 dB. Average noise level in Delhi, Mumbai and Kolkata is about 95 dB near the airports, noise levels between 82 dB and 85 dB were recorded with an increase of 20-25 dB during landing and takeoffs. Near railway tracks too, ambient noise level increases up to 10-20 dB during train movement. In Maharashtra, noise levels in many towns exceed standards in all

categories of areas, for both day and night, by wide margins, mainly due to industrial and vehicular noise. The noise levels are much higher during festival times like Ganeshutsav and Navratri.In sensitive areas; even the higher end of the noise level exceeds acceptable standards **(CSO, 2001)**. Night time noise levels are particularly higher in Mumbai than in other cities, mainly because several activities in the city take place on a round-the-clock basis **(Rana et al., 2008).** In early days before the development of Environmental jurisprudence, the Common law remedy of nuisance was the only means to provide remedy against noise pollution and the same was wholly based on the discretion of the judges .The people, because most of the people in India do not consider noise as a pollutant but take it as a part of daily routine and of modern life in order to curb noise pollution, it is essential that citizens should first realize it's dangerous consequences and then to take some remedial measures. Available scant rules, regulations and few state laws have however addressed the issue of noise pollution but in part, confined to certain activities .The Indian Constitution under Art. 19 grants to every citizen a fundamental right to freedom of speech and expression, with reasonable restrictions on the grounds of decency ,morality, security of State, defamation, incitement of offence, etc. The use of loudspeakers as a means of expression is regulated by reasonable restrictions, so as to meet public order and peaceful atmosphere. The Judiciary, on its part, has come up with some interesting observations, as to the freedom of expression and right to religious practices, with that of noise –free environment. The Judiciary has thus, trying to maintain a balance between the healths of peace loving citizens **(Vijendra Mahandiyan, 2006).** The scientists have been by and large conscious about noise pollution. Natural physical laboratory has surveyed the noise pollution country over and revealed that noise level in Delhi, Mumbai, Calcutta, Chennai ,was very high in dense populated areas. By publishing such survey reports, awareness has been aroused among the public who have started thinking that noise is also a serious kind of pollutant to be taken seriously. To invite official attention to the authorities, government and others, towards this malady, a Conference was held, with the joint efforts of National Physical Laboratory and Indian Acoustic Institution. This conference was attended by a large number of the scientists, engineers, construction architects, crafters, industrialists, transport officers, medical experts, advocates and defense officers. Many facets of noise pollution were discussed at length seriously and they all expressed their deep and great concern. Thus, the noise was raised against noise pollution, collectively and individually. Through series of similar conferences, seminars, meetings, and workshops, it was experienced that this blazing problem is not confined only to the metro-cities but also has dimensions in other cities and industrial areas. After a survey in 1983, Indian Medical Research Council has warned, that the damage, the audio, bio, and psycho power of whole mankind to a great extent. Also, The Indian Acoustic Institute had prepared a detailed report in 1985 and expressed the felt dire need for comprehensive Noise Pollution in urban and industrial areas. As a result, thereof, Ministry of Environment and Forest had to appoint an expert committee, to study the present levels of noise in the country and to submit its report to pave way for legislation. But, Indian government without waiting long for last submission of this committee till June 1987, recognizing the gravity and urgency of his malady, introduced an amendment to the Environmental (protection) Act, 1986. The noise was added as an environmental pollutant in the definition section, i.e. section 2 of EPA, 1986. In 1989, the Ministry of environmental and central pollution control board constituted technical committee to suggest measures to prevent and control noise pollution. The committee studied and classified various sources, viz. high noise. While preparing its report, the committee kept in view not only the international noise standards of other countries and World Health Organizations, but also took into account, the social conditions and the Indian way of life. In the country loudspeakers are extensively used for political meetings, marriages, religious functions, music programmes and advertising. Trucks, buses, heavy vehicles and passenger cars, produce undesirable noise to the annoyance of the people. Aircraft noise is a disturbance to the people living around airports in the country. The noise pollution in the country has resulted into a noise hazard, leading to permanent hearing loss and nuisance affecting efficiency, comfort and enjoyment. 50 percent of the students in noise polluted areas fail to concentrate on their studies. In Mumbai, 36% of the population in the city constantly encounters noise pollution. Of these, 75 percent felt lack of concentration, 69.5% complete disturbance of sleep and 65% restlessness. The high intensity of noise pollution has affected the

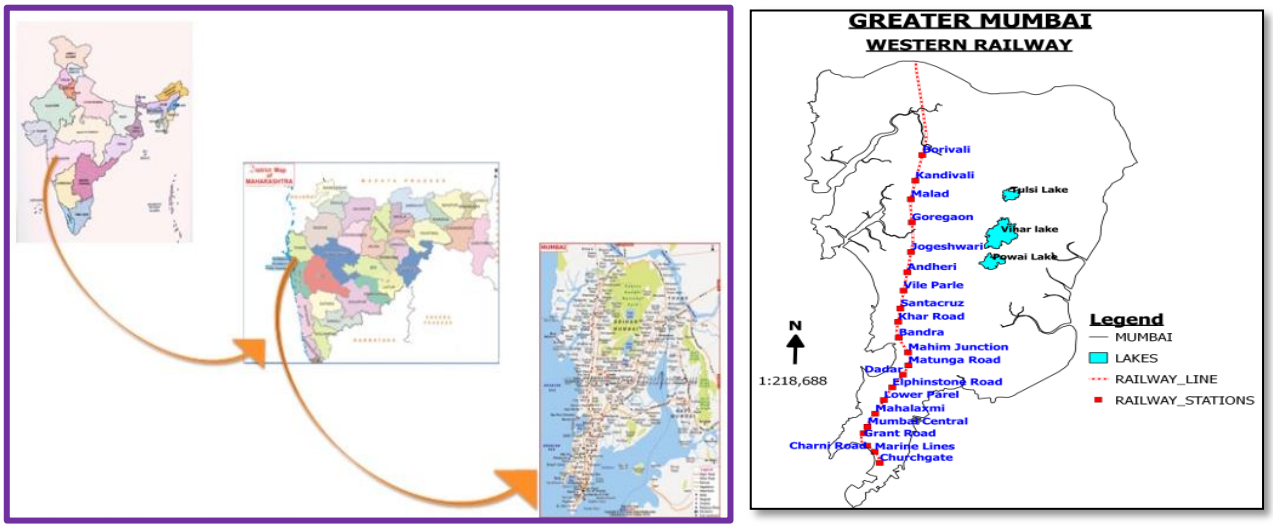
Khajurao temple in Madhya Pradesh which is reported to have developed cracks due to sonic booms. The metropolitan cities of Mumbai, Kolkata and Chennai are amongst the noisiest cities in the world. It is estimated that in Mumbai, with more than six lakh vehicles and a large number of trains playing every day, the noise level ranges from 57 to 91 dB **(B. Navin and P. Geeta, 2006).** Urban noise is mostly associated with urban development. Effect of noise can be temporary or permanent. In Mumbai, where land area is a constraint, various land uses formally demarcated have overlapped and sound levels are observed to be above the permissible limits **(Bhave, Prashant et al., 2013).**

OBJECTIVES OF THE STUDY

- To calculate noise levels and prepare a noise level map
- To understand the role of railways in noise pollution in a metro city with a case study
- To give a spatial and temporal reference to the levels of railway noise.
- To recommend suggestions to reduce noise pollution

LOCATION OF STUDY AREA

The study area chosen is Greater Mumbai. It's co-ordinates are 18°58'30"N 72°49'33"E.It lies on



the Western Coast of the state of Maharashtra and is a part of the Konkan Division of the state. It thus has a coastal location. The district constitutes seven islands and is collectively called as the Salsette Island. It is bound by water bodies on all sides, namely, the Arabian Sea in the West, Thane Creek in the South and East and Ulhas River in the North. The noise levels were recorded at all the railway stations of the Western railway in the city. Western Railway in its present form came into existence on 5th November, 1951 by the merger of its forerunner, the erstwhile Bombay, Baroda and Central India Railway (BB&CI), with other State Railways viz, Saurashtra, Rajputana and Jaipur. The BB&CI Railway was itself incorporated in 1855, starting with the construction of a 29 mile broad gauge track from Ankleshwar to Utran in Gujarat state on the West Coast. In 1864, the railway was extended up to Mumbai. The suburban section of Western Railway in Mumbai extends from Churchgate, the city's business centre to Virar covering a distance of 60 kms and 28 stations. The section has been extended to Dahanu Road adding 10 more stations and 60 kms.

JUSTIFICATION FOR THE STUDY AREA

Western Railway carries more than 3.5 million passengers per day. In other words, railways are considered to be the lifeline of the metro city- Mumbai. People belonging to almost all the classes prefer to travel be train. This is because; it helps avoiding heavy traffic on road and is speedy. It is considered the lifeline of the city due to its undoubted importance for the people belonging to the job sector as it is a successful and trustworthy means of travelling to all parts of the city. Its economic nature aggravates the

choice to use it. Since, railways do not create much of other types of pollution; it was thought appropriate to record noise levels here. It was thus thought important to know the impacts of the lifeline of the city on its citizens.

METHODOLOGY

Research methods refer to the operational techniques of data collection. In order to study the **Temporal and Spatial Analysis of Noise Levels: Case Study of Western Railways in Mumbai City,** the methodology adopted by the researcher will be rationalistic one and has been designed in three stages.

Pre-Field Method:

This includes collection of primary and secondary data on the respective topic from various books, journals and articles from the college library and from those available online. To get a comprehensive knowledge of the study area various internet sources were consulted. Field observation involves qualitative as well as quantitative methods of data acquisition. For measuring noise levels a decibel meter application was downloaded in the smartphone and noise levels were recorded. The name of the application is Blue Lizard Games' Decibel Meter. It gave 3 readings viz. current reading, maximum reading and average reading.

Field Method:

The noise levels had to be recorded during peak -hours and off-hours. The peak hours are from 8:30 am to 10:30 am and 5:00 pm to 7:30 pm. The rest are the off hours for the day. Initially the readings were taken during peak-hours i.e. between 8:30 am to 10:30 and the readings for off hours were taken between 3:30 pm and 5:00 pm. The readings were taken on 10th September, 2014 a local train running from Borivali station to Churchgate station on the western line.

Post-Field Method:

The collected data were processed, assimilated and analyzed. To plot the data on the map of Mumbai, the map had to be digitized and layers of road and junctions had to be created using GIS software. For this, Google Maps was used and the layout and styling was done using QGIS 2.1.0. The data was thus represented cartographically.

LIMITATIONS OF THE STUDY

Even though a lot of planning and effort was put in to design the research and survey, there are certain limitations which it faces. Firstly, due to unavailability of a decibel meter device, a mobile application had to be trusted upon. The difficulty was that it did not record noise above 85 dB. Secondly, Western Railways is not the only local train service in the city, there are Central Railways and harbor line also. Thus, this study is only indicative of the levels of noise in the city caused by railways. Also, due to lack of time, people residing along the road could not be surveyed for the effects of noise pollution on their health. Lastly, pictures to support the facts and data could not be clicked due to the continuous movement of the train.

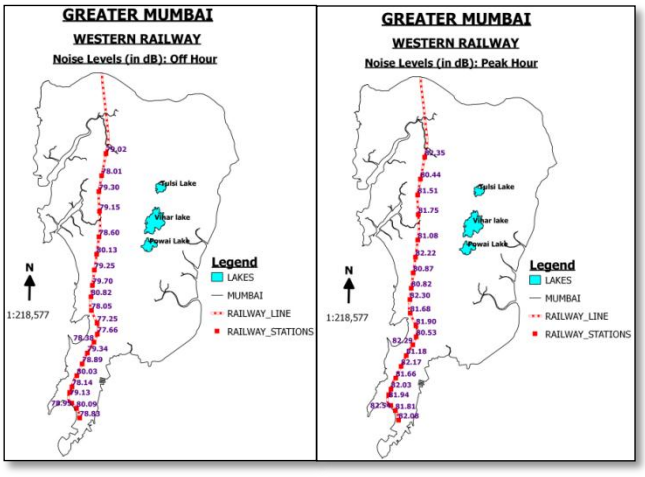
DISCUSSION

The table given below represents the levels of noise recorded to each station in decibels. There are in all 21 railway stations between Borivali and Churchgate.

Table 1: Noise Levels Recorded

Sr. No.	Station	Peak-Hour	Off-Hour	Difference
1	Borivali	82.35	79.02	3.33
2	Kandivali	80.44	78.01	2.43
3	Malad	81.51	79.3	2.21
4	Goregaon	81.75	79.15	2.6
5	Jogeshwari	81.08	78.6	2.48
6	Andheri	82.22	80.13	2.09
7	Vile Parle	80.87	79.25	1.62
8	Santacruz	80.82	79.7	1.12
9	Khar Road	82.3	80.82	1.48
10	Bandra	81.68	78.05	3.63
11	Mahim Junction	81.9	77.25	4.65
12	Matunga Road	80.53	77.66	2.87
13	Dadar	82.29	78.38	3.91
14	Elphinstone Raod	81.18	79.34	1.84
15	Lower Parel	82.17	78.89	3.28
16	Mahalaxmi	81.66	80.03	1.63
17	Mumbai Central	82.03	78.14	3.89
18	Grant Road	81.94	79.13	2.81
19	Charni Road	82.54	78.95	3.59
20	Marine Lines	81.81	80.09	1.72
21	Churchgate	82.08	78.83	3.25

From the table it can be observed that most of the readings during peak hours are more than that during off hours. Most of the readings during peak hours cross 80 dB and during off hours they are not less than 77 dB. Thus, it can be said that there is not much difference in the levels of noise produced during any time of the day. This is because; there is not much difference in the noise produced by the trains during any time. The noise which was already high even during off hours gets higher during peak hours. The differences that are obtained are largely due to the difference in the crowd present during peak hours and off hours; which is maximum and minimum respectively.



The maps given above represent the noise level sat the stations during off-hours and peak-hours respectively. It can be seen that the highest noise level of 82.54 dB is recorded at Charni Road station, and the lowest noise level of 80.44 dB is recorded at Kandivali station. The results are as expected. Since, Charni road is a commercial area, more than 50% of the crowd gets off the train at this railway station and thus, the highest

levels of noise are recorded here. The noise that is recorded here not only includes the noise generated from the train but also from the crowd which, shouts, fights and struggles to get down at the station in the stipulated time period of around 30 seconds. The lowest levels are recorded at Kandivali because; it is just the next station after Borivali. Since, the train is almost full at Borivali station, not many people are able to get in the train and the noise generated is very less.

During off hours, highest noise levels are recorded at Khar road station and lowest at Mahim Junction station viz. 80.82 dB and 77.25 dB respectively. This is because, during off hours, a lot of people travel towards Khar for shopping purposes as it is supposed to be one of the posh areas of the city. Also, many students and other travelers who come to visit Mumbai either gets in or off the train during this time and generate more noise. On the other hand the lowest noise is recorded at Mahim Junction due to its commercial nature. During off hours very few people get in and off the train, thus generating the least noise here.

The following table gives the Permissible Noise levels as given by Maharashtra Pollution Control Board

Table 2: Permissible Noise Levels, MPCB

Area Code	Category of Area/Zone	Limits (In Db)	
		Day	Night
A	Industrial Area	75	70
B	Commercial Area	65	55
C	Residential Area	55	45
D	Silence Zone	50	40

From Table 2, it can be observed that noise levels permitted in a residential area should not exceed 55 dB during day and 45 dB during the night. The limits for silence zones must not exceed 50 dB during day and 40 dB during night. Schools, Colleges and Hospitals are considered to be falling under this category.

Since, all the readings obtained exceed the permissible limits given by MPCB, it is necessary for us to consider the presence of residential areas and elements of silence zones along the railway tracks.

Using Google Maps and from the observations made from the train, it can be said that, there are many residential buildings, educational institutes and hospitals all along the railway tracks and railway stations. Most of the slums of the city are situated along the railway tracks and are affected the most. Actually, the property rates near the railway stations are always very high due to the presence of markets. Thus, residents who are indigenous to the area have not shifted their residence even after the tracks or the stations were constructed. On the other hand, due to presence of market and resultant movement of people, many hotels and restaurants are constructed here. Educational institutes and classes develop near the stations so that students and teachers find it easier to access them. This is because, most of the students and teachers come from faraway places and more than 50% of them use railways as their means to travel.

Due to all the above reasons we find that many residences, educational institutes and restaurants are constructed along the railway tracks and stations. The lack of space in the city worsens the problem and there is no stoppage to the forthcoming edifices too.

Since, the survey could not be conducted, from secondary sources, it was noted that, people living along the railway tracks are badly affected due to the constant exposure to train honks and noise generated from

the friction of the trains and the tracks. Their auditory senses are affected the most, followed by overall mental health.

OBSERVATIONS

While collecting the readings, some observations were made. They are as follows:

- The trees which act as buffer zone for noise mitigation were less in number.
- The structures along the tracks were road facing thus inviting more noise indoor.
- It is not only the honk that creates noise, but, fights, talks, hawkers, etc. also contribute to the noise.

CONCLUSION

From the study, it can be concluded that noise pollution does exist in the city of Mumbai. Transportation or traffic noise especially, that from railways is not a negligible factor and thus needs to be taken care of. Special care needs to be taken particularly in the cases where there are hospitals and educational institutes. This hinders early recovery and concentration respectively. The study highlights upon the spatial and temporal facets of noise pollution in Mumbai. It shows that, there is not much temporal difference, but a considerable spatial difference in the levels of noise in the city.

RECOMMENDATIONS

After the study, following can be recommended:

- The number of trees all along the tracks, around railway stations and in the campuses of the buildings must be increased.
- The material used for construction may include some sound poof ingredients.
- A Decibel Meter can be installed at major junctions. This will help timely monitoring of noise levels and will help to reduce the same.
- The new buildings that are coming up must avoid facing the tracks directly.
- There should be proper planning so as to avoid noise pollution in the city.
- Indian railways must undergo ISO 3095:2013, a standard which specifies measurement methods and conditions to obtain reproducible and comparable exterior noise emission levels and spectra for all kinds of vehicles operating on rails or other types of fixed track.

ACKNOWLEDGEMENTS

I would like to thank my parents and my guide Dr. Moushumi Datta for their endless support and guidance in conducting this research.

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Review on Theory of Biogas Production Using Kitchen Waste

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Abstract

There are millions of tons of biomass waste being produced every year from kitchen which disposal is a problem. At the same time the world is rapidly depleting supply of natural gas, which is known to be the cleanest of the fossil fuels. Anaerobic digestion is a highly promising technology for converting kitchen waste into methane, which may directly be used as an energy source. Biogas is a mixture of methane and carbon dioxide, produced by the breakdown of organic kitchen waste by bacteria without oxygen (anaerobic digestion). In this paper, a complete literature review of existing anaerobic digestion in general Anaerobic Digestion technology in particular is presented. This paper describes an alternative low cost approach to anaerobic digestion and energy production**.** This study depends mainly on the organic materials gained from kitchen waste materials.

INTRODUCTION

The generation of biogas is a process of organic waste treatment method commonly used in waste treatment plants across the world. The only difference is that instead of releasing the gases produced during the fermentation process, the gases are collected and utilized as a gaseous fuel product.

Under the absence of oxygen the degradation of organic matter containing carbon like sewage sludge, municipal solid waste, biodegradable wastes or feedstock, manure form a gaseous product like Methane, Carbon dioxide, and Carbon monoxide called as Biogas [2].

It occurs in marshes and wetlands, and in the digestive tract of ruminants. The bacteria are also active in landfills where they are the principal process degrading land filled food wastes and other biomass. Biogas can be collected and used as a potential energy resource [7].

The anaerobic digestion process is done by methane bacteria. In this process anaerobic (oxygen-free) environment through the activities of acid- and methane-forming bacteria that break down the organic material [4].

Indispensible ambiance conditions are:

- Anaerobic milieu
- PH-values between 6.5 and 8.0
- A variety of feedstock which is not that big
- Temperatures between 15°C and 55°C.
- Existence of trace minerals such as nickel
- Avoiding retardants, such as heavy metal salts, antibiotics, disinfectants

The formation of biogas is ecological, renewable and decreases the reliance from imported fossil fuels. As biogas energy is self sufficient beneficiaries to generate heat and electricity for us [1].

Biogas is a carbon neutral way of energy supply. The substrates from plants and animals only emit the carbon dioxide and Methane without energy utilization since, the economical balance sheet will get down one day.

Bio-digester

The tank known as bio-digester, in which the decomposition of organic material takes place. It occurs in different shapes and size, depends of application.

 ISBN: 978-93-84663-07-0

The sound advantages of biogas are

- Renewable energy source
- Drop in greenhouse gases
- Got eminence fertilizer
- Independence in energy
- Prevent nearly 7000 kg of CO_2 while producing 1KW electricity generating using Biogas instead of conventional fuel

The above mentioned advantages are elaborated as follow:-

Renewable energy sources

In general condition the 4-6 kwh, energy will get from per m^3 biogas, in which the 2 kWh of useable electric is produced with the remainder turning into heat energy [7].

Reduced Greenhouse Gas Emissions

The use of anaerobic digestion to create biogas from kitchen waste can reduce GHG emissions in two methods. First, that stores manure under anaerobic conditions, it can prevent the release of CH_4, a greenhouse gas, into the atmosphere. Second, the biogas or bio-methane generated by the anaerobic digestion process can replace the use of fossil fuels that generate GHGs. As Methane is also main component of natural gas, it can produce energy. Generally, Biogas contain near about 60-70% Methane. From recent scenario it is observed that, methane is 21 times more affect GHGs than carbon dioxide by weight.

Got eminence fertilizer

As after the digestion of organic matter the slurry gives fast-acting nutrients that easily enter into the soil solution, thus becoming immediately available to the plants. The organic fertilizer reduces soil erosion. In addition to supplying nutrients, sludge also improves soil quality by providing organic mass [1], [7].

STANDARD PROCEDURES FOR BIOGAS PRODUCTION

The general or standard process for biogas production, before fed into plant, the organic matter is under go through process of cleaning and parting. The plant consist mixer, two digesters and gas storage, these digesters are fermentation tanks, in which anaerobic conditions are produced due to absence of air, since the suitable atmosphere is observed for bacteria generation.

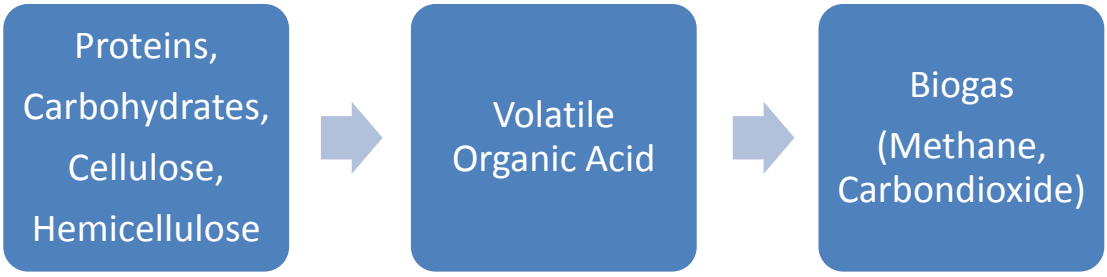

Fig.1. The general process of Biogas Production

The stirring is needed in order to get homogeneous mixture so that the gas formation takes place and these gases are collected into the gas chamber made by steel. Generally in most design of biogas plant, the gas holder is equipped with a gas outlet, while the digesters are provided with an overflow pipe to lead the sludge out into a drainage pit.

The generated biogas is further processed so that the carbon dioxide and hydrogen sulphide gases are removed. Since, mostly methane is remained. As methane is similar to natural gas obtained from the oil & gas fields (fossil fuel).

The general composition of biogas

- 50-75 % Methane, CH_4

- 25-50 % Carbon dioxide, CO_2
- 0-10* % Nitrogen, N_2
- 0-1 % Hydrogen, H_2
- 0-3 % Hydrogen sulphide, H_2S
- 0-2* % Oxygen, O_2

*often 5 % of air is introduced for microbiological desulphurization. These, above mentioned advantages are elaborated

RECENT TREADS TO INCREASE PERCENTAGE OF METHANE IN BIOGAS

Increasing the Methane Content in Biogas

There are several technical methods that can be used to increase amount of methane gas production and extraction at landfills and wastewater treatment plants. However, these techniques are used for industrial fields like dairy farm and etc.

It includes pretreatment of the feedstock with heat, ultrasonic devices, or impact grinding (all to increase the degree of hydrolysis of the feedstock); microbial stimulants; or co-digestion with other wastes [5].

Pretreatment Technique

The pretreatment like thermal may increase the methane percentage of certain substrates. Where, mostly ultrasonic test is used for effective in disintegrating kitchen waste, resulting in greatly improved fermentation rates, in which low frequency ultrasonic diminish the cell, and longer ultrasound applications damage cell walls in liquid phase. But, at that time destruction of solid also takes place it causes the production of biogas.

Stimulation to micro-bacteria

The some steroids product are available in market which activate microbes, these comes from plants and used to activate the microbial population. At yet it is not experimented on commercial level.

Co-Digestion with Other Waste Sources

It is beneficial that, the co-digestion of kitchen waste with other substrate like industrial wastes, animal by-products (slaughterhouse waste).

On the experiments done previously, we can say that, its gives nearly double amount of methane gas by using co-digestion method in the retention of 20 days.

CONCLUSIONS

In this paper, review is taken on biogas and its theory. Various methods to increase amount of methane in biogas are discussed in details. Advantages of biogas in energy sector as well as in agriculture sector have studied. In future, there will be a lot of scope for biogas in renewable energy. It is the most economical source and gives continues supply of energy.

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Diminishing of Vibration Energy by Using TMVA

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ABSTRACT

Vibration phenomenon occurred due to reciprocating motion, stresses which leads to fatigue or failure of that component or machine, decreases product quality etc. its results in the form of unusual economy of product. The vibrations occurred during machining process may cause the deflections, inaccuracy, rough surface finish, chatter on the component. It also decreases the product quality along with the life of machine. Vibrations can be reduced by controlling the natural frequencies of the system and avoiding resonance under externals excitations, by preventing excessive response of the system, even at resonance by introducing a damping or energy –dissipating mechanisms, by reducing the transmissions of the excitations forces from one part of the machine to other, by the use of vibration isolators or by the addition of an auxiliary mass neutralizer or vibration absorber. In this paper theory and applications of Tuned Mass Vibration Absorber are discussed in detail.

INTRODUCTION

Engineering machinery undergo various sources of vibrations, throughout their life. In mechanical systems is still a thriving research field as it enables improvement in life as well as noise reduction and thereby comfort enhancement.

Vibration is caused due to oscillations and it is transmitted through continuous medium. It is in nature observed that whole universe is a self damper or absorber. Vibration is referred in terms of displacement, velocity and acceleration of a point on the vibrating structure. These quantities are functions of time, and are referred to as signals. Vibration signals will be referred to simply as vibration. Vibration, or vibration signals, can be divided into two main categories with respect to the characteristics of signals, namely, deterministic and nondeterministic. Deterministic vibration which can be categorized further, which can be periodic or non-periodic., on one hand periodic vibration is classified as sinusoidal or complex periodic, on the other hand non-periodic vibration is classified as almost periodic or transient .Sinusoidal vibration has the form of a sine signal, while complex periodic vibration may have the form of a combination of sine signals of different frequency and amplitude, or it may be any other signal that is periodic. Example of sinusoidal vibration is the rotation of unbalanced machinery such as turbines, wheels and shafts. Transient vibration is another case of non-periodic vibration. In this case, an initial displacement, velocity or acceleration, or a sudden change in one of these quantities caused by an external element, causes the structure to experience vibrations that decay with time.

Vibration is used in different fields for numerous applications. Vibrating mixers and sieves are used in production systems for use in automated production, e.g. automatic feeders. Vibrating sieves and tools are used in construction, e.g., pneumatic drills. In medicine, vibrating machines are used by doctors to cure diseases, e.g. sound waves are used to break kidney stones, as in the lithotripter, which is used for Extracorporeal Shock Wave Lithotripsy (ESWL) treatments.

Although there are some applications that benefit from vibrations, in general, vibration is not desired in mechanical systems and engineering structures. The cyclic characteristic of vibration introduces dynamic stresses in members, which cause fatigue and can eventually lead to failure. Vibrations caused by earthquakes may cause structures to fail unless they are designed properly. Vibration of the passenger compartments of vehicles cause discomfort to the passenger.

The concept of resonance is very important and has a high priority in the study of forced vibrations. The term forced vibration is used for cases where the structure is excited continuously by an external source, e.g., a sinusoidal force. The forcing frequency is the frequency of this forcing function, e.g., the frequency of the sine wave.

For a vibratory system, resonance occurs when the forcing frequency is equal to the natural frequency, also referred to as the resonant frequency, of the structure. Under resonance, displacement of a nodal point reaches its highest value. Since displacements are maximum at resonance, resonance imposes the highest strains and stresses on the structural members, and therefore causes the most damage. The idea in using a vibration absorber in a system is mainly to reduce the destructive vibrations that the primary system experiences when it is excited at or around its natural frequency, i.e., when it experiences resonance, A vibration absorber can be described as an auxiliary system connected to the primary system of concern, which attenuates the vibrations of the primary system by absorbing and/or dissipating its kinetic energy.

TUNED MASS VIBRATION ABSORBER

The tuned mass vibration absorber (TMVA) is probably the most popular device for passive vibration of mechanical machines. It is commonly used for civil (e.g. Millennium bridge, Taipei 101 and Burj-el-Arab buildings) and electromechanical engineering machines (e.g. cars and high-tension lines). Its broad range of applications is mainly due to its linear character and thereby the solid theoretical and mathematical foundations on which it relies. Despite the well-established theory for simple primary systems, the design of such an absorber is still a challenging problem when it is coupled to more complex machines. The present section aims to review the existing tuning procedures when a TMVA is attached to single-degree-of-freedom (SDOF) and multi-degree-of-freedom (MDOF) systems presenting linear and nonlinear characteristics.

It is a necessary to eliminate undesirable vibrations of externally excited body, by coupling some vibrating system to it. This attached system is called as vibration absorber. In that case, excited frequency should equal to natural frequency of body. Vibration absorber is used to control structure resonance.

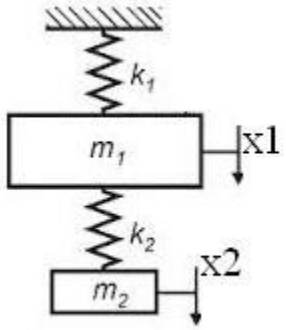

Figure 1. Tuned Mass Absorber

For example, if the excitation frequency ω is equal to the natural frequency $\omega=\omega_n=\sqrt{\frac{k1}{m1}}$ of the system amplitude of the vibrations would be very large because of resonance. Spring mass system ($m_2 – k_2$) is coupled to the main system as shown in figure. This spring mass system act as vibration absorber and reduces the amplitude of m_1 to zero, if its natural frequency is equal to excitation frequency i.e. $\omega=\sqrt{\frac{k2}{m2}}$

Thus $\frac{k1}{m1}=\frac{k2}{m2}$

When this condition is full filled, the absorber is called tuned absorber. Now, system becomes double degree of freedom.

 ISBN: 978-93-84663-07-0

$m_1 \ddot{x}_1 + k_1 x_1 + k_2(x_1-x_2)= F \sin\omega t$ (1)

$m_2\ddot{x}_2 + k_2(x_2-x_1)= 0$ (2)

Solution will be,

$x_1 = A_1 \sin\omega t$ (3)

$x_2 = A_2 \sin\omega t$ (4)

SINCE,

$\ddot{x}_1= -\omega^2 A_1 \sin\omega t$ and $\ddot{x}_2= -\omega^2 A_2 \sin\omega t$

Putting values of $\ddot{x}_1$ and $\ddot{x}_2$ in eqn. (1) & (2)

$(k_1+k_2-m_1\omega^2)A_1-k_2a_2=F$

$-k_2a_1+(k_2-m_2\omega^2)A_2=0$

Solving above eqn. We get,

$A_1 =\frac{(K2-m2\omega2)F}{\beta}$ (5)

$A_2=\frac{K2F}{\beta}$ (6)

Where, $\beta= [m_1m_2\omega^4-\{m_1k_2+m_2(k_1+k_2)\}\omega^2+k_1k_2]$

To get the amplitude of mass m_1 as zero, let us consider Eqn.(5),

$A_1 =\frac{(K2-m2\omega2)F}{\beta} =0$

$\omega = \sqrt{\frac{k2}{m2}} = \omega_2$

From this it is found that the amplitude of absorber mass (m_2) is always much greater than that of the main mass (m_1). Thus, the design should be able to accommodate the large amplitudes of the absorber mass. Also the amplitudes of m_2 are expected to be large, the absorber spring (k_2) needs to be designed from a fatigue point of view. [5]

Types of Vibration

FREE VIBRATION

It occurs when a mechanical system is set off with an initial input and then allowed to vibrate freely. Examples of this type of vibration are pulling a child back on a swing and then letting go or hitting a tuning fork and letting it ring. The mechanical system will then vibrate at one or more of its "natural frequency" and damp down to zero.

FORCED VIBRATION

It is when a time-varying disturbance (load, displacement or velocity) is applied to a mechanical system. The disturbance can be a periodic, steady-state input, a transient input, or a random input. The periodic input can be a harmonic or a non-harmonic disturbance. Examples of these types of vibration include a shaking washing machine due to an imbalance, transportation vibration (caused by truck engine, springs, road, etc.), or the vibration of a building during an earthquake. For linear systems, the frequency of the steady-state vibration response resulting from the application of a periodic, harmonic input is equal to the frequency of the applied force or motion, with the response magnitude being dependent on the actual mechanical system.

NEED OF VIBRATION REDUCTION AND IT'S CONTROL

In case machining, the vibrations occurred during machining process may cause the deflections, inaccuracy, rough surface finish, chatter on the component. It also decreases the product quality along with the life of machine.

The vibrations developed at Aero-plane during on board, whether it may develop due to reciprocating engine or air resistance, it may result in Air Crash. Since these harmful un-necessary vibrations must be reduced, for human being.

The following are the several methods for vibration control:-

- By controlling the natural frequencies of the system and avoiding resonance under externals excitations.
- By preventing excessive response of the system, even at resonance by introducing a damping or energy dissipating mechanisms.
- By reducing the transmissions of the excitations forces from one part of the machine to other, by the use of vibration isolators.
- By reducing, the response of the system, by the addition of an auxiliary mass neutralizer or vibration absorber.

VIBRATION REDUCTION METHODS

Damping is the conversion of mechanical energy (vibrations) into heat. Basic methods exist for vibration control of industrial equipment, as Force Reduction of excitation inputs due to, for example, unbalances or misalignment, will decrease the corresponding vibration response of the system. Mass Addition will reduce the effect (system response) of a constant excitation force. Tuning (changing) the natural frequency of a system or component will reduce or eliminate amplification due to resonance. Isolation rearranges the excitation forces to achieve some reduction or cancellation.

Vibration reduction methods are classified into three distinct categories:

1. Active control generally gives the best vibration reduction performance, but it is not widely used due to its cost, the necessity to have an external energy supply, its lack of robustness and reliability in the industry.

2. Semi-active control of machines using electro- and magneto-rheological fluids was recently proposed. The particularity of these fluids lies in their varying viscosity with respect to the electric or magnetic field in which they are plunged. Since no energy is transferred to the controlled system, these techniques are robust and reliable while offering a vibration reduction level similar to active techniques. However, the modeling of the fluid behaviors as well as the development of the controller represent major challenges that still complicate the use of the systems for real-life structures.

3. Passive vibration method simply a structural modification by adding either a mass or a dynamical vibration absorber (DVA). It represents a very interesting alternative to the aforementioned methods as its performance is acceptable without requiring external energy supply.

APPLICATION OF TUNED MASS VIBRATION ABSORBER

Vibrations occurred at Gym Floor

In day-today life, generally excessive vibrations are occurred at Mechanical Workshop, Aero-Plane Board, Industry, Earth-quake on concrete slabs these are human induced vibrations occurred due to different loading conditions, whether it may be, residential or commercial building. The Tuned Mass Damper was proposed to improve the performance to control the excessive vibrations developed which discomfort for the people. For effective working of TMD at workshop floor Different models considering one and more TMDs, varying its placements and parameters, besides the frequency reference value to tune the damper were considered. An efficient control solution to this practical problem is presented to reduce its undesirable vibrations.

Since, for effective working the location of TMD plays an important role, while other parameter like spring's stiffness values, mass ratio also decided performance rate. Where, TMD reduces energy dissipation due to mass-spring dashpot system connected to structure. [1]

Earthquake vibration control by using hybrid mass liquid damper

A tuned liquid damper (TLD) is a passive vibration control device consisting of a rigid tank filled with water that relies on the sloshing of water inside it to dissipate energy. In a standard TLD configuration the TLD is connected rigidly to the top of the building structure. The TLD is more effective when its base acceleration amplitude is larger, as it dissipates more energy through increased sloshing. In TLD configuration, the TLD is rigidly attached to a secondary mass that is attached to the primary structure through a spring system. This configuration is called as hybrid mass liquid damper (HMLD). For very small values of the secondary mass, when the secondary spring is rigid, the alternate and standard TLD configurations are identical. For a given structure with HMLD there exists an optimum value of the secondary spring's stiffness for which the HMLD effectiveness is maximum. An optimally designed HMLD configuration is more effective as a control device than the standard TLD configuration for both harmonic and broad-band earthquake motions. The effectiveness of the HMLD is clearly dependent on the relative stiffness of the secondary spring system compared to the stiffness of the primary system. For large amplitude harmonic excitations, the HMLD configuration with an optimum secondary stiffness and with the same total mass has been found to be significantly more effective than the standard TLD configuration.

The most important point for practical implementation of the HMLD as an earthquake vibration control device is that the optimal secondary spring constant value is fairly constant for a given set of design ground motions and the structure. This ensures that it is possible to suggest a practical design of a HMLD configuration for a particular structure once the design basis earthquake ground motions are known. For example, for the broad-band ground motions considered in this study, irrespective of the structure's dynamic characteristics A HMLD with a low secondary mass relative to the water mass in the TLD is a robust control device as the efficiency is not significantly affected by small variations of the λ value around the optimal value. [2]

Forced vibration in power transmission lines

In several fields of engineering The Suspended cables are extensively used such as extra-high voltage transmission lines and cable-stayed bridges. Due to flexibility, relatively small weight and low energy-dissipative characteristics of cables, they are exposed to external excitations such as wind, wind–rain, earthquake and traffic loadings. Along with, galloping phenomenon is one of the most important sources of electrical/mechanical failures in power transmission lines. Tunable vibration absorbers (TVAs), as a semi-active control approach, were designed to suppress the undesirable vibrations of transmission lines.

Flexible long cables with low structural damping, in case of transmission lines are susceptible to wind-induced oscillations. These large amplitude oscillations may be caused by various wind excitation mechanisms such as wind –rain vibrations. The suppression of cable vibrations via passive/ active control methods used in retrofitting mechanism for existing transmission lines or designing of new installations. Cables are oscillating most commonly in the vertical plane, horizontal or rotational motion is also possible Conductor galloping is the high-amplitude, low-frequency oscillation of power transmission lines due to wind..

This undesirable motion leads to the high loading stress on insulators and electricity pylons, raising the risk of mechanical/electrical failures and interruption of the power supply. [3]

Regenerative chatter in nonlinear milling process:

In milling process, tunable vibration absorber (TVA) was employed for designed to suppress regenerative chatter. . Under regenerative chatter conditions, for minimizing vibrations optimum values of the absorber position and its spring stiffness plays major role. While, machining the majority of work-piece materials or the interaction of work-piece/cutting tool causes the cutting forces to demonstrate nonlinear behavior. The application of TVA (as a semi-active controller) is investigated for the process with an extensive nonlinear model of cutting forces TMVA leads to great improvement in stability while machining, the regenerative chatter are developed under resonance and non-resonance conditions. Large depth of cut, more material removal rate can be achieved under unstable conditions. [5]

Chatter observed in boring

Chatter occur negative effects as poor surface quality, decreased removal rate and accelerated tool wear, high noise level. In boring the two categories of chatter ,primary chatter that can be produced by the cutting process itself (friction, thermo-mechanical or mode coupling effects) and secondary chatter caused by the regeneration of waviness of the work piece surface.

In the chatter control of boring, including difficult methods, such as the use of electro-rheological and magneto-rheological fluids and active dynamic vibration absorbers. Another possibility for active chatter suppression is varying the spindle speed to interrupt regenerative chatter effects. The common procedure to analyze the boring bar stability with a passive vibration absorber is modeling the system as a two degree of freedom system. The vertical displacement of the DVA corresponds to the second degree of freedom. The absorber design implies the identification of optimal parameters (mass, stiffness and damping) leading to the desired response of the system. [8]

Applications of TMVA for building structure

For vibration control of structures when subjected to earthquake excitations tuned mass vibration absorber (TMVAs) [5] are comprising a spring, mass attached to the structure is used. It is a frequency reliant device. Results demonstrate that PTMVA effectively damps the response on building during earthquake. Two pedestrian bridges, equipped with tuned mass dampers almost two decades ago, have been evaluated for their long-term performance. The response due to pedestrian action, forced vibrations as well as deck response is compared to the response at installation. Since both inherent bridge damping and absorber effects reduce the overall response, it is difficult to separate the two effects. [6]

The concept of effective damping is used to show the correlation between the two effects. This concept permits separating the effects of bridge damping, absorber mass, and detuning in an approximate manner. The assessment shows that both bridges and tuned mass dampers are still working satisfactorily. Detuning has been observed in one of the two bridges, where it was existed already at installation. Parameters of the tuned mass dampers depend significantly on seasonal temperatures to give some practical limits to exact optimal tuning. The combined effect of detuning at installation and detuning due to temperature effects can be expressed as loss in effective damping. Under summer and winter conditions, the loss in effective damping for the girder bridge was more than that for cable-stayed bridge. The temperature effects thus reduced the effective damping by in both cases. [7] A simple and practical hybrid vibration absorber (HVA) was proposed for global vibration control of flexible structures under random stationary excitations.

CONCLUSION

In this paper theory of Tuned Mass Vibration Absorber is studied in detail. It is found that it is effective tool to reduce amplitude of vibrating body. It is found that it can be used for the various applications like (Vibrations occurred at Gym Floor, Earthquake vibration control by using hybrid mass liquid damper ,Forced vibration in power transmission lines ,Regenerative chatter in nonlinear milling process: ,Chatter observed in boring ,Applications of TMVA for building structure). It is found that the same can be used for single degree of freedom and also for multi degree of freedom vibrating systems.

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Wastewater Treatment and Electricity Generation Using MFC Microbial Fuel Cell

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ABSTRACT

Waste management is becoming the talk of the day in lieu of the population crossing alarming limits. Microbial fuel cells (MFCs) represent a new method for treating various kinds of wastewater and simultaneously producing electricity. MFC representing a complete new approach to the treatment of wastewater is also capable of generating sustainable clean energy by removal of organic matter. The experimental setup is basically divided into three parts i.e. anode part, cathode part and ion exchange membrane, giving an alternative treatment technology which will be cost effective as well as will require less energy for its operation. The system being operated under a wide range of conditions such as temperature, pH, electrode surface area, reactor size and operation time, is built in a double chamber. The key role played by microbes disintegrates waste water and help electrons to move and generate electricity.

Keywords: Waste water treatment, microbial fuel cell, sustainable energy, electricity generation, microbes.

INTRODUCTION

On our earth 71% of the total surface area is occupied by water, even though only 1% of it is potable. As science progresses, rate of mortality is decreasing. This causes explosion of population, which is now crossing alarming limits. On the other side available potable water is getting contaminated due to disposal of mostly untreated or partially treated industrial effluents, domestic sewage & other solid wastes. These all pollutants decrease the self cleaning capacity of these water bodies due to loss of marine life in it. This is irreparable & inexcusable destruction of potable water. We cannot produce potable water artificially nor can we import it from other planet. Only alternative remain that we have to conserve the available potable water resources.

This can be only achieved by treating these effluents & sewage up to safe levels before ultimate disposal into any natural water course. All conventional methods to treat this effluents & sewage are not cost effective and hence avoided. Scientists are trying to find new technologies for waste management and sewage treatment.

MFC, Microbial fuel cell is renewable source of energy which produces electricity from waste simultaneously treats it. It is becoming world-wide popular as it directly generates electricity from organic matters. MFC is the device that directly converts chemical energy into electrical energy from organic matters.

LITERATURE SURVEY

In recent years, there are many people, scientists and researchers working on MFC who came up with different findings and variety of applications.

I Ieropoulos, J Greenman, D Lewis, O Knoop of West of England and University of Bristol [1] constructed 8 MFC and connected hydraulically. The anode and cathode electrodes were made of 15 cm2 carbon veil and artificial urine is used for the experiment. MFCs were inoculated using activated anaerobic sludge; after 17 days of fed batch mode they were switched to continuous flow, initially at 0.09 mL/h and subsequently at 0.43 mL/h, resulting in HRT of 12.69 minutes/MFC. MFCs showed stable performance following the

maturing period and produced, under polarization experiments, peak power levels of 117 µW, corresponding to 962.94W/m3.

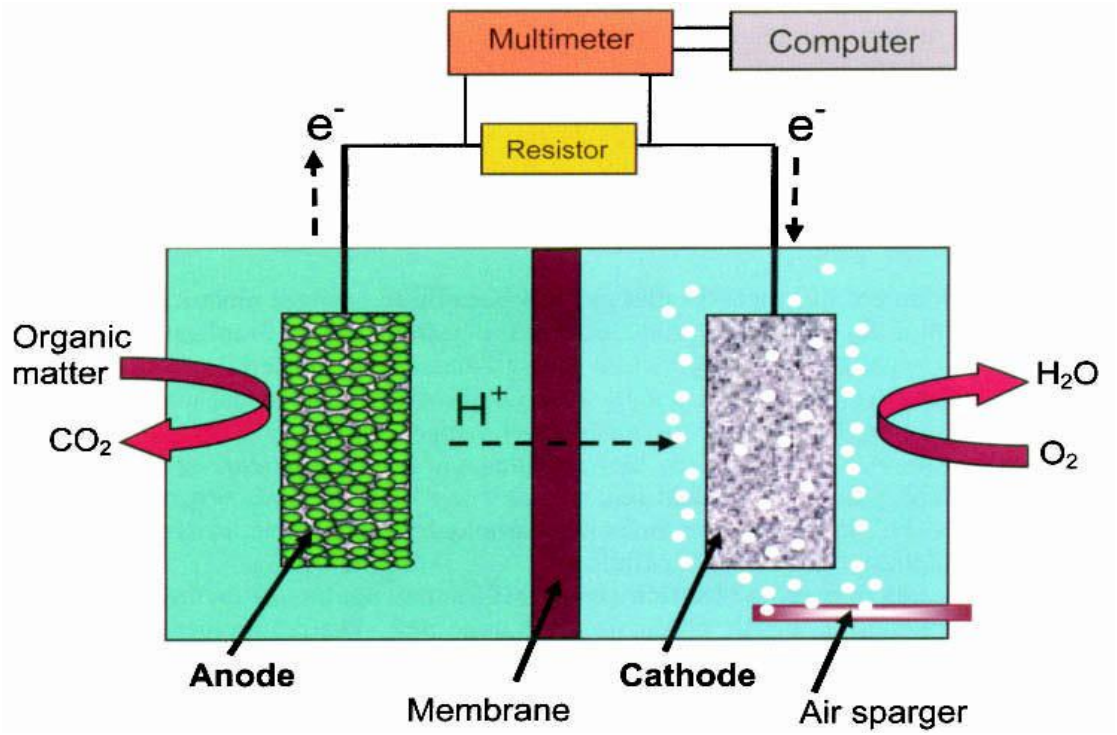
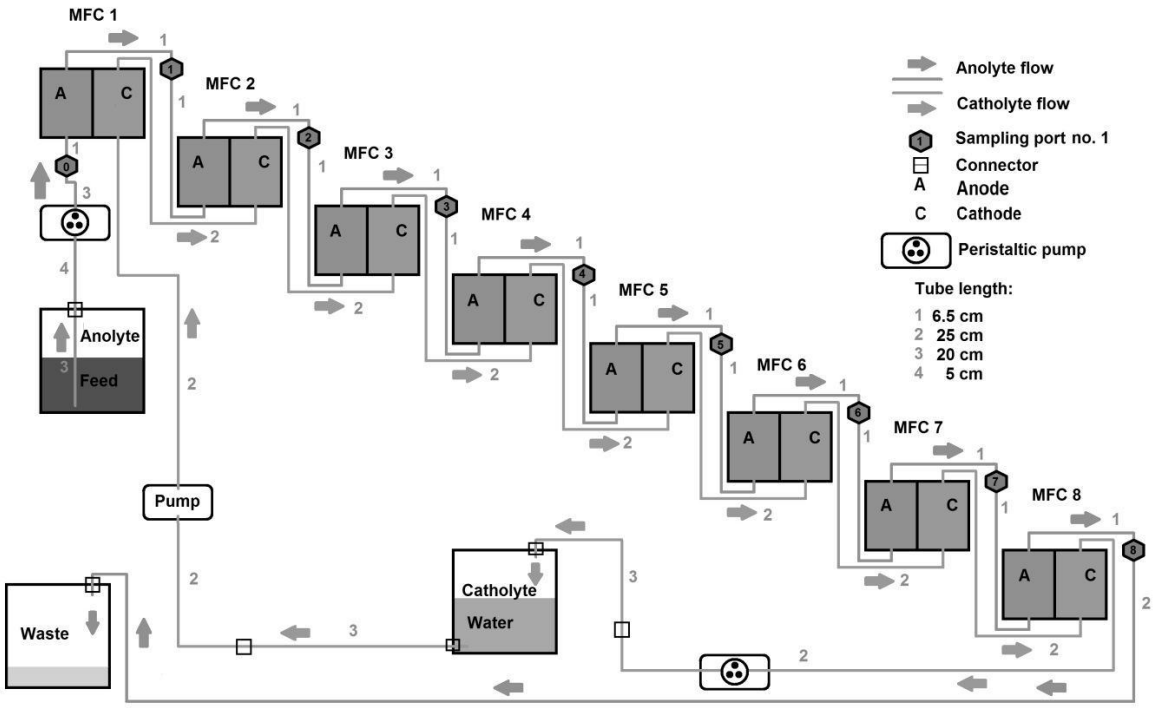


Figure (a),[4]



Junqiu Jiang, Qingliang Zhao, Department of Chemical Engineering, National Taiwan University, Taipei, Taiwan [2]. A two-chambered microbial fuel cell (MFC) with potassium ferricyanide as its electron acceptor was utilized to degrade excess sewage sludge and to generate electricity. Stable electrical power was produced continuously during operation for 250 h. Total chemical oxygen demand (TCOD) of sludge was reduced by 46.4% when an initial TCOD was 10,850 mg/l.

Booki Min, JungRae Kim, SangEun Oh, John M. Regan, Bruce E. Logan of The Pennsylvania State University [3] worked on Electricity generation from swine wastewater using microbial fuel cells.a two-chambered MFC with an aqueous cathode indicated that electricity could be generated from swine wastewater containing 83207190 mg/L of soluble chemical oxygen demand (SCOD) (maximum power density of 45 mW/m2). More extensive tests with a single-chambered air cathode MFC produced a maximum power density with the animal wastewater of 261 mW/m2 (200O resistor), which was 79% larger than that previously obtained with the same system using domestic wastewater (14678 mW/m2) due to the higher concentration of organic matter in the swine wastewater. Power generation as a function of substrate concentration was modelled according to saturation kinetics, with a maximum power density of Pmax ¼ 225 mW = m2 (fixed 1000O resistor) and half-saturation concentration of Ks ¼ 1512mg = L (total COD). Ammonia was removed from 19871 to 3471 mg/L (83% removal). In order to try to increase power output and overall treatment efficiency, diluted (1:10) wastewater was sonicated and autoclaved. This pre-treated wastewater generated 16% more power after treatment (11074 mW/m2) than before treatment (9674 mW/m2). SCOD removal was increased from 88% to 92% by stirring diluted wastewater, although power output slightly decreased. These results demonstrate that animal wastewaters such as this swine wastewater can be used for power generation in MFCs while at the same time achieving wastewater treatment.

METHODOLOGY

The MFC comprises of a double chambered experimental setup consisting of anode compartment and cathode compartment. The compartments are plastic containers connected by ion exchange membrane.

Anode compartment is filled with 5L wastewater from wastewater treatment plant. Cathode compartment is filled with 4L distilled water with 30gm NaCl/KCl. Membrane is a mixture of Solid Agar and NaCl from Lab was prepared and placed in fitting PVC Pipe connecting Anode and Cathode.

Figure (c) showing experimental setup

Solution Containing Organic Matter: A wastewater solution was created with 25 grams of D-glucose mixed in 5L of influent wastewater.

Microorganisms: Naturally Occurring Microorganisms present in waste water and also later Algae was added to observe new readings.

RESULTS AND DISCUSSION

The experiments performed with MFC are in small scale. At starting of the process power produced is 0.23V and then it decreases to 0.18V. If we keep running the process the power level increases through time. The maximum power obtained is 0.7V. Applying MFCs on large scale, we can produce greater power.

CONCLUSION

There are vast applications of microbial fuel cell. Under the recent investigations microbial fuel cells treat waste and generate electricity simultaneously. So it can be used in waste water treatment process reducing use of conventional chemicals and also eliminate usage of energy resources required. These combinations will help in saving millions of rupees as a cost of waste water treatment at present.

FUTURE SCOPE OF STUDY

This report addresses in a comprehensive manner the following areas:

- Overview of MFC development and cost advantages and disadvantages of using MFC in waste to energy program.
- Available MFC system and its application in environmental engineering.
- Design of MFC and its power generation ability.
- Construction monitoring and its inspection.
- Recent design methods and some modifications in this method.

ACKNOWLEDGEMENTS

This research was supported by G.H.Raisoni College of Engineering & Management, Civil Department. We are very thankful to our respected principal, head of civil department and professors for their motivation. They helped us in this research apart from our curricular.

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Green Synthesis of Silver Nanoparticles Using Extracts of Caesalpinia pulcherrima

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ABSTRACT

The biosynthesis of nanoparticles has been proposed as a cost effective and environmental friendly alternative to chemical and physical methods. Plant mediated synthesis of nanoparticles is a green chemistry approach that interconnect nanotechnology and plant biotechnology. In the present study, synthesis of silver nanoparticles (AgNPs) or (Green-Silver) has been demonstrated using extracts of Caesalpinia pulcherrima reducing aqueous silver nitrate. The AgNPs were characterized by Ultraviolet-Visible (UV-Vis) Spectrometer, Scanning electron microscopy (SEM). The reaction process was simple for formation of silver nanoparticles and AgNPs presented in the aqueous medium were quite stable. This work proved the capability of using biomaterial towards the synthesis of silver nanoparticles by adopting the principles of green chemistry.

***Keywords*:** Silver nanoparticles, UV- Visible, SEM, Caesalpinia pulcherrima.

INTRODUCTION

In the recent trend nanoparticles have wide scope for their diversified application. Since nanoparticles exhibit completely new or improved properties based on specific characteristics such as size, distribution and morphology, new applications of nanoparticles and nanomaterials are emerging rapidly. Nanoparticles can be synthesized by various approaches like chemical and photochemical reactions in reverse micelles (Telab *et al.* 1977), thermal decomposition (Esumi *et al*. 1990), electrochemical (Rodriguez-Sanchez et al. 2000), sonochemical (Zhu *et al.* 2000), microwave assisted process (Pastoriza-Santos *et al.* 2002) and also by biological methods (Begum *et.al.* 2009, Bar *et al.* 2009).

In this research work, we adopted biological method for the synthesis of nanoparticles because it is cost effective and environmental friendly compared to physical and chemical methods. Since chemical and physical methods involve use of high pressure, energy, temperature and toxic chemicals, plant extracts are used for the synthesis. The microbial enzymes and phytochemicals with anti oxidant or reducing properties are usually responsible for reduction of metal compounds into their respective nanoparticles. Nature has devised various processes for the synthesis of nano and micro-length scaled inorganic materials which have contributed to the development of relatively new and largely unexplored area of research based on the biosynthesis of nanomaterials (Mohanpuria *et al.* 2000). In medical and industrial process, Silver has effective inhibition on microbes. The vital application of silver and silver nanoparticles in medical industry is topical ointments to prevent infection against burn and open wounds (Burd *et al.* 2006). Bioreduction of silver ions to yield metal nano particles using living plants like geranium leaf (Shankar *et al.* 2003) and neem leaf (Shankar *et al.* 2004) have been studied. The Biosynthesis of silver nanoparticles using *Lantana camara* fruit extract has been studied (Sivakumar *et al*. 2012). According to previous investigations, the polyol components and the water-soluble heterocyclic components play significant role in the reduction of silver ions. These components also proved to be a effective capping and stabilizing agents for silver nanoparticles (Arangasamy *et al*. 2008). In the present work, a sensitive and simple method for the determination of trace amounts of a copper (II) – Caesalpinia pulcherrima extracts of flowers by spectrophotometry. The influences of some analytical parameters including metal ion concentration, volume of reagent, etc. on the colour formation were investigated. All seeds of Caesalpinia are poisonous. However the seeds of some species are edible before the seed reach maturity (e.g. immature seeds of C. pulcherrima) or with treatment (C. bonduc toxicity is reduced after roasting). C. pulcherrima is the most widely cultivated species in the genus Caesalpinia. It is a striking ornamental plant, widely grown in

domestic and public gardens and has a beautiful in florescence in yellow, red and orange. Its small size and the fact that it tolerates pruning well allow it to be planted in groups to form a hedgerow; it can be also used to attract humming birds.

Leaves: Even-bipinnate, alternate, to 24 inches long, with 4-9 pairs of even pinnae, 5-12 pairs of oblong to obviate leaflets

Flowers: Caesalpiniaceous, yellow, red or pink, with 10 long thread-like stamens, on terminal racemes to 22 inches long Fruits: Pods, flatten, to 5 inches long with 5-8 shiny brown, flat seeds

METHODS AND MATERIALS:

Materials: $AgNO_3$ was purchased from Aldrich and used without purification. Filter paper of size 0.45 µ and 0.25 µ were purchased from Fischer scientific. The aqueous solutions used for synthesis were ultrahigh purity (Mill-Q) water

Plant extracts: Crushed Caesalpinia pulcherrima of flowers were extracted by the following methods.

Extraction at room temperature or cold extraction: 50 g Caesalpinia pulcherrima of flowers were dipped in 100 ml petroleum ether and hexane respectively for 2 hr at room temperature in a stoppered conical flask and shaken periodically by electrical stirrer. The extracts were filtered and filtrate was evaporated under reduced pressure on water bath to obtain crude.

Hot extraction or reflux extraction: 50 g Caesalpinia pulcherrima of flowers were refluxed in 100 ml petroleum ether and hexane respectively for 2 hr, in a round bottom flask. The extracts were filtered and filtrate was evaporated under reduced pressure on water bath to obtain crude.

Soxhlet extraction: In this method, 50 g Caesalpinia pulcherrima of flowers were extracted in 100 ml petroleum ether by soxhlet extraction technique for 2 hr. The extracts were filtered and filtrate was evaporated under reduced pressure to obtain crude.

Preparation of Caesalpinia pulcherrima flower

The collected Sample (Caesalpinia pulcherrima) was brought to laboratory and it was washed with fresh water to separate contaminants such as adhering impurities, sand particles and dust. Then the sample was soaked in distilled water. The flowers were shade dried for 14 days. The dried flower was ground and stored in air tight containers.

Aqueous Extraction of prepared Caesalpinia pulcherrima: The powder obtained was extracted with distilled water. To 5g of powdered sample, 100 mL of distilled water was added and boiled to 60 - 70 °C for about 10 min. Then the resulting crude extracts were filtered through 0.25µ filter and stored in refrigerator.

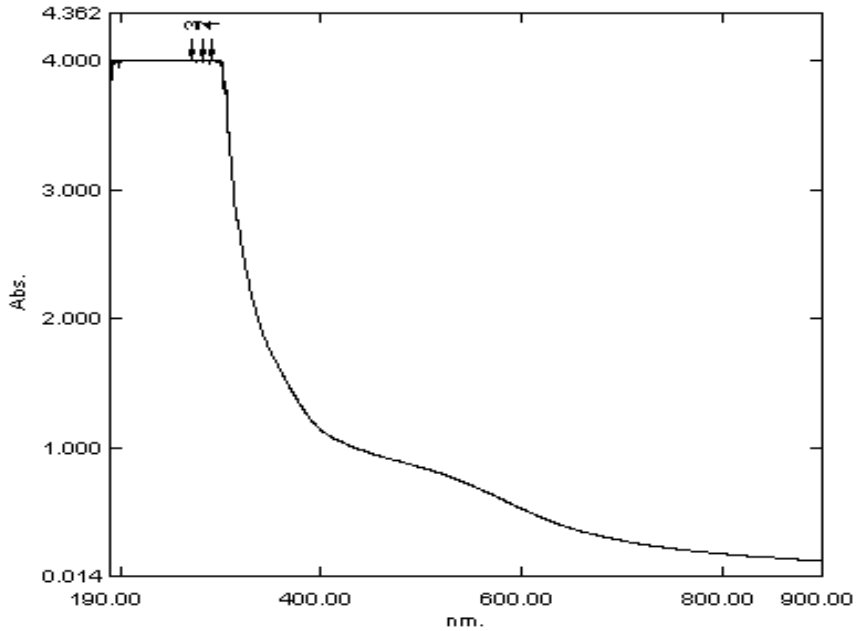
Synthesis of Silver Nanoparticles: $AgNO_3$ of 1mM was prepared by adding 0.015g of $AgNO_3$ to 90 mL of distilled water and used for the synthesis of silver nanoparticles. Then 10 mL of Caesalpinia pulcherrima flower extract was added into 90 mL of prepared aqueous solution of 1mM $AgNO_3$ for reduction into Ag+ ions and kept in magnetic stirrer for 1hour at room temperature.

Charaterization: UV–Vis Spectra analysis was carried out to confirm the silver nanoparticles formation in Shimadzu 1800 UV spectrophotometer (Systronic). Further the size of synthesized nanoparticle was determined by SEM.

RESULTS AND DISCUSSIONS:

UV-Vis Spectra Analysis

Synthesized silver nanoparticles were yellowish orange in aqueous solution due to excitation of surface plasma vibrations in silver nanoparticles [22]. The colorless $AgNO_3$ solution changed to yellowish orange when Caesalpinia pulcherrima flower extract was added. This colour change was due to the reduction of Ag+ into Ag0 which leads to the formation of silver nanoparticles. UV-Vis absorption spectrophotometer was used to investigate the LSPR phenomenon. The spectra displayed the characteristic surface plasmon resonance (SPR) band of silver nanoparticles at about 435 nm, indicating the formation of silver nanoparticles (Fig. 3)



SEM analysis: SEM images provided information about the morphology and size of the biosynthesized silver nanoparticles. The silver nanoparticles were found to be spherical in shape. The diameter of synthesized silver nanoparticles was identified as 20 - 35 nm. Further SEM image showed the high density silver nanoparticles synthesized by the Caesalpinia pulcherrima flower extract. This confirmed the development of silver nanostructures by the plant extract.

Conclusions: In conclusion, green synthesis of silver nanoparticles from Caesalpinia pulcherrima flower extract was studied. The reduction of the metal ions led to the formation of silver nanoparticles of fairly well-defined dimensions using the flower extract. This green chemistry approach towards the synthesis of silver nanoparticles has many advantages such as environmental friendly, cost effective and easily scaled up to large scale synthesis.

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Renewable Energy, Global Warming Problem and Impact of Power Electronics

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ABSTRACT

Global energy consumption is increasing at a dramatic rate due to the increase in the world's population and the quest for improvement of living standards. Most of our energy comes from fossil fuels which cause the problem of global warming due to the emission of greenhouse gases (GHG) also fossil fuels are becoming scarce and that their combustion produces CO2 which contributes to climate change. As a result, there are many harmful effects such as rise in sea level, drought in tropical regions near the equator, an increase in hurricanes, tornadoes and floods, and the spread of disease. Climate change mitigation and security of supply have become the focus of many recent national energy policies. Renewable energy is the energy generated from natural resources such as solar heat and light, wind, rain, tides, waves, and geothermal heat, which are replenished naturally. About 19% of global final energy consumption came from renewable, with 13% coming from traditional biomass, used mainly for heating, and 3.4% from hydroelectricity. New renewable (small hydro, modern biomass, wind, solar, geothermal, and bio fuels) accounted for another 2.7% and are growing rapidly. At the national level, at least 30 nations around the world already have renewable energy contributing more than 20% of energy supply. The share of renewable in electricity generation is around 21.6%, with 15% of global electricity coming from hydroelectricity and 6.6% from new renewable. Wind Power, for example, is growing at the rate of 30% annually, with a worldwide installed capacity of 282,482 megawatts (MW) at the end of 2013.This paper highlights in particular the impact of power electronics in solving or mitigating the global warming problem and supporting the generation of renewable energy.

Keywords: Renewable Energy, Global Warming, Power Electronics.

INTRODUCTION

Global energy consumption is increasing dramatically due to our quest for higher living standards and an increasing world population. Most of our energy comes from fossil fuels, and burning these fuels causes global warming. Global warming raises the sea level, brings drought to tropical regions near the equator, increases hurricanes, tornadoes and floods, and spreads disease. These consequences are serious and will eventually bring tremendous unrest in the world. Various measures to solve or mitigate global warming are outlined in the paper.

Power electronics help improve the energy efficiency of apparatus, and helps the generation of environmentally clean or green energy. Renewable green energy sources will constitute the bulk of our energy sources in the future. It has been estimated that widespread energy efficiency improvement, by power electronics and other methods with the existing technologies, can save 20% of global energy demand, and another 20% can be saved by preventing waste, i.e., by various conservation methods. "Global warming problem is solvable by the united effort of humanity".

World Energy Outlook

Demand for coal, shown in Fig. 1, has been growing faster than any other energy source, and is projected to account for more than a third of incremental global energy demand by 2030. World reserves of coal are very large and will last for 200 years at the current rate of consumption. Oil

demand, shown in Fig. 2, will peak at 88 mb/d before 2020 and then fall to 81 mb/d by 2035, with a plunge in OECD demand more than offsetting continuing growth in non-OECD demand. World reserves of oil will last for 40 years at the current rate of consumption. But that has been the situation for many years. In other words, until now, the oil consumed was able to be replaced by new reserves. Gas demand, shown in Fig. 3, will increase from 108trillion cubic feet in 2007 to 156 trillion cubic feet in2035. World reserves of gas will last for 60 years, at 2005consumption levels. In other words, the issues surrounding the future of natural gas are the same as those for oil, but with a delay of an additional 20 years or so.

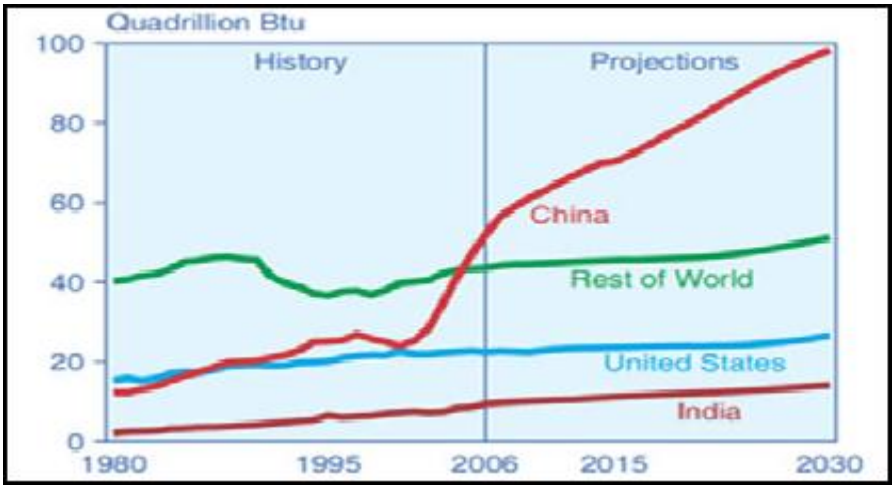

Fig.1. Coal Demand

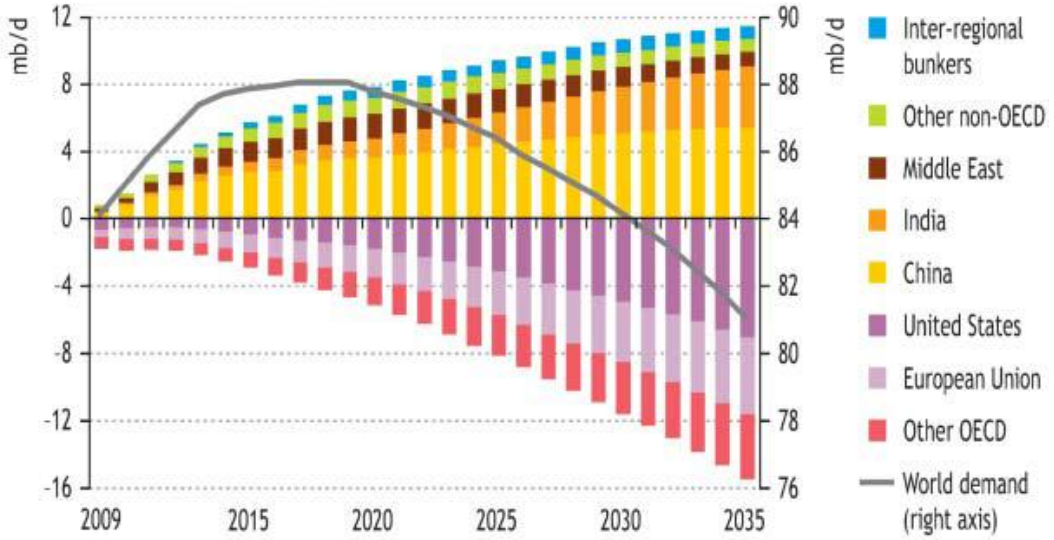

Fig.2. Oil Demand

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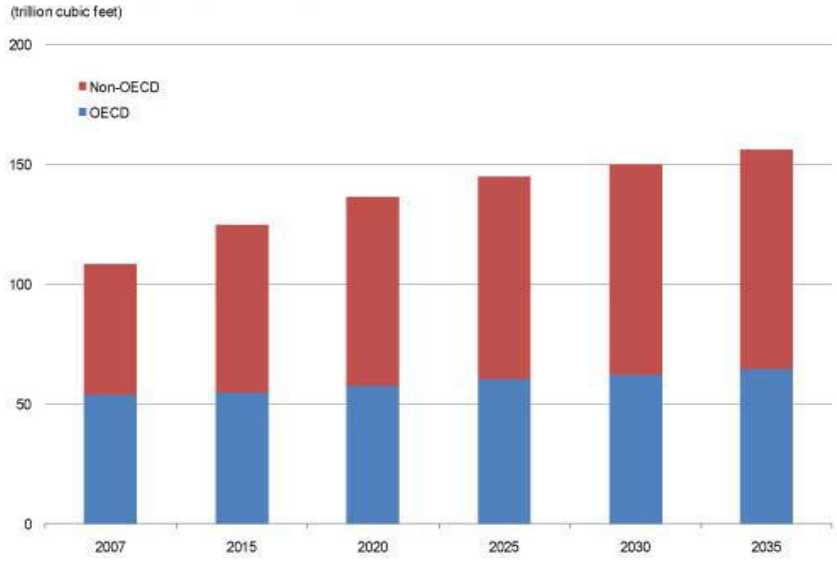

Fig.3. Gas Demand

World energy demand, shown in Fig. 4, will expand by 60% between 2003 and 2030.

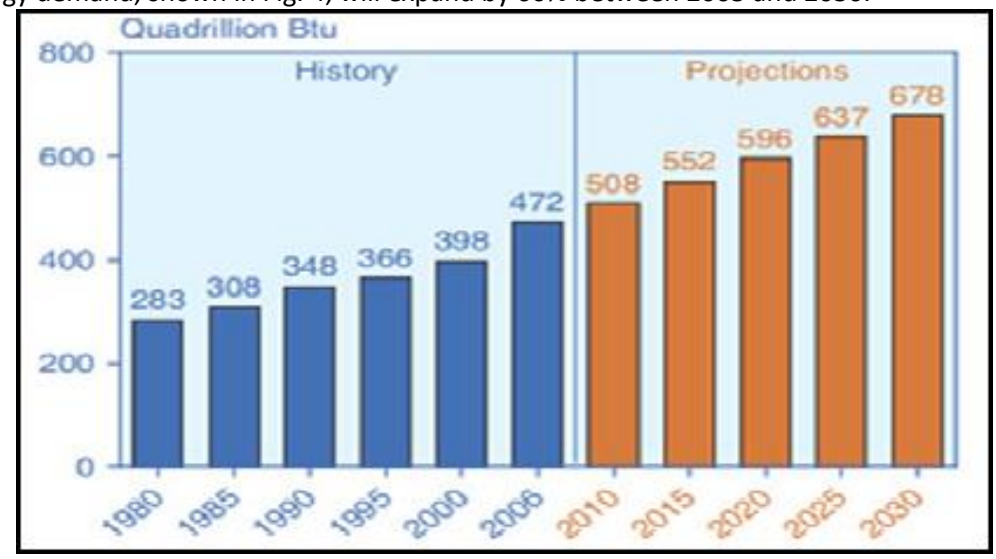

Fig. 4. World Energy Demand

After 2020, renewable are expected to become the second largest source of electricity behind coal. Nuclear energy does not have the traditional environmental pollution problem, but the safety aspects of nuclear plant, in terms of radiation hazard and radioactive waste, are of serious concern. Renewable, shown in Table I, are the fastest-growing source of world energy, with their consumption increasing by 3 % per year.

Table 1. World Renewable Energy Generation

	2002		2030	
	Electricity generation TWh	Share in total renewables (%)	Electricity generation TWh	Share in total renewables (%)
Hydropower	2 610	89	4 248	69
Biomass	207	7	627	10
Wind	52	2	929	15
Geothermal	57	2	167	3
Solar	1	0	119	2
Tide/wave	1	0	35	1
Total	**2 927**	**100**	**6 126**	**100**

Global Warming Problem

Energy is the lifeblood of the continued progress of human civilization. Per capita energy consumption is the barometer of a nation's prosperity. Global energy consumption has increased dramatically to accelerate our living standard. The USA with 5% of the world's population, consumes 25% of total energy. Japan with 2% of the world's population consumes 5% of total energy. China and India with 35% of the world's population consume only 3% of total energy. But this scenario is changing fast.

The Earth's atmosphere accumulates solar heat due to GHG concentrations and raises the temperature. This causes:

- melting of glaciers and polar ice caps
- Inundation of low-lying areas
- Adverse effect on world climate
- Severe drought in tropical countries near the equator that damages agriculture and vegetation
- Hurricanes, tornados, heavy rain and floods
- spread of disease
- Extinction of some animal species
- Acidity increase in seawater.

According to UN predictions, some example scenarios due to global warming are:

- 50% of Bangladesh will be under water in 300years displacing 75M people
- Several island nations in the Pacific will be underwater within 100 years.
- India's agricultural production will decrease by38% by 2080 due to drought, but CO2 fertilization will offset it by 9%
- Melting of ice in Antarctica and Greenland will cause ocean level rise by 200 ft.
- Melting of all the ice in the world will cause ocean level to raise by 210 ft.
- Arctic regions will be virtually free of ice by 2070
- If fossil fuel burning is completely stopped today, ocean level will rise by 4.6 ft. in next 1000 years

Table 2 presents the top six emitting countries.

Table 2. Top 6 Emitting Countries

Country	Share GHG2 005	Share CO_2 2005	Share CO_2 2009
China	17 %	20 %	26 %

USA	15 %	20 %	17 %
EU-27	11 %	14 %	12 %
Russia	05 %	06 %	05 %
India	05 %	04 %	05 %
Japan	03 %	05 %	04 %

Note that human beings and other animals exhale GHG, but the trees absorb $CO_2$by photosynthesis (called the carbon fertilization effect). Some CO_2 is washed away by rain and dissolves as carbonic acid in the ocean. In normal conditions, different natural sources and sinks of GHG maintain the ecological balance that maintains the stable atmospheric temperature.

The Impact of Power Electronics

The modern era of high density solid state power electronics started with the invention of PNPN triggering transistor by Bell Labs (1956), which was later translated into the commercial thyristor (1958) by GE. Since then, there has been a vast expansion in the technology with the R&D radiating in different directions (power semiconductor devices, converter topologies, analytical& simulation techniques, estimation, control techniques, control hardware and software). It is interesting to note that the name "Power Electronics" emerged systematically from the early 1970s. Earlier, it was included as a part of Industrial Electronics.

Evolution of Power semiconductor devices Power Electronics is an exciting, but complex technology, because of its multi-disciplinary nature. It is currently the most active discipline in electric power engineering, as indicated in Fig. 5.

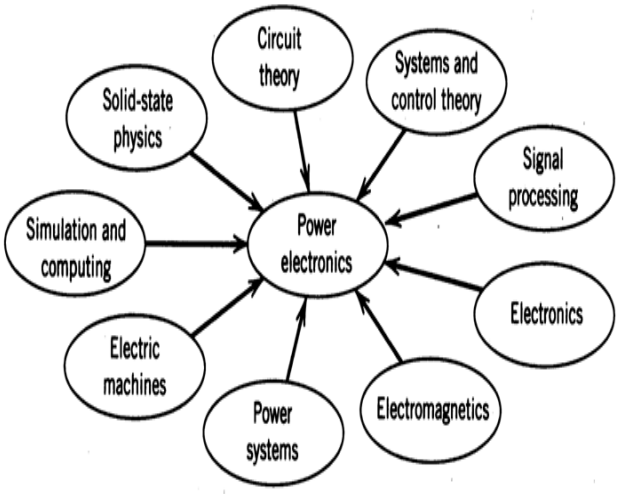

Fig. 5. Multi-disciplinary Nature of Power Electronics

Power electronics is the interface between electronics and power. The applications of power electronics may include dc and ac regulated power supplies, uninterruptible power supply (UPS) systems, electrochemical processes (such as electroplating, electrolysis, anodizing, and metal refining),heating and lighting control, electronic welding, power line static VAR compensators [SVCs, static VAR generator, or static synchronous compensator(STATCOM)], active harmonic filters, high voltage dc(HVDC) systems, photovoltaic (PV) and fuel cell (FC)power conversion, solid state dc and ac circuit breakers, high-frequency heating, and motor drives. The motor drive area may include applications in computers and peripherals, solid state starters for motors, transportation (electric/hybrid electric vehicles (EV/HEV), subway, etc.), home appliances, paper and textile mills, wind generation system, air-conditioning and heat pumps, rolling and cement mills, machine tools and robotics, pumps and compressors, ship propulsion, etc. In addition to

applications in energy systems and industrial automation, power electronics is now playing a significant role in global energy conservation that is helping environmental pollution control indirectly, i.e., solving the global warming problem. It is also an important player enabling the better utilization of renewable energy sources by implementing maximum power point tracking (MPPT) function (for wind and photovoltaic), ride-through capabilities, etc. Power converters are capable of seamlessly transferring variable frequency power to the fixed frequency grid (ac-dc-ac). It is critical for wind energy and hydro-energy. Economical storage solutions can increase the capacity factor of renewable energy sources like wind and PV and increase their penetration in the grid. Distributed power generation systems will provide solutions to avoid energy crises in the future. It will increase the power production in the vicinity of the consumption centers. In the long-term, it will decrease the power volume at the transmission level and make the central grid control very complex. Local grid control will be necessary in order to avoid grid instability and blackout.
New control methods appear to improve performance. The future distributed generation is able to run in on-grid and off-grid modes. Advanced control of grid converters, including grid impedance estimation, adaptive current control, are emerging. Monitoring and advanced diagnosis will also be integrated.
The solutions to solve global warming problems include:

- Widespread promotion of renewable energy
- Applying advanced emission control standards to fossil fuel based power generating stations
- Promotion of Electric Vehicles. (The ICEvehicles will be replaced by electric vehicles withthe intermediate step of hybrid vehicles
- Widespread mass transportation (as in Japan andEurope)
- Promotion of energy efficiency in the generation, transmission, distribution and utilization of electrical energy.

A. Variable-frequency drives:

According to the estimate of the Electric Power Research Institute (EPRI), USA, around 60% to 65% of grid energy in USA is consumed in electrical machine drives, and 75% of these are pump, fan, and compressor-type drives. The majority of the pumps and fans are used in the industrial environment for control of fluid flow. It is reported that, currently, around 97% of medium to high power drives for such applications operate at fixed speed, so only 3% of these drivers operate at variable frequency speed control. In a variable frequency drive, converter-machine efficiency can be improved further by machine flux programming at light load and reduced speed. Power electronics-based load proportional speed control in air-conditioning can save as much as 30% of energy, compared to the traditional thermostatic control. The additional cost of power electronics can be recovered by saving energy in a period depending on the cost of electricity.

B. Lighting:

Approximately 24% of grid energy in the USA is consumed in lighting. Power electronics-based high frequency compact fluorescent lamps (CFLs) can, typically, be four times more efficient than traditional incandescent lamps, besides giving much longer life. Light dimming control of CFL can further improve energy efficiency. The CFLs are expected to completely replace the incandescent lamps in the near future. Solid state LED lamps with higher efficiency and longer life are becoming more popular. According to the EPRI estimate, 15% of grid energy can be saved easily by widespread (but economical) applications of power electronics.

C. Wind Energy:

One of the best sources of renewable energy is wind energy. Wind energy has the biggest share in the renewable energy sector. Over the past 20 years, grid connected wind capacity has more than doubled and the cost of power generated from wind energy based systems has reduced to one-sixth of the corresponding value in the early 1980s.
Early versions of wind turbine generators consisted of fixed-speed wind turbines with conventional induction generators. This class of machines was rugged but was limited to operation in a narrow wind-

speed range. In addition, the conventional induction generator, which was connected directly to the electrical grid, required that reactive power support be provided locally to achieve the desired voltage level.

Advances in power electronics have revolutionized wind turbine technology and led to the development of the doubly fed induction generator (DFIG).

D. Fuel Cell System:

A fuel cell is an electrochemical cell that converts energy from a fuel into electrical energy. Electricity is generated from the reaction between a fuel supply and an oxidizing agent. The reactants flow into the cell, and the reaction products flow out of it, while the electrolyte remains within it. Fuel cells can operate continuously as long as the necessary reactant and oxidant flows are maintained.

Fuel cells are different from conventional electrochemical cell batteries. Fuel cells consume reactants that must be replenished, while batteries store electrical energy chemically in a closed system. Fuel cells can be used in electric vehicles, building cogeneration, portable power sources, UPS systems, and distributed power generation for utility systems. Currently, there are a large number of corporations involved in fuel cell technology, such as Sony, Honda, Mobion, Angstrom, Volkswagen and Innova Tek. Sony showed the world a prototype of its developed micro-size fuel-cell system in 2008.

The micro fuel cell uses methanol directly as fuel and it is an active fuel-cell system, which controls fuel supply with a pump. With 10 ml of methanol, the device can supply enough power for a mobile phone to play 1seg movies for fourteen hours.

F. Solar Energy:

The use of solar energy is heavily dependent on power electronics. The conversion of solar energy to electricity is currently accomplished mostly in two ways: by direct conversion using photovoltaic's (PVs), or by solar thermal conversion. These are briefly described below.

In the direct-conversion method, PVs generate a direct current (DC) output that is converted to alternating current (AC). This conversion is achieved by a power electronic device called an inverter. Most PVs are roof top units, and PV-based solar energy primarily has limited distribution and capacity. However, some large commercial PV-based solar facilities of up to 60 MW have been built recently.

Solar Thermal Conversion:

In solar thermal conversion, the sun's rays are directed by mirrors to heat a thermal exchange agent (e.g., mineral oil) to a sufficiently high temperature. This agent then exchanges the heat generated via a conventional steam cycle and runs a steam turbine that drives a synchronous generator. The solar thermal method also has the capability of storing energy using a thermal phase-transition approach. This is commonly achieved by using molten salt to store heat for up to six hours; the stored heat is used to run a conventional steam cycle when energy from the sun is not available.

Although solar thermal facilities have plant capacities in the range of several hundred MWs, they also require significant quantities of water for cooling and steam generation. Unfortunately, water resources are limited in many parts of the United States where solar radiation is plentiful.

Power Electronics in Electric Vehicles

An electric vehicle (EV), also referred to as an electric drive vehicle, uses one or more electric motors. Electric vehicles include electric cars, electric trains, electric Lorries, electric aircraft, electric boats, electric motorcycles and scooters, and electric space craft. Burning fuel in a small, mobile engine is inefficient compared to industrial power generators. If the electricity used is generated from wind, solar, waves, tide or nuclear fuel then electric cars have zero emissions. Either way, air quality improves dramatically in cities or consequently the greenhouse gas emission decreases. The penetration of electric vehicles in today's market is still not considerable and fossil fuels such as petroleum comprise most of the required fuel for transportation. In2005, the United States used 570 billion liters of petroleum for transportation; if current trends persist this will rise to 745 billion liters per year in 2025, and nearly 1trillion liters in 2050. From a more global perspective, the problem will worsen in the future, due largely to the rapid rate of

motorization and industrialization in China and India. In the past few years, power device technology has made tremendous progress. These power devices have grown in power rating and performance by an evolutionary process. The recently introduced power devices are the gate-turn off thyristor (GTO), power bipolar-junction transistor (BJT), power metal-oxide field-effect transistor (MOSFET), insulated-gate bipolar transistor (IGBT), static-induction transistor (SIT), static-induction thyristor (SITH), and MOS-controlled thyristor (MCT). Active research is still being pursued on the development of high-performance power devices. The selection of power devices for EV propulsion is generally based on the requirements of the voltage rating, current rating, switching frequency, power loss, and dynamic characteristic. The voltage rating depends on the battery nominal voltage, maximum voltage during charging, and maximum voltage during regenerative braking. The current rating depends the motor peak power rating and number of devices connected in parallel. The switching frequency should be high enough to reduce the acoustic noise, size of filters, and EMI problem. On the other hand, higher switching frequencies increase the switching loss. Since an extra 1%efficiency in EV propulsion can enable an additional few miles in the EV driving range, the power loss, including both switching and conduction losses, should be minimal. The dynamic characteristic should be good enough to allow for high dv/dt capability, simple driving, and easy paralleling. The device protection, packaging, reliability, and cost should also be considered.

CONCLUSION

In recent years, the increasing importance of power electronics has been realized for energy saving. The high efficiency of power electronics-based energy systems has been discussed in the literature. Saving energy gives a direct financial benefit, particularly where the energy cost is high. The extra cost of power electronics in energy saving can be recovered within a reasonable period depending on the cost of electricity. In addition, reduced consumption means reduced generation that indirectly mitigates the environmental pollution or global warming problem. In general, the integration of renewable energy resources is still not satisfactory. The significance of power electronic was discussed to make the role of power electronics more clear in terms of advancement in inverters, microcontrollers, and high temperature solid state fuel cells. Due to the polluting nature of conventional combustion motors the significance of EV in mitigating the environmental issues was presented with an emphasis on power electronics.

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A grinding induced, efficient and green synthesis of 4,4'-(arylmethylene)-bis-(1H-5-pyrazol-5-ols) by tandam Knoevengel-Michael reaction

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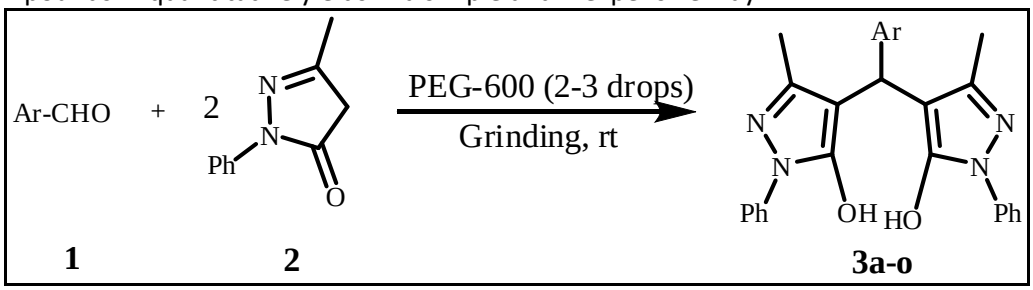
Abstract:

A grinding induced, efficient and mild method for the synthesis of 4,4'-(arylmethylene)-bis-(1H-5-pyrazol-5-ols) in the solid state reaction of aldehydes and pyrazolones at room temperature has been described. This method is a good option to obtain the title compounds in quantitative yields in a simple and inexpensive way.



INTRODUCTION

In recent years, Development of organic solid state reaction has emerged as a frontier area of research in synthetic organic chemistry (Li et al., 2001). These reactions are especially appealing because they have certain advantages such as high efficiency, selectivity, easy separation, purification, mild reaction conditions and environmental acceptability (Mallakpour et al., 2003; Rasmussen et al., 1997; Wang et al., 1998). This approach has been widely used in a variety of organic reactions (Satish et al, 2008).

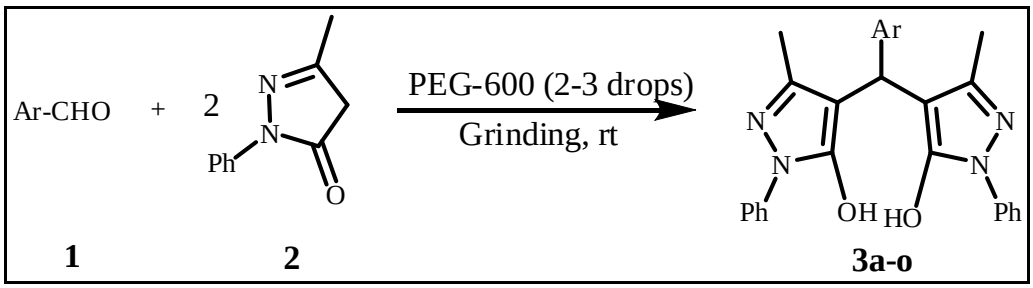
Experience has shown that compounds with biological activity are often derived from heterocyclic structures. Indeed, one of the richest sources of diversity for the medicinal chemist are small heterocyclic rings, which, in addition to often exhibiting biological activity. Pyrazoles are one such class of heterocycles which have attracted much attention as they have been reported to possess a wide range of biological activities, including anti-anxiety, antipyretic, analgesic, and anti-inflammatory properties (McDonald et al, 2006; Chavan et al, 2013). 4,4'-(arylmethylene)-bis-(1H-5-pyrazol-5-ols) have a broad spectrum of biological activities, such as anti-inflammatory, antipyretic, gastric secretion stimulatory, antidepressant, antibacterial agents (Sugiura et al, 1977; Behr et al, 1967; Rosiere et al, 1951; Bailey et al, 1985; Mahajan et al, 1991). And also the pyrazole derivatives are applied as fungicides, pesticides, insecticides, and dyestuffs, and as the chelating and extracting reagents for different metal ions (Singh et al, 1991; Londershausen 1996; Lubs, 1970; Uzoukwu, 1993; Maurya et al, 1997; Garnovskii et al, 2004).

The conventional chemical approach to 4,40-(arylmethylene)-bis-(3-methyl-1-phenyl- yrazol-5-ols) involves one-pot tandem Knoevenagel–Michael reaction of arylaldehydes with 2 equiv of 5- methyl-2-phenyl-2,4-dihydro-3H-pyrazol-3-one performed under a variety of reaction conditions (Hamama et al, 2001; Li et al, 1998). The procedure utilizes the catalysis of the components with piperidine in ethanolic solution or reaction under neutral conditions in either ethanol or benzene. Wang et al. reported its synthesis in water using sodium dodecyl sulfate as the surfactant catalyst over a one-hour period, but the process needs a temperature of 100 ^{o}C. Elinson et al. used electro-catalytic procedure for its synthesis. Further, Perumal and co-workers reported the synthesis and antiviral activity of 4,4'-(arylmethylene)-bis-(3-methyl-1-phenyl-1H-pyrazol-5-ols) using CAN as a catalyst. Recently, Niknam et al., were reported the synthesis of 4,4'-(arylmethylene)-bis-(3-methyl-1-phenyl-1H-pyrazol-5-ols) using SBSSA (Silica-Bonded-S-Sulfonic Acid) in ethanol at reflux temperature. Sobhani et al. have used amino-propylated silica gel as

heterogeneous catalyst for the synthesis of 4,4'-(arylmethylene)-bis-(3-methyl-1-phenyl-1H-pyrazol-5-ols). However, most of the methods suffer from at least one limitation that may include moderate yields, long reaction times, harsh reaction conditions, or tedious workup procedures.

Polyethylene glycol (PEG) and its aqueous solutions represent interesting solvent systems for organic reactions, and may stand comparison to other currently favored systems such as ionic liquids, supercritical carbon dioxide, and micellar systems (Mukhopadhyay et al, 2008; Chen et al, 2005). PEGs are selected instead of other polymers because they are inexpensive, biodegradable, non halogenated and having low toxicity.

However, the synthesis of 4,4'-arylmethylene-bis-(3-methyl-5-pyrazolones) using PEG-600 has not been reported. In continuation of our work on the development of useful synthetic methodologies (Chavan et al, 2011; 2011; 2013; 2014; 2008; 2014), we report a general and highly efficient route for the synthesis of those compounds using catalytic amount an inexpensive and commercially available PEG-600. This efficient synthesis using grindstone chemistry, not only preserving the simplicity but also consistently giving the corresponding products in good yields (**Scheme 1**).



Scheme 1: Grinding induced synthesis of 4,4'-(arylmethylene)-bis-(3-methyl-1-phenyl-1H-pyrazol-5-ol) derivatives.

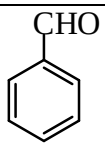
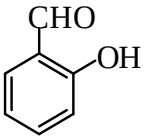
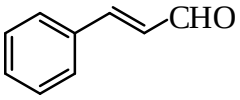
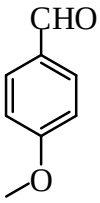
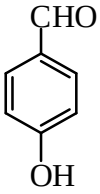
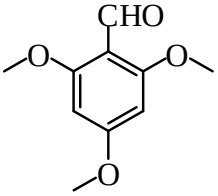
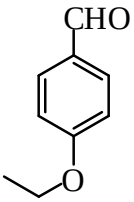
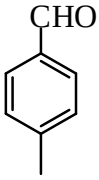
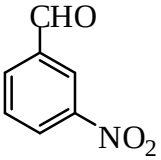
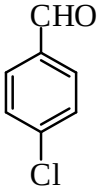
RESULTS AND DISCUSSION

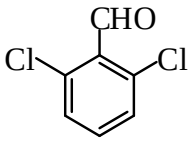
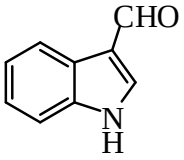
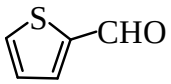
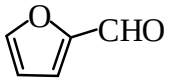
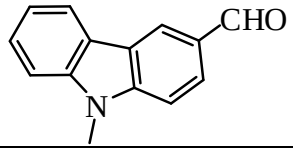
In the beginning, condensation reaction of benzaldehyde **1** and 5-methyl-2-phenyl-2,4-dihydro-pyrazol-3-one **2** can be achieved by grinding at room temperature without using any catalyst and solvent, which resulted in the formation of a condensation product **3a** after 1.5 hour (58%). With similar substrates, reaction was carried out using 2-3 drops of PEG-600; the reaction rate was significantly improved and afforded the title compound **3a** in 20 min with greater yield (87%). Further increase in the amount of PEG did not show further increase in the rate of reaction.

Thus, in an optimized reaction condition, benzaldehyde (1 mmol) and 5-methyl-2-phenyl-2,4-dihydro-pyrazol-3-one (2 mmol) were taken in a mortar and ground well by adding 2-3 drops of PEG-600 at room temperature for 20 min. After completion of the reaction (TLC), a simple workup afforded the product in excellent yield. In order to demonstrate the versatility of this method, a series of aromatic aldehydes and 5-methyl-2-phenyl-2,4-dihydro-pyrazol-3-one were subjected to condensation (**Table 1**). All these reactions showed rapid formation of 4,4'-arylmethylene-bis-(3-methyl-5-pyrazolone) at room temperature with high efficiency. However, the variations in the yields were very small, both electron donating and electron withdrawing group containing aldehydes gave the condensed products in excellent yields. The acid-sensitive substrates like indole-3-carboxaldehyde and thiophene-2-carbaldehyde were converted into the corresponding products **3j** and **3k** in 75% and 71% yields, respectively.

Table 1: Synthesis of 4,4'-alkylmethylenebis(3-methyl-5-pyrazolone) using various aldehydes by grinding at room temperature.

Entry	Ar-CHO	Product	Time(min)	Yield(%)[a]	MP (^{0}c)	Ref.

1.		**3a**	20	87	169-170	26
2.		**3b**	20	86	230-233	26
3.		**3c**	20	84	140-142	--
4.		**3d**	25	85	152-154	26
5.		**3e**	25	82	147-149	28
6.		**3f**	25	84	164-166	--
7.		**3g**	25	82	180-182	--
8.		**3h**	22	81	197-199	26
9.		**3i**	20	83	176-178	28
10.		**3j**	20	86	207-209	28

11.		**3k**	20	87	226-228	28
12.		**3l**	25	81	184-186	--
13.		**3m**	25	85	175-177	28
14.		**3n**	20	80	185-187	27
15.		**3o**	20	85	290-192	--

[a] Isolated yields.

CONCLUSIONS

In conclusion, we have developed a novel and efficient method for the synthesis of 4,4'-arylmethylene-bis-(3-methyl-5-pyrazolones) by a tandem condensation reaction of aromatic aldehydes with 2 equiv of 5-methyl-2-phenyl-2,4-dihydro-3H-pyrazol-3-one by grinding in presence of 2-3 drops of PEG-600. In addition to its efficiency and simplicity, this method provided high yields of 4,4'-arylmethylene-bis-(3-methyl-5-pyrazolones) in very short reaction time.

EXPERIMENTAL

General procedure for the synthesis of 4, 4'-arylmethylene-bis-(3-methyl-5-pyrazolones): Aldehyde (1 mmol) and 5-methyl-2-phenyl-2, 4-dihydro-pyrazol-3-one (2 mmol) were taken in a mortar and ground well by adding 2-3 drops of PEG-600 at room temperature. After completion of the reaction (TLC), water (5 ml) was added to it and precipitated product filtered, dried and recrystallized from ethanol and water (1:1) to afford the desired product in pure form with excellent yield.

Spectral data for representative compounds:

4,4'-(Phenylmethylene)-bis-(3-methyl-1-phenyl-1H-pyrazol-5-ol) 3a: Pale yellow solid; Mp: 169–170 ^{o}C; IR (KBr, cm^{-1}):3420, 3017, 1599, 1580, 1499, 1415, 1216, 1026, 694, 667; ^{1}H NMR (300 MHz, DMSO-d6): 1.98 (s, 6H), 4.65 (s, 1H), 6.85-7.32 (m, 10H), 7.35-7.75 (m, 5H); MS(m/e): 437.2 (M+1).

4,4'-[(4-Methoxyphenyl)methylene]-bis-(3-methyl-1-phenyl-1*H*-pyrazol-5-ol) 3c: Off white solid; Mp: 152–154 °C; IR (KBr, cm^{-1}):3626, 3016, 1698, 1541, 1437, 1209, 1045, 927, 668; ^{1}H NMR (300 MHz, DMSO-d6): 2.29 (s, 6H), 3.68 (s, 3H), 4.88 (s, 1H), 6.83 (d, 2H, *J* = 8.4 Hz), 7.14 (d, 2H, *J* = 8.4 Hz), 7.23 (t, 2H, *J* = 7.2 Hz,), 7.44 (t, 4H, *J* = 7.8 Hz), 7.66 (d, 4H, J = 7.8 Hz); MS (m/e): 467.25 (M+1).

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Waste Management: a Case Study of Borivli, Mumbai

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ABSTRACT

"Waste not the smallest thing created, for grains of sand make mountains, and atomies infinity." -E. Knight

Wastes are materials that are not prime products for which the generator has no further use in terms of his/her own purposes of production, transformation or consumption, and of which he/she wants to dispose. Wastes may be generated during the extraction of raw materials, the processing of raw materials into intermediate and final products, the consumption of final products, and other human activities. Waste is a continually growing problem at global and regional as well as at local levels. Solid wastes are generated from human and animal activities. It includes things that are usually discarded or are useless or unwanted. Since, industrialization has paved the way for rapid production and consumption, urban society rejects and generates solid material regularly which leads to considerable increase in the volume of waste generated from several sources such as, domestic wastes, commercial wastes, institutional wastes and industrial wastes of most diverse categories. Nowadays, management of wastes is a big challenge for all the countries of the world. In cities of developing countries, however, the problem is acute due to its population explosion and improper waste management. Thus, to study the degree of problem, a study was conducted in Borivali suburb of Mumbai City- one of the largest and densely populated suburbs of the city. 50samples were selected with the help of random sampling and a survey with the help of questionnaire was conducted. The major observations highlight on the fact that the quantities of solid waste generated is huge and improper management is a concern. Following this, measures like maintaining different dustbins for dry and wet waste to be maintained, planned handling of the waste generated from the houses to be undertaken may be suggested. Thus, the present paper tries to put forward the problem of waste management in a global city like Mumbai with the help of a case study.

Keywords: *waste, improper management, developing countries, case study, suggestions.*

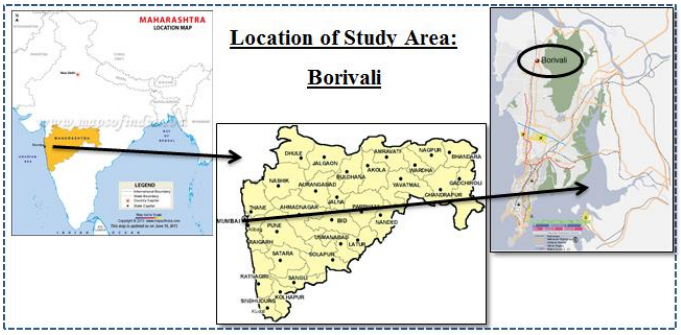
INTRODUCTION

"Wastes are materials that are not prime products (that is products produced for the market) for which the generator has no further use in terms of his/her own purposes of production, transformation or consumption, and of which he/she wants to dispose. Wastes may be generated during the extraction of raw materials, the processing of raw materials into intermediate and final products, the consumption of final products, and other human activities. Residuals recycled or reused at the place of generation are excluded."

REVIEW OF LITERATURE

Waste is a continually growing problem at global and regional as well as at local levels. Solid wastes are generated from human and animal activities. It includes things that are usually discarded or are useless or unwanted. In other words, solid wastes may be defined as the organic and inorganic waste materials produced by various activities of the society which have lost their value to the first user. Since,

industrialization has paved the way for rapid production and consumption, urban society rejects and generates solid material regularly which leads to considerable increase in the volume of waste generated from several sources such as, domestic wastes, commercial wastes, institutional wastes and industrial wastes of most diverse categories. Management of solid waste may be defined as that discipline associated with the control of generation, storage, collection, transfer and transport, processing, and disposal of solid wastes in a manner that is in accord with the best principles of public health, economics, engineering, conservation, aesthetics, and other environmental considerations. In its scope, solid waste management includes all administrative, financial, legal, planning, and engineering functions involved in the whole spectrum of solutions to problems of solid wastes thrust upon the community by its inhabitants **(Tchobanaglous, G. et al, 1997)**. Solid wastes have the potential to pollute all the vital components of living environment (i.e., air, land and water) at local and at global levels. Waste, and how we manage it, typically ends up toward the bottom of the environmental policy agenda. Problems like air quality, global climate change, and energy are often the focus of policy makers' attention, with issues related to waste either ignored or deferred, but, waste is actually an integral part of the overall environmental management picture. Increased consumer consumption of goods means more natural resources, such as forest product and fossil fuels, are used for packaging, leading to an increased space for landfill or more particulate matter is emitted by incinerators. This increases the demand for electricity and nuclear power plants expand creating more high-level radioactive waste **(Jacqueline Vaughn, 2009).** To make wastes more lightweight, less expensive to produce, and reusable, most plastics are now designed to be disposable, meaning that they are used and then thrown away. Their disposable nature is one of the major reasons why industrialized countries are dealing more with waste management problems than they did in the 19th and 20th centuries **(Jacqueline Vaughn, 2009)**. Waste, as one such resource is too valuable to be 'wasted', because the eco-efficient use of waste materials has a great potential to contribute to resource savings. Closing material cycles often minimizes mineral as well as fossil resource use. Closing a cycle will still leave some waste, which wis either too expensive or too energy demanding to recycle. However it can be used thermally in many cases, for instance as fuel in industrial production nor for electricity and heat generation **(Lemann, Martin F., 2008)**.



LOCATION OF STUDY AREA:

The study area chosen is the suburb of Borivali in the city of Mumbai in the State of Maharashtra. It is located in the north-west section of the city. Its latitudinal extension is between 19^{0}21'N and 19^{0}24'N and longitudinal extension is between 72^{0}81'E and 72^{0}87' E approximately. It is surrounded by Manori creek in its West, Dahisar taluka in the North, Sanjay Gandhi National Park in the East and Kandivali taluka in the South. Borivali is home to several gaothans (village like localities) such as Vazira, Babhai, Eksar, Chikuwadi, Shimpoli, Poisur and others which are still there with their old charm but slowly giving way to the concrete jungle.

OBJECTIVES OF THE STUDY:

- To examine the waste management strategies and the role of citizens of Borivli, Mumbai
- To provide an overview of emergent trends in environmentally sound and economically viable approaches to 'waste management' in the contemporary world.

RESEARCH METHODOLOGY:

Research methods refer to the operational techniques of data collection. In order to study the "Waste Management: A Case Study of Borivli, Mumbai" the methodology adopted by the researcher will be rationalistic one and has been designed in three stages.

Pre-Field Method

This includes collection of primary and secondary data on the respective topic from various books, journals and articles from the college library and from those available online. To get a comprehensive knowledge of the study area various internet sources were consulted. To collect data in a systematic order, a questionnaire was framed to cover aspects related to the generation of waste and it's disposable. Information was also obtained using secondary sources. The secondary sources consisted of existing literature on the issues and conditions relating to the management of waste.

Field Method

Field observation involves qualitative as well as quantitative methods of data acquisition. First of all 50 samples were selected with the help of simple random sampling in the selected study area. A primary survey was conducted with the help of structured and unstructured questionnaire.

Post-Field Method

The collected data were processed, assimilated and analysed. Editing, coding and decoding of collected data were also done simultaneously, according to the aims and objectives of the study using simple statistical techniques with the help of MS-Excel.

A suitable bibliography will be prepared to show the references used. As a whole, the research design is both qualitative and quantitative in nature.

THE CASE STUDY OF BORIVALI:

To examine the waste management strategies and the role of citizens in the same, a small survey was conducted in the Borivali ward of Mumbai suburban region. For this survey, 50 families randomly were interviewed and their opinions were recorded. Primary focus was laid down on what type of waste was generated in their houses and what are their strategies of disposal of such wastes. From their opinions following observations were drawn.

Figure 1.1 represents whether solid waste is a problem in the city or not. It is observed that all the respondents agreed with the question and agreed that solid waste is a problem in the city. This is because huge quantities of solid wastes are generated in the city every day. The quantity is beyond the capacity of disposal and therefore, complaints about its mismanagement and improper handling are always originated.

Figure 1.2 represents whether the respondents have any idea about of solid waste management or not. It can be observed that 66%f of the respondents know of the techniques that can either reduce the generation of solid waste or the effects of the same on the environment and the society. On the other hand 34% of them were unaware of the solid waste management techniques. This was particularly because of their low level of education and over dependency on the BMC and other local sweepers. When asked they were of the belief that their part of the duty is only to collect the household waste in the dustbins which will be later collected and disposed by BMC according to their processes. Thus, they need not bother.

Figure 1.3 represents people's support to the principle of waste management. Here, 72% people agreed to support the movement and 28% did not. The respondents who supported the movement may belong to the well aware and educated class, who know about the results of such mismanagement. The ones who do not support the movement may either be unaware of the issues or are ignorant about it.

Figure 1.4 represents the number of respondents using separate bins for wet and dry solid wastes. It is observed that only 38% of respondents used separate bins and 62% did not. The ones who used separate bins may be were aware of the hazardous problem that would crop up due to mishandling of solid waste. The literacy levels have a crucial role to play here. The ones using separate bins may have knowledge of issues related to improper disposal of waste and are hence readily participating and helping the BMC in their own way on an individual scale. Actually, wet and dry waste can be disposed off separately more effectively than one together. But this fact was known to a very few people surveyed. Even who were aware were not using separate dustbins. They idea was to collect both type of waste together. When asked about this, it was observed that firstly they didn't want to waste their time in segregating the wastes and secondly it was very uneconomical to keep two separate dustbins.

Majority of the surveyed people kept their dustbins in the kitchen under their washing sinks. Thus from the survey it was found that only 38% people used two separate bins and remaining dumped their waste in one bin itself.

People were later interviewed for the waste collection mechanism provided by their society association (Figure 1.5). Here it was observed that 36% of the societies had such mechanism, for which majority of them charged the residents for its maintenance. These charges were drawn particularly for hiring separate sweepers for the society who would collect the waste from the houses everyday and would sweep the society so that surroundings could be kept clean. In this case 64% of the people interviewed claimed that their society does provide them with different alternatives so that the surrounding could be kept clean.

Though the society is providing assistance to the people and helping them to collect the waste, they are failing to provide separate bins for dry and wet waste. Hardly 32% of the societies do provide separate bins for dry and wet waste (Figure 1.6). When the society officials were asked about this, they were of the opinion that when the people themselves were not segregating wet and dry wastes, there was no use in providing the sweepers with two separate bins to collect different types of wastes.

Figure 1.7 represents the frequency of collection of waste from their houses. It was observed that 68% of the respondents replied that the waste was collected just once a day (probably every morning), 24% replied that there is no fix schedule for collection of the wastes i.e. the sweepers come every day but some days, they don't collect the wastes. They just sweep the roads and go. On such days, people have no option left but to throw the garbage themselves in the nearby bins, located on the corners of the crossroads, under the trees or near the creeks or nalas. They cannot avoid throwing the garbage, because, the amount of garbage collected every day is huge and if the sweepers fail to collect it, the accumulated quantity of the same results in extra littering in the houses and it may stink too.

Figure 1.8 represents the rate of reusing the waste items by the respondents. It is observed that 75% of the respondents do not reuse the items that are generated as the waste and hence, all the items are disposed off. On the other hand only 25% of the people did reuse the items that are generated in waste and could be reused. It was true particularly in the case of plastic bags which could be used over and over for carrying articles. Majority of the paper which is waste is also used as wrapping paper to pack the articles or to clean the dust from the furniture.

Another example would include reusing the tea leaves. The tea leaves which remain after the preparation of the tea are used by some of the ladies to clean their skin. Thermocols, waste bags, bottles, coconut, cardboard, soaked water from rice, etc. are some of the articles that the respondents reused in the study area.

The process of waste collection and treatment of the same is basically the responsibility of the waste management departments of the local municipalities of the city. The main responsibility of the municipalities is collection and segregation of waste, packaging, recycling of bulky waste, waste treatment, sewage sludge, etc. When the respondents were questioned on their opinion of the main agencies in collecting the waste generated from their households, 64% replied, it is the municipality, 28% replied that the waste is collected and disposed by the sweepers. However, there were 8% of the respondents who were unaware of it. This was because, there nobody collected wastes from their houses and hence, they were disposing the waste themselves (Figure:1.9).

Health and wellbeing are undoubtedly a chief concern of every human being. Thus, we need an appropriate organization to check in for waste management. Health is achieved when we observe the individual and social hygienic standards. In the study area, hygienic standards are among the most neglected elements. There is dirt on the streets due caused by improper management of solid waste which is reported by nearly 86% of the people (Figure 1.10). This needs to be checked upon by the local citizens

as well as by the concerned authorities as it may adversely affect the health of people. Children will be affected the most.

Every day millions of tons of wastes are generated from our houses and communities. Part of the enormous amount of waste is generated through construction, renovation and demolition of homes. From the survey, it was found that, food items comprised 29% of the wastes generated, followed by papers (26%), disposables (21%), garden waste (8%), and waste from other items comes accounted for 21% of it (Figure 1.11). Such type of waste is collected in the same bin everyday and disposed off in the same place without segregating them.

Figure 1.12 represents the alternatives that could be adopted by the BMC towards proper management of solid waste as suggested by the respondents. It is observed that they came out with three alternatives viz.

- Collection of bulky waste for reuse and recycling,
- Collecting kitchen and garden waste for composting,
- Collecting all the recyclable materials separately and send them to the recycling plants.

All the respondents have replied that at individual level it becomes difficult to collect the waste, which if any organization would do on a grand scale can attain a great success. Other things that the people noted were that, neither they have any type of mechanism which (even if they desire) would retain them from the recycling of the waste materials. Whatever is possible at the domestic level, will be done by them, but looking at the amount of waste generated, only a grand scale project would be needed to satisfy the need.

When the question was raised about raising of the funds from the pockets of the people themselves to keep the environment clean, majority of the people (74%) of them replied that they would do so.

Figure 1.13 represents the readiness of the respondents to spend for proper solid waste management. The respondents are ready to spend, if they are getting clean environment. However, 26% of them were not. They believed that there is no use of spending on the waste disposal project, because these funds, according to them, would not be used in effective way and hence all the money spent will go in vain. Similarly people also said that support and funding should be dedicated effectively in minimization initiatives. Nearly 90% of the interviewed people agreed to this fact.

People were asked whether they have any idea where the waste is taken for disposal after it is collected from their households or not. Here the answer was 50 percent each (Figure 1.14). Exactly half the number of respondents was aware about it. They knew that after collection of the waste, the waste was taken to Gorai dumping ground for the process of decomposition. However, remaining half replied that it is not their look out where and how the waste collected was disposed. They were of the opinion that when they are paying the sweepers to collect the garbage, the sweepers would do so effectively and will dispose that off wherever they find it appropriate. Because of this attitude, they were unaware of the fact where exactly the garbage form home was dumped.

Figure 1.15 represents respondents' opinions about the appropriateness of Gorai landfill. Landfills also have some sort of control over what goes in so the protection can be designed properly. When the people were asked about landfill as an effective measure of dumping the household waste, 46% replied positively. According to them, a landfill with, say, household garbage would be treated differently from a landfill that takes hazardous chemicals or radioactive waste. Landfills are also covered each day with soil to keep birds, insects, rats, and other animals from moving in and becoming a nuisance. The daily covering also keeps water and air out of the trash, which keeps the material from rotting too fast and creating bad smells.

Dumps, on the other hand, are just that - a big hole or a big pile of garbage and possibly other dangerous things. They do not prevent the waste from coming into contact with the ground, they are full of rats, roaches, and other vermin, and they stink.

However, nearly 54% of the people were literally, unaware of the landfill and dumping, thus they were of the opinion that it is not an appropriate measure for waste disposal. Landfills are really difficult and expensive to run. Finding enough landfill space gets more difficult as time goes by. It is important to create

as little waste as possible and recycle whenever you can to preserve landfill space and help keep pollution to a minimum.

Finally people were questioned about the most hazardous waste, according to them which can create maximum problem, where nearly 34% of the respondents replied it is the waste generated out of plastics. 22% were of the opinion that most hazardous is the nuclear waste, 18% replied it is the industrial waste and 12% chemical waste (Figure 1.15). Other respondents replied that part of mining waste, agricultural waste, construction waste, e – waste and metal waste is also harmful.

INDIA'S BEST PRACTICES FOR WASTE MANAGEMENT

In Calcutta, 80% of house-to-house collection has been achieved in residential areas at no extra cost to citizens, using only existing Municipal sweepers since 1995. They cover two "beats" by moving in pairs with a wheelbarrow. One pushes the cart and blows a whistle at each gate at a fixed time daily, while the other empties waste-bins into it, and they exchange duties on alternate days. Commercial establishments are not cooperating so well: only 60% do. There is no waste-segregation. Waste-pickers forage at the transfer-points or landfill.

Doorstep collection is most successful in slums. Cities usually make the mistake of thinking that rich or upper-middle areas will not feel the pinch of such small monthly collections. However, they are always the most unwilling group to pay this, so such attempts often fail and municipalities get discouraged. Slum-dwellers, neglected everywhere, understand and appreciate the monetary value of cleanliness and are most willing to cooperate and pay willingly.

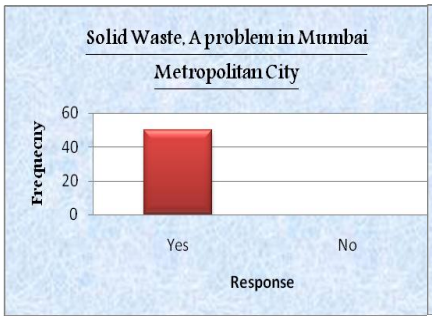
Temporary take-away bins work in extremely crowded slums where handcarts cannot move through the lanes. At Mumbai's Prem Nagar slum, stackable plastic bins are made available from 8.00-10.00 am at every gully corner and inner-lane crossing. From 10.00-11.00 am, these are emptied into waiting Municipal trucks and then stacked in a central place till next morning. Nobody minds a dustbin at their door for just 2 hours a day, and they are used in a very disciplined way. Residents pay Rs 1 per head per month, with a maximum of Rs 5 per household per month (US $0.10), to support the local cleaning boys, who are paid Rs 1500 per month (US $30) for 4 hours' work. Cooperation by slum-dwellers was 50% from the first month.

In Ahmadabad, the door-to-door bell carts have a special frame that can hold four to six 25-litre containers which can be directly emptied, when full, into waiting trucks or dumper placers, avoiding manual handling of waste which was formerly lifted off the street and into trucks.

Nasik is a city without dustbins, as trucks move from one street corner to another directly receiving waste from each household at fixed times. Loaders receive waste bins from residents, or fetch them from outside some houses where people are away at work. This is very popular with residents and cost effective for the city, but results in a lot of fuel wastage and pollution if the trucks keep their engines idling for 7-10 minutes while waiting at each road crossing. This system is ideal for smaller towns where tractor-trailers can be used.

Surat has spotless dumper placers and surroundings because of "pin-point beats", in which sweepers must take personal responsibility for the cleanliness of their stretch of road and any dustbins or dumper placers in their stretch. These rests on paved areas, slightly higher than the road, and slope towards a drain opening nearby. This system works only because of the extreme dedication of Commissioner S.R. Rao and the fine work ethic he initiated. In almost every other city, dustbins are surrounded by a huge permanent area of filth.

Waste separation at source is vital but difficult. Bangalore has opted for this as its official city policy. The entire sweeper force has been trained and sufficient 4-bucket handcarts have been donated by the corporate sector to cover 50% of the city which is served by the city's own sweepers. New contracts for the remaining



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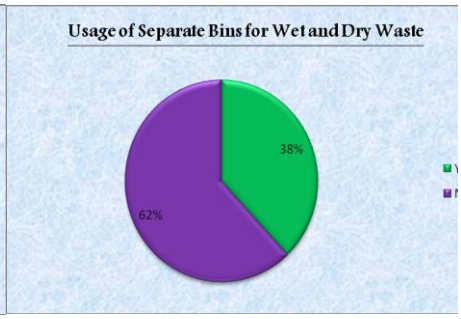

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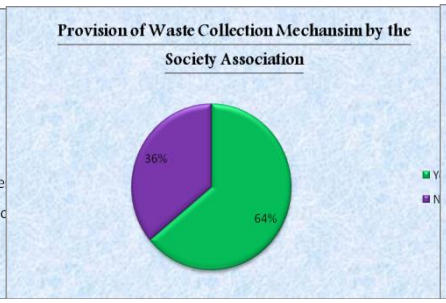

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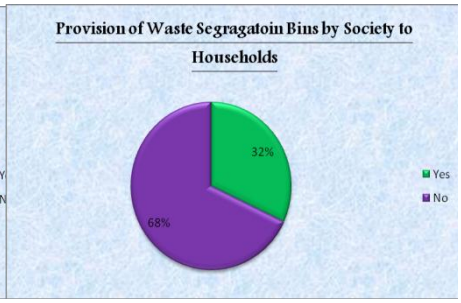

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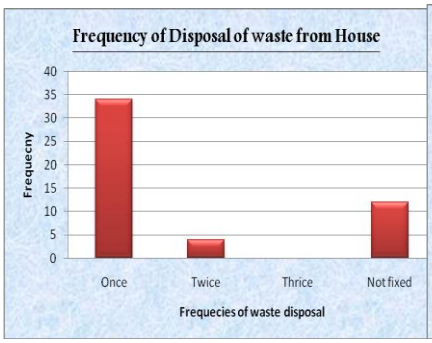

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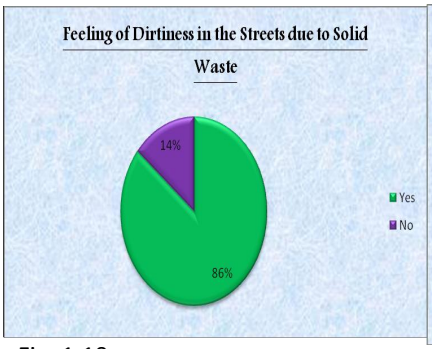

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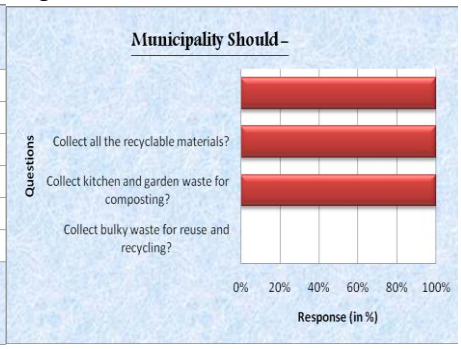

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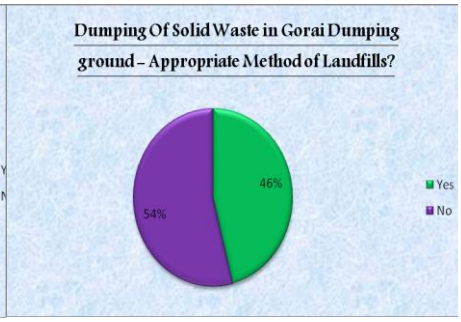

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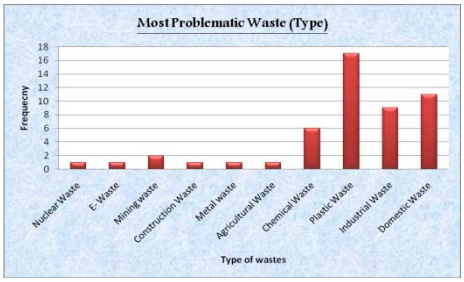

Fig. 1.16

50% of the city now specify doorstep collection of source-separated wastes as part of the cleaning and transport contracts. Cooperation has been 20% in the first year. One drawback is that city sweepers keep the clean saleable recyclables for themselves, leaving less for traditional rag pickers. Also, residents seeing their source-separated "dry" and "wet" waste go from the handcarts into the same truck wonder if their efforts are worth it and get discouraged.

Weekly doorstep collection of dry wastes is done in Ahmedabad by SEWA's rag-picker cooperative, which has a hotline to ensure punctual collection and solve absenteeism and crises. No money is paid or asked for. The waste-pickers get their earnings from the higher-value clean and unmixed waste.

Doorstep collection of both dry and wet wastes is done for a fee at Pune, by a 5,000 member rag pickers' union. They keep the dry waste for sale and dump the wet waste into municipal bins or into a nearby composting site if available. The rag pickers do not seem interested in learning composting skills and trying out an additional source of income.

Coorg District was cleaned up by having all schoolchildren bring dry recyclable wastes weekly from home to school, where an NGO arranged for its purchase by a waste-buyer visiting regularly every week. Funds collected were used for eco-club activities for the classes.

CONCLUSION:

Unrecycled waste quantities in developing countries are increasing exponentially. Calling a material "recyclable" is meaningless unless recycling is actually done. Thin plastic bags and PET bottles of mineral water and soft drinks clog India's drains and sewers. It also causes monsoon flooding, littering of the peri-urban landscape, and affects water percolation and seed germination. Tetrapaks are made into hardboard in dozens of countries, but not in India. Styrofoam continues to be used for shipping goods though it is banned elsewhere. No world class recycling technology has yet come to India because it still has no laws enacted to require this. It is a moral tragedy that in most developing countries, many multi-national corporations use cheap and dirty practices that their home countries stopped tolerating over a decade ago. Consumers pay for such corporate profits through city taxes for cleaning up the new one-time use wastes, or in health costs, filth or eco-damage. Hence, there is urgent need for new legislation and market strategies that promote product stewardship, producer responsibility and waste minimization. This is the next battle to be fought in India. Both Europe and North America have numerous examples of such legislation that developing countries can study and adopt before it is too late. A simple solution is to restrict entry of new industries to the country only to those who bring in the same recycling and product life-cycle policies and standards that are complied with in the West.

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Waste Management and Sustainability of Environment in Mumbai

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Introduction:

The industrialization and globalization has increased the urban growth of large population and waste in the cities caused a rapid deterioration in levels of sanitation and the general quality of urban life. The total population of Mumbai city amounts to nearly 13 million that is increasing on a daily basis. Such a huge habitat obviously generates a huge amount of waste of many kinds the management of which is a massive task for the local administration. The waste management is the generation, prevention, monitoring, treatment, handling, reuse and residual disposition of solid wastes .The term usually relates to materials produced by human activity, and the process is generally undertaken to reduce their effect on health, the environment or aesthetics. Every day, Mumbai generates 7,500 MT of garbage. It also spews out 21 lakh tonnes of industrial waste, which is half the national total. And with dump yards nearing their saturation points and no possibilities of open spaces, every day the city is struggling to manage this huge amount of solid garbage. A day in future when there will not be any place to dispose our garbage…What we will do? The Brihanmumbai Municipal Corporation (BMC) is silent about waste management and disposal in the future. Rising population, changing lifestyle of citizens has contributed to a rise in garbage in Mumbai. As of today, the per capita waste generated per day is 450 gm. As per the 2011 Census, the total population of Greater Mumbai is 1,25,00,000. Huge numbers of peoples are coming to Mumbai daily seeking jobs. At present, about 7,500 MT (metric tons) of Municipal Solid Waste (wet + dry) is generated per day. Mumbai is vertically expanding. Being a commercial hub with offices scattered across the city, more solid waste is also added in addition to the regular routine garbage. The research paper focuses on the types, management and awareness of waste by local people.

Objectives:

- To focus on the types and management of waste in Mumbai.
- To evaluate the process of waste management by the local authorities in Mumbai.
- To focus on the awareness of Mumbai people about the management of waste.
- To suggest some management process for sustainability of environment.

Methodology

The research paper is mainly based on the literature review but the researcher has also taken primary survey of fifty people to focus the awareness of Mumbai people about the waste management.

 ISBN: 978-93-84663-07-0

Analysis

Mumbai has a coastal stretch of 603 sq km. Geographically, the city of Mumbai can be divided into three sections, namely, the island city (or main city), the western suburbs and the eastern suburbs. We have, in our city, three dumping grounds which are located in the northern part of Mumbai at Gorai (Borivali), Mulund and Deonar. Local government body is responsible for the waste.

The financial and commercial capital of the Country, accommodating more than 12 million people presently, Mumbai has garbage (MSW) production to the tune of 6500 Tons per day. It also produces nearly 2500 Tons of construction and demolition (C&D) waste per day. The collection and transportation of the huge amount of waste is a matter of concern for any Corporation. MCGM operates a huge fleet of 983 Municipal and Private Vehicles for collection of waste making 1396 number of trips each day.

Waste generation by Mumbai people:

The generation of waste by an individual depends on the socio-economic conditions to which the person belongs. For example, a rich family will generate nearly four to five kg of mixed waste per day; a middle class family will generate between one to three kg of mixed waste per day and a poor family, in slums, will generate close to 500 g / day. However, with better and improved standard of living, it will go up to more than 600 gm in 2020.

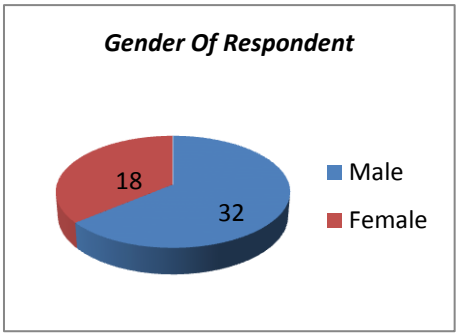
Management of Waste

The Municipal Corporation of Greater Mumbai (MCGM) is formally responsible for the management of waste in the city. The prevailing approach has been one of collection and disposal that is, garbage is collected from communities by the municipal authorities and disposed off at the three main dumping sites that are currently servicing the city.

- ***The present and future crisis:***

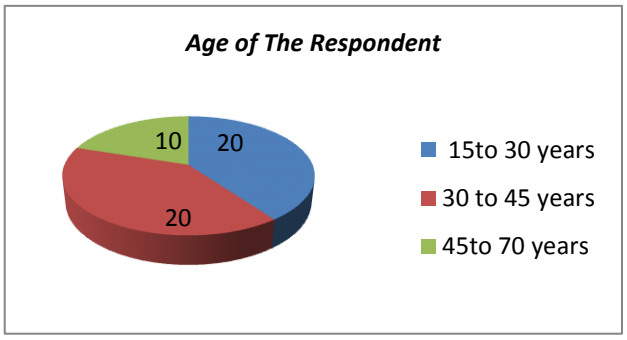
The 110 hectare Deonar dumping ground rises up to seven stories high, the dumping ground was opened in 1927 and accepted approximately 1,450,000 tonnes of waste in 2006. Currently, the site has approximately 9.2 million tonnes of waste in place. The average life of a dumping ground is 30 years. The remaining life of our largest dumping ground, i.e., Deonar, is only five to six years and, so far, no alternative site has been found for waste disposal. The waste at the dumping ground is covered with debris and spread evenly in layers. The organic waste undergoes natural decomposition and generates a fluid, which is known a leachate, and is very harmful to the ecosystem, if not treated properly.

The garbage collection activity itself has several differences amongst the localities; there are highly-serviced areas, medium-serviced areas and very low-serviced areas. The low serviced areas include mainly slums and the local government extends its services only to regularized slums which are declared official or recognized under the census of slums.

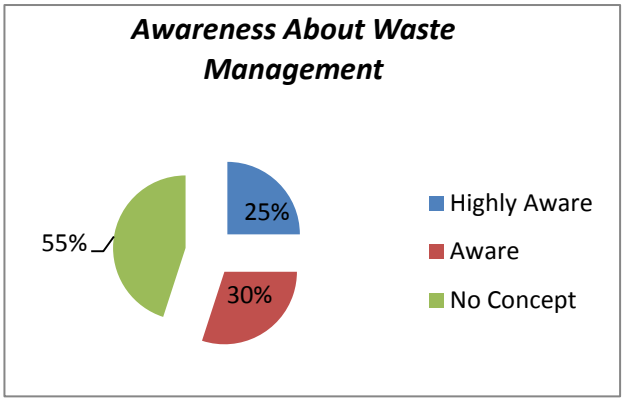


Survey Analysis:

The researcher has taken the survey of fifty people in Chembur area of Mumbai to focus on the awareness of Mumbai people regarding the proper waste management. Among them some are students, homemaker and other. Fifty people have been surveyed in different socio-economic status and from different age and also different educational back ground.



 ISBN: 978-93-84663-07-0



It was observed during the survey that there is a gap in the concept of waste management. Some people do not have any idea about the environmental impact. Some just dump their domestic waste near their residence mainly in the slum area. But most young generations are much concerned about the waste management. In some area municipality not clear the local dumping areas regularly. Some societies have given the official letter to the local municipal authority but they do not pay any attention for the concerned matter.

Role of Mumbai people:

The citizens of Mumbai have to be trained in the three 'Rs' with respect to management of wastes. The solution, in the first place, is the minimization of waste. Where waste cannot be avoided, recovery of materials and energy from waste as well as remanufacturing and recycling waste into usable products should be the second option. Recycling leads to substantial resource savings.

Reduce

The reduction of waste can happen only when we, as citizens of Mumbai, reduce waste generation in the first place.

Reuse

Simple habits like carrying a cloth bag while going shopping will be helpful to reduce the need for plastic bags. Please do not buy any products in a polythene bag and help the environment as a whole.

Recycle

To recycle, we should segregate our garbage at source. Wet garbage can be recycled by composting or vermi-composting in your backyard or in the vicinity. This will produce good manure that can be used for gardens and lawns. The dry garbage can be given to the rag pickers who sell it to re-users. We have to make ourselves concern about the recycle process.

The rag pickers play an important role in managing the solid waste; they retrieve all possible recyclable items from waste and, thus, put these materials back to proper reuse. But, sadly the rag pickers are never recognized for the invaluable service they provide to the city's solid waste management.

Conclusion:

The increasing volume and complexity of waste associated with the modern economy is posing a serious risk to ecosystems and human health. Waste disposal is in some extent neglected in city like Mumbai also and leading towards major environmental health hazard. Increasing quantities of waste and their changing composition are a major challenge for municipal governments. As the population is increasing everyday in Mumbai and in order to achieve the benefit of the financial city proper disposal of solid waste must be consider as the key development for the city. The cost of disposal of large quantities of waste is often beyond their financial capacity. So, as citizens our efforts go to waste until the government provides a method for segregating garbage. The research paper aims to aware the people to use eco-friendly products, minimized the waste production, re-use and sustain the development of our dream city. To make Mumbai "*Chaka Chak*" is in our hand. Let's try for sustainability of our next generation.

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The Sustainable Growth and Development of Indian Agriculture

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ABSTRACT

India has been witnessing a blinding pace of growth and development in recent times. There is talk of the country leapfrogging into the league of developed nations sooner than later. But this growth has raised concerns from sundry quarters as regards its basic texture and health. Experts are now calling for "sustainable development" and the term has gained currency in the last few years. In spite of fast growth in various sectors, agriculture remains the backbone of the Indian economy.

Sustainability entails attaining equilibrium between the demand and supply of agriculture produce. The green revolution may bring the efficiency in agriculture produce and thus, the productivity increases. The ultimate performance of agriculture depends on the performance of various resources, the strategies and methods adopted. To face dryness due to the decrease in the rainfall, the agriculturist has to use the innovative strategies.

***Keywords*:** Agriculture, Sustainable growth, Resources, Development, trends, economy

INTRODUCTION

Agriculture occupies the most important position in Indian economy, as it is one of the largest private enterprises in India, which continues to dominate the change in economy through its links of various sectors of production and markets. The role of agricultural sector in Indian economy can be seen through its contribution to GDP (Gross domestic Product) and employment. This sector also contributes significantly to sustainable economic development of the country. The sustainable agriculture development of any country depends upon the judicious mix of their available natural resources. In fact agriculture determine the fate of a country like India where about two-thirds of the population still lives in rural India with agriculture as its livelihood, in spite of the increasing urbanization that has been taking place since many decades. Therefore if agriculture goes wrong, it will be really bad for the economy as the falling of agricultural growth not only affects employment but GDP too(thus increasing poverty).The larger objective for the improvement of agriculture sector can be realized through rapid growth of agriculture which depends upon increasing the area of cultivation, cropping intensity and productivity. But for a country like India, increasing productivity is more important than the rest of the two. This is simply because of increasing urbanization, industrialization and the limited land size of the country. The productivity can be increased by two ways. First, increasing output by efficient utilization of available resources second, increasing output by variation of input. The first method is better with respect to productivity and sustainability. But due to increasing population, this method cannot provide a permanent solution. Thus we can go for the second method which may potentially cause environmental degradation in the economy and affect its sustainability. Therefore there is need to tackle the issues related to sustainable agriculture development.

SIGNIFICANCE OF THE STUDY

The basic purpose of this research paper is to study the growth and sustainability in agriculture sector. It also helps to explain the innovative strategies & achieving the growth in this sector.

RESEARCH METHODOLOGY

The prepared paper is a descriptive study in nature. The study has been carried out based on the collection of the relevant secondary data. Secondary data collection was based on various sources such as published books, articles published in different journals & news papers, periodicals, conference paper, working paper and websites, etc.

OBJECTIVES

The objectives of study were based on:

1. To help to know conceptual development of agriculture growth.
2. To help to understand the Advantages of sustainable agriculture.
3. To help to understand the Economic Sustainability.
4. To help to understand the Issues & Challenges.
5. To help to understand Future Prospects and Solution for India.

MEANING & DEFINITION

Sustainable agriculture is the act of farming using principles of ecology, the study of relationships between organisms and their environment. Sustainable agriculture can be understood as an ecosystem approach to agriculture.

It has been defined as "an integrated system of plant and animal production practices having a site-specific application that will last over the long term" For Example:

- Satisfy human food and fibre needs.
- Enhance environmental quality and the natural resource base upon which the agricultural economy depends.
- Make the most efficient use of non-renewable resources and on-farm resources and integrate, where appropriate, natural biological cycles and controls.
- Sustain the economic viability of farm operations.
- Enhance the quality of life for farmers and society as a whole.

CONCEPTUAL DEVELOPMENT OF AGRICULTURE GROWTH

Since 2000, there has been strong progress in the agricultural sector (which includes crops, livestock, forestry, aquaculture and fisheries) overall agricultural growth has averaged 4 percent a year.

This is partly due to policy reforms including ongoing impacts of allocating land use rights to individuals, and the result of market-based incentives such as higher prices for crops. The agriculture performance linkages with rural poverty and household nutrition, supply response and investments in agriculture, performance and potential of rain fed agriculture, efficiency in Indian edible oilseed sector, progress and potential of horticulture, linkages between urban consumption and rural nonfarm employment and agriculture income, subsidies and investment in livestock sector, post harvest management of fish, and cooperative credit.

ADVANTAGES OF SUSTAINABLE AGRICULTURE OVER TRADITIONAL PRACTICES

- **Soil Fertility:** Continuous fall in soil fertility is one of the major problems in many parts of India. Sustainable agriculture improves fertility and soil structure.
- **Water:** Irrigation is the biggest consumer of fresh water, and fertilizer and pesticides contaminate both surface and ground water. Sustainable agriculture increase the organic matter content of the top soil, thus raising its ability to retain and store water that falls as rain.
- **Biodiversity:** Sustainable agriculture practices involve mixed cropping, thus increasing the diversity of crops produced and raising the diversity of insects and other animals and plants in and around the fields.
- **Health & Pollution:** Chemicals, pesticides and fertilizers badly affect the local ecology as well as the population. Indiscriminate use of pesticides, improper storage etc. may lead to health problems. Sustainable agriculture reduces the use of hazardous chemical and control pests.
- **Land use Pattern:** Over-exploitation of land causes erosion, land slides and flooding clogs irrigation channels and reduces the arability of the land. Sustainable agriculture avoids these problems by improving productivity, conserving the soil etc.

 ISBN: 978-93-84663-07-0

- **Climate:** Conventional agriculture contributes to the production of green house gases in various ways like reducing the amount of carbon stored in the soil and in vegetation, through the production of Methane in irrigated field and production of artificial fertilizers etc. By adopting sustainable agriculture system, one can easily overcome this problem.

ECONOMIC SUSTAINABILITY

For agriculture to be sustainable it should be economically viable over the long term. Conventional agriculture involves more economic risk than sustainable agriculture in the long term. Sometimes governments are inclined to view export-oriented production systems as more important than supply domestic demands. This is not right. Focusing on exports alone involves hidden costs: in transport, in assuring local food security, etc. Policies should treat domestic demand and in particular food security as equally important to the visible trade balance.

It is a popular misconception that specific commodities promise high economic returns. But market production implies certain risks as markets are fickle and change quickly. Cheap foreign food may sweep into the national market, leaving Indian farmers without a market. As a World Trade Organization signatory, the Indian government is under pressure to deregulate and open its economy to the world market so it cannot protect its farmers behind tariff walls.

The main source of employment for rural people is farming. Trends towards specialization and mechanization may increase narrowly measured "efficiency", but they reduce employment on the land. The welfare costs of unemployment must be taken into account when designing national agricultural support programs. Sustainable agriculture, with its emphasis on small-scale, labour-intensive activities, helps overcome these problems.

ISSUES & CHALLENGES

The central issue in agricultural development is the necessity to improve productivity, generate employment and provide a source of income to the poor segments of population. Studies by FAO have shown that small farms in developing countries contribute around 30-35% to the total agricultural output.

The pace of adoption of modern technology in India is slow and the farming practices are too haphazard and unscientific. Some of the basic issues for development of Indian agriculture sector are revitalization of cooperative institutions, improving rural credits, research, human resource development, trade and export promotion, land reforms and education.

FUTURE PROSPECTS AND SOLUTION FOR INDIA

Agriculture sector is an important contributor to the Indian economy around which socio-economic privileges and deprivations revolve and any change in its structure is likely to have a corresponding impact on the existing pattern of social equity. Sustainable agricultural production depends upon the efficient use of soil, water, livestock, plant genetics, forest, climate, rainfall and topology. Indian agriculture faces resource constraints, infrastructural constraints, institutional constraints, technological constraints and policy induced limitations.

Sustainable development is the management and conservation of the natural resource base and the orientation of technological and institutional change in such a manner as to ensure the attainment and continued satisfaction of human needs for the present and future generations. Such sustainable development (in the agriculture, forestry and fisheries sector) conserves land, water, plant and animal genetic resources, is environmentally non-degrading, technically appropriate, economically viable and socially acceptable.

So, to achieve sustainable agriculture development the optimum use of natural resources, human resources, capital resources and technical resources are required.

In India the crop yield is heavily dependent on rain which is the main reason for the declining growth rate of agriculture sector. These uncertainties hit the small farmers and labourers worst which are usually leading a hand to mouth life. Therefore something must be done to support farmers and sufficient amount of water and electricity must be supplied to them as they feel insecure and continue to die of drought, flood, and fire. India is the second largest country of the world in terms of population; it should realize it is a great resource for the country. India has a huge number of idle people. There is a need to find ways to

explore their talent and make the numbers contribute towards the growth. Especially in agriculture passive unemployment can be noticed.

The sustainable development in India can also be achieved by full utilization of human resources .A large part of poor population of the country is engaged in agriculture, unless we increase their living standard, overall growth of this country is not possible. If we keep ignoring the poor, this disparity will keep on increasing between classes. Debt traps in country are forcing farmers to commit suicides. People are migrating towards city with the hope of better livelihood but it is also increasing the slum population in cities. Therefore rural population must be given employment in their areas and a chance to prosper. India has been carrying the tag of "developing" country for quite long now; for making the move towards "developed" countries we must shed this huge dependence on agriculture sector.

CONCLUSION

The growth and development in the agriculture is achieved by Green Revolution. It is the need of the tense to maintain the resources and to respond the climate change. The conservation of water resources is required to be focused. To face the difficulties in summer and the decrement in the rain fall, it is important to save a single drop of water, for this one of the strategies that to pour the water collected by the roof in the land, other strategies may be dividing land in to several other parts to match the demand and supply for food grains and the vegetables. The agricultural technology needs to move from production oriented to profit oriented sustainable farming. The conditions for development of sustainable agriculture are becoming more and more favourable. New opportunities are opening the eyes of farmers, development workers, researchers and policy makers like agric related businesses, dairy farming, poultry farming castle farming and fisheries. Now the time is to see the potential and importance of these practices not only for their economic interest but also as the basis for further intensification and ecological sustainability. To conclude, a small-farm management to improve productivity, profitability and sustainability of the farming system will go a long way to ensure all round sustainability.

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Study of Effects of Some Factors on Declining of Some Passerine Birds in Painganga Sanctuary of Umarkhed, Dist. Yavatmal M.S.

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Abstract

Study of birds has great importance in the discipline of Ecology. Environmental pollution, climate change, depleting food resources and overuse of pesticides causes the declining of population of birds species. The present investigation is undertaken to enlist the species of birds particularly Passerine birds as well as causes of its declining. Investigation was carried out for two years from 2012 to 2013. 25 species of passerine birds were observed and causes of their declining were studied in jurisdiction of the research area – Painganga sanctuary .Of these all 25 species were found to be declined to certain extent. The most declining species was found to be *Ploceus Philippines* (Baya Weaver) while the least decline species was found to be *Pscittaceula kramery* (Rows ring parakeet).

***Keywords*:** Environmental factors, Pesticides, Sparrows, Sanctuary, Villages, Declining, Hunting etc.

Materials and Methods

The instruments and devices used in the present investigation were electronic digital camera, sound recorder, resources used were information from villagers about nesting site of birds and methods used were monitoring method and point count methods .Birds were monitored by digital camera and by point count methods. This is the simplest method of counting and enlisting the birds in which a trained observer can records all the birds seen and heard from a point count station for a set period of time -two years. A series of counts completed over a fixed route then compared to the result of the same point count in every year. Seven routes namely East, West, North, South, Central, Central Upper and Central Lower in vicinity of water resources were tracked carefully every week for two years. Data of temperature and rainfall was collected from tehsil office umarkhed. The increased or decreased in temperature, rainfall and overuse of pesticides were expressed in terms of percentages. Depleting food resources were observed and studied for two years whereas information of use and over use of pesticides used in the crop fields was obtained from farmers of the region.

Result and Discussion:

Table 1 indicates the increased or decreased in environment factors like temperature and rainfall and pesticides.

Increased in Temperature	Over use of pesticides	Decrease in rainfall
2.9 ^{o}C	10 %	7%

Sr. No.	Species of Sparrows	Common Name	Total No Monitored		
1	*Prinya socialis*	Ashy prinya	24	18	11
2	*Ploceus philippinus*	Baya weaver	26	19	10
3	*Hirudo rustica*	Barn swallows	12	09	06
4	*Monticola cinctorhyncus*	Blue caped rock thrush	08	07	04
5	*Acrocephalus dumetorum*	Blyth's red warbler	07	06	03
6	*Dicrurus macrocercus*	Black dorongo	22	18	16
7	*Periparus ater*	coal tit	14	11	09

8	*Orthotomus citorius*	Common tailorbird	11	08	07
9	*Alcedo atthis*	Common kingfisher	17	12	--
10	*Dendrocopus cathparius*	Crimson breasted woodpecker	23	18	14
11	*Sternus vulgaris*	European starlings	14	03	01
12	*Phylloscopus trochilloides*	Greenish warbler	09	07	05
13	*Merops orientalis*	Green bee eater	32	27	24
14	*Carvus splendens*	House crow	112	98	76
15	*Passer domesticus*	House sparrow	286	244	168
16	*Pitta brachyuran*	Indian pitta	68	34	26
17	*Coracias benghalensis*	Indian roller	32	21	17
18	*Cuculus micropterus*	Indian cuckoo	18	12	09
19	*Otus bakkamoena*	Indian scops –owl	16	11	08
20	*Aerodramus unicolor*	Indian swiftlet	27	19	13
21	*Mirafra erythroptera*	Indian bush lark	07	03	02
22	*Pterocles indicus*	Painted sandgrouse	19	14	11
23	*Carpodacus erytrinus*	Pink browed rosefinch	03	01	00
24	*Rhyacornis fuliginosay*	Plumbeous water red start	12	06	02
25	*Emberiza bruniceps*	Reed bunting	16	10	08
26	*Psittacula krameri*	Rose ringed parakeet	28	24	17
27	*Rhipidura albicolis*	White throated fantail	32	27	21
28					

From the analysed data in the present investigation, it could be predicted that these Passerine birds were found to be in the trends of declined in number. Attempts were made to find out probable causes of declining of birds in the present investigation. There were climate change, depleting food resource, overuse of pesticides leads increased in temperature and fall in rainfall.

Climate change: From the data obtained it could be said that the rainfall was found to be reduced to 7% in consecutive where as temperature was increased by 2.9^{o}C, it could be correlated with the declining of birds. Similar types of observations were made by Nicola and *et al* (2011). Climate is changing at fast pace causing widespread profound consequences for living organisms. Failure to adjust the timing of life cycle event to climate mismatch to the life cycle of other species and abiotic factors. the findings in the present investigation also showed conformities with the investigation made by Nicola and *et al* (2011) wherein 117 europian migratory birds have changed over the past five migratory decades .Migrants and particularly those wintering in subsaharan Africa, now arrive at higher degree days and may have therefore accumulated a 'thermal day'. Thus, possibly becoming increasingly mismatched to the spring phenology. It could be said that the present investigation also get the support by the works of Walter and et al (2002) wherein it was investigated that the climatic variation is a major ecological and evolutionary force acting on populations both directly and indirectly; organisms were selected to track those variation (Parmeson, 2006); and failure to adaptively respond to it may cause demographic decline and drive population to the verge of extinction; the increase in winter and spring temperature at medium and high latitude has led to generalised advancement of spring phonological events (Klein Tank and *et al*; 2002). Newton (2008) also found similar results-change in climate can entail considerable viability costs because of the risk of facing adverse weather or still poor food supply. Both and *et al* (2006) found that as inability of birds to tract climate change may cause their population to decline. IPCC (2007) also stated that temperature change have been occurring at faster pace during recent decade than in the previous ones.

Depleting food resource: The rainfall in jurisdiction of research site was found to be decreased by 7 %. Hence the agricultural production was found to be reducing to great extents. It was also observed that there was remarkable change in the crop pattern in the associated area. In spite of cultivation of mug,

udid, Moat, chawli, tur, jowar and bajri the cultivation of sugarcane and cotton was found to be increased. It could positively be correlated with the declining of passerine birds .Food resource in sanctuary was also found to be depleted in those two years due to reduced rainfall and increased temperature. The present investigation was found to be inconformity with the investigation made by Podolsky (2008) and Nietschke and et al (2007) wherein it was stated that food are strongly and *et al* (2006) also found that photoperiod can also intervene the distribution of birds dependent on weather and temperature qualities as most important factor. Bradshaw

Pesticides: Pesticides used in the vicinity of research area particularly in the agricultural fields were *Acephate, alachlor , Atrazine, Benomyl, Bifenthrin, Captan, Chlorothalonil, Cypermenthrin, Dichlorvos, Diclofop Methyl, Decofol, Mancozeb, Methomyl, Metolachlor, Oxadiazon, Oxyflourfen, Permethrin, Phosphamidon, Propiconazole, Propoxur, Thiodicarb, Thiophanate Methyl, Triadimefon, Trifluralin*. Alteration in crop pattern and cultivation of sugarcane and cotton led to the overuse of pesticides in the said area. It could boastfully be said that it has negative correlation with the declining of passerine birds. Similar observations were made by Michael (1986) where in it was investigated that the distribution and abundance of organisms to some extent depends upon some aspects of environment. The Canadian wildlife service report (1998) stated that despite the usefulness of pesticide to human being, there is damaging effect on birds and their habitat. The decline has been blamed not only on habitat loss, but also on agriculture intensification in which pesticides play a key role.

Conclusion: From the above investigation it could be concluded that climate change, depletion in food resources and overuse of pesticides were found to be the cause of declining of some passerine birds in the said ambit of investigation. The most declined was found to be ploceus phillippines (Baya weaver) While list declined species was found to be Pscittaceula Kramery (Rose ring parakeet)

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Impact of Rural Development on Green Economics

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Abstract

The paper submitted deals with the impact of rural development on green economics which is the most crucial topic of today's world. Green Economics is nothing but the overall development of the country with environmental management and sustainability. In India, cities are too developed that there is no or less scope for further development which may or may not be required. But we say "Once you stop to developed, your development will stop." Now the country started to developed rural areas which is good for the economic development, but at what cost? Is rural development is possible without affecting or harming environment? Due to increasing population and industrialisation we don't have other option, It has become ad key issue for human survival. It is the concept of rational adjustment of man with nature. Human beings are at cross road. This paper elaborates the need of rural development and at the same time maintaining sustainable with the discoveries of new tools, techniques and strategies which will help to minimise environmental damages. The researcher has concentrated the impact of rural development on green economics, because "Rural development is the development of nation".

Key words: Green Economy, Rural Development, Infrastructural Facilities.

Introduction

What is green economy? Green economy is an economy that results in improving the human well-being and social equity, while significantly reducing environmental risks and ecological scarcities. The global problems of environment pollution and hence degradation of our environment is linked with development process. Environment is a living dynamic and it is changing its entity. It requires attention at every level from loss of biodiversity to economic productivity and ecological security. Today increase in rural development through eco-destructive ways has threatened human adaptation to nature. **"Environmental crisis"** is the biggest issues which is getting attention all over the world. There is an urgent need of worldwide awareness regarding problems related to the protection and conversation of environment. It can be seen as a means for achieving the resilient economy that provides a better quality of life for all within the ecological limits of the planet. It can be also seen as a means to link the economic, environmental and social considerations of sustainable development in such a manner that long-term economic development is achieved by investing in environmentally friendly and socially equitable solutions.Green Sticker and ecolabel practices have emerged as consumer facing measurements of friendliness to the environment and sustainable development. Many industries have started to adopt these standards as a viable way for promoting their greening practices in a globalizing economy. Green economy and the related field of ecological economics share many of their perspectives with feminist economics, including the focus on sustainability, nature, justice and care values. The purpose of the green economy is to stimulate green investments in and across various economic and social sectors. Such investments should help to use natural capital and ecosystems, both considered to be critical economic assets, in a more efficient way or to substitute them by other assets, in particular when there is a risk of depletion or

degradation. The investments should, at the same time, support the creation of social equity and employment opportunities.

Rural development

Rural development means overall development of the people living in rural area such as development in infrastructural facilities, job opportunities, raising the standard of living of the people. Rural areas are the prime location for the development, because the development level has some restriction on itself and development is on going process which is moving from urban to rural areas but the question is "Environment Sustainability". Whether we will be able to maintain our environment with the development? The development of rural areas and environment sustainability is linked with each other and rural development without harming environment is a global challenge. A significant segment of India's population, particularly the rural poor, depends on natural resources for subsistence and livelihood. Poverty reduction and economic growth can be sustained only if natural resources are managed on a sustainable basis because in fast growing development, increasing population and industrialisation we need to take steps towards protection of the environment in rural areas which has become our primary concern and an intensely debated issue of the present era.

Statement of the problem:

Is Rural Development possible without harming environment?

Objective of the paper

- To study the concept of green economy.
- To study the factors influencing green economy.
- To analyze problems and measures to overcome that.

Methodology

The analysis of this paper totally depends upon secondary data like journal, books and various website from internet.

Factors influencing green economy for the development of rural areas

Whatever infrastructural facilities we used in present era, environment sustainability is possible to some extend if we follow the concept of green economy. Following are the some factors where in the concept can be applied for the better life and to maintain the quality of environment.

Buildings Construction has consequences - let's construct a better world. Construction and buildings take a large toll on global resources and climate. A home or business energy audit can reduce your building's climate footprint and lead to significant savings in energy costs. We must all try to go green and reduce our carbon footprint to make our planet a better place to live; not only for us, but also for the coming generation. The best part of green homes is that these are energy-efficient and all the energy saving investments further increases the value and boosts the saleability factor of your home.

Fishery

Seafood is delicious and healthy - but depleting our fish stocks isn't. Overfishing in many parts of the world threatens to deplete future fish stocks. We can avoid this by working now to promote sustainable fishing practices. Research ecolabel in your area and buy seafood products that have been harvested sustainably.

Forestry

Forests support livelihoods, societies and cultures, our climate, and a plethora of wildlife and ecosystems. Deforestation accounts for close to 20% of the world's greenhouse gas emissions. Sustainably managed forests can continue to support communities and ecosystems without damaging environment and climate. Use electronic files to reduce your demand for paper products, and seek out timber and paper products that come from certified sustainable forests. When you support certified sustainable forest products, you support a healthy environment and sustainable livelihoods.

Transport

Congestion, pollution, traffic accidents.. there's a better way. Riding alone in your car isn't just environmentally and economically inefficient, it's lonely. Carpooling or taking public transport reduces environmental impacts and economic costs while strengthening community. Walking or riding a bike for short trips is good for your health - and the environment's, too. When you choose alternative transportation methods, you support a Green Economy in the transport sector.

Agriculture

Use your consumer power to support local, organic and sustainable agriculture. The population is growing. It's time to support sustainable agriculture to ensure our ability to feed EVERYONE. Grow your own veggies, eat in-season, and shop local farmers' markets. When you buy local, organic, and sustainable food products, you send a message to producers that you support a Green Economy for agriculture.

Energy Supply

Our lifestyle demand energy, but is the demand too great on our resources? The current mainstream energy sources - oil, coal, gas, etc. - are not only harmful to health and environment; they're not sustainable in a world of growing energy needs. You can support the development of clean, renewable energy by choosing businesses and products that invest in them - or by investing in them yourself! While we work towards a transition to renewable energy, consider ways to improve your personal energy efficiency. Turn off lights and unplug appliances when you aren't using them. Don't heat your house when no one's home.

Tourism

Tread lightly on your travel destinations. Tourism can be great for local economies, but not if it results in negative environmental and social impacts. The same principles apply to supporting a Green Economy both at home and a far: buy local, travel with others; limit water and energy use, etc.Know before you go: What hotels and travel agencies support ecotourism? How can I limit my impact on sensitive habitats? When you support ecotourism, you help the communities in your travel destinations achieve economic growth without sacrificing environmental and social well-being.

Waste

If everything you buy becomes waste, where will we put it all? Throwing something away means losing the chance to reuse materials and can contribute to methane (the most potent greenhouse gas) emissions from landfills. Electronics in particular are only recycled at a rate of 15% globally. Recycling appropriate materials and composting food waste reduces the impact of landfills as well as the demand on our natural resources to produce more materials. Learn about recycling opportunities in your community and support a more resource-efficient Green Economy.

Manufacturing and Industry

It's no big secret that industry and manufacturing have been rough on the environment - but things can change, and you can help. Industry and manufacturing drive employment and economic growth in many countries, but is it worth it to employ someone to pollute. Be a wise consumer - support businesses that have sustainability plans, use ecolabel, and invest in renewable energy. Green washing is everywhere! But many companies are sincerely committed to achieving sustainability. Do your homework and ask questions. When you choose a sustainable business over a 'business-as-usual,' you send the message that it's time for industry and manufacturing to transition to a Green Economy.

Conclusion:

The survival of man depends upon how effectively and judiciously he manages the earth and maintains the quality of his overall environment for that purpose we need to try to create awareness regarding green economy and environment management by educating people regarding the importance of environment and hazardous substances to be left out in the rural areas should be restricted or prohibited. At the time we need to developed innovative and participatory models of natural resources management. The development of rural areas is possible if we follow the concept green economy for the better life and quality environment which is the need of the hour.

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Optimization of pH, Agitation and Incubation Time for Xanthan Gum Production

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ABSTRACT

The usefulness of water-soluble carbohydrate polymers like Xanthan gum in industry relies on its wide range of functional properties. Xanthan gum producing microorganisms are *Xanthomonas campestries, Xanthomonas citri, Xanthomonas oryzae, Xanthomonas musacearum.* Generally the species of Xanthomonas infects the cabbage plants whose infected parts or leaves can be used as source for isolation of organism. In present study, a local isolate of *Xanthomonas spp.* was obtained from infected cabbage leaves *(Brassica oleracea);* leaves showing the yellow necrotic lesion were collected randomly from a cabbage plants in agricultural field around Jalgaon city. The leaves were cut into the small pieces and soaked into the sterile distilled water for overnight. Then this sample was inoculated into the Yeast Malt extract broth and incubated at 28^{o}C for two days. Enriched culture was streaked onto Yeast-Malt (YM) extract agar. The plates were incubated at 28 ± 1°C for 4 days for satisfactory isolation. The optimum condition for Xanthan gum production was found to be as pH 7, the optimum agitation is 250 rpm and optimum incubation period was found to be 6 days at temperature 28° C. The isolate shows yield of Xanthan gum 6.5 gm/lit while standard shows less yield 6.1 gm/lit. Thus this study revealed the standard parameters for optimum yield.

INTRODUCTION

Xanthan gum is used as a food additive, modifier, commonly used as a food thickening agent and a stabilizer. Microorganisms such as bacteria and fungi produce three distinct types of carbohydrate polymers:

1. Extracellular polysaccharides, which can be found either as a capsule that envelops the microbial cell. 2. Structural polysaccharides, which can be part of the cell wall. 3. Intracellular storage polysaccharides.

The usefulness of water-soluble carbohydrate polymers like Xanthan gum in industry relies on its wide range of functional properties. The most important characteristic is its ability to modify the properties of aqueous environments that is their capacity to thicken, emulsify, stabilize, flocculate, swell and suspend or to form gels, films and membranes. Another very important aspect is that polysaccharides obtained from natural, renewable sources are both biocompatible and biodegradable.

Xanthan gum producing microorganisms are *Xanthomonas campestries, Xanthomonas citri, Xanthomonas oryzae, Xanthomonas musacearum.* Generally the species of Xanthomonas infects the cabbage plants whose infected parts or leaves can be used as source for isolation of organism. Xanthan gum production using microbes becomes more significant as Xanthan gum have wide applications in Salad dressings, Dry Mixes, Syrups, toppings, relishes, sauces, Beverages (fruit and non-fat dry milk), Dairy products, Pharmaceuticals (creams and suspensions), Cosmetics, Agriculture, Petroleum production, Enhanced oil recovery etc.

MATERIALS & METHODS:

Sample collection, Enrichment and Isolation:

A local isolate of *Xanthomonas spp.* was obtained from infected cabbage leaves *(Brassica oleracea);* leaves showing the yellow necrotic lesion were collected randomly from a cabbage plants in agricultural field around Jalgaon city. The leaves were cut into the small pieces and soaked into the sterile distilled

water for overnight. Then this sample was inoculated into the yeast malt extract broth and incubated at 28 ^{0}C for two days. Enriched culture was streaked onto yeast-Malt (YM) extract agar. The plates were incubated at 28 ± 1°C for 4 days for satisfactory isolation.

Characterization of organism:
The obtained isolate morphologically characterized by colony characteristics , Gram staining, Capsule staining, motility and biochemical tests like Sugar fermentation tests (Glucose, Fructose, Arabinose, sucrose), Enzyme Tests (Gelatin Liquefaction, Starch utilization, Nitrate reductase test, Catalase test) were recorded of single selected colony. And then culture was maintained on YM agar slants at 4°C and was sub cultured every two weeks.

Optimization of Parameters for Production of Xanthan Gum:
Effect of pH on production: A loopful suspension of isolate was inoculated in 50 ml Sterile Yeast extract malt extract broth containing flasks with different pH values as 5, 6, 7, 8 and 9 and incubated these flasks at 28°C for 6 days. After incubation period the viscosity of the broths was measured using Brooke's viscometer.

Effect of Agitation on Production: A loopful suspension of isolate was inoculated in 50 ml Sterile Yeast extract malt extract broth and incubated these flasks at respective RPM- 50, 100, 150, 200, 250 at 28°C for 6 days. After incubation period the viscosity of the broths was measured using Brooke's viscometer.

Effect of Time Duration/Incubation on Production: A loopful suspension of isolate was inoculated in 50 ml Sterile Yeast extract malt extract broth and incubated these flasks at at 28°C for 6 days. After incubation of 1, 2, 3, 4, 5, 6 days viscosity was measured using Brooke's viscometer.

Production of Xanthan gum at optimum condition:
Inoculum preparation: The inoculum was prepared by transferring cells from YM extract agar slants to 50 ml of YM broth which consists of (g/l) glucose, 10; peptone, 5; yeast extract, 3; malt extract, 3. Then incubation was carried out in shaker incubator at 150 rpm and 28 ± 1°C for 48 h. These cultures were further used for seed production medium at 5%.

Process of production: The production basic medium composed of the following components in g/l, K_2HPo_4, 5; $MgSo_4.7H_2O$, 0.1; yeast extract, 0.5 and urea, 0.4; glucose, 20 was added as a carbon source unless otherwise stated and sterilized separately. The pH was adjusted to 7.3 before sterilization. The medium was 250 ml and this was sterilized, after cooling; the flasks were seeded with the prepared 5% inoculum of *Xanthomonas spp and i*ncubated in rotary shaker incubator at 150 rpm and 28 ±1°C for 8 Days.

Process of recovery: After 8 days of incubation, final broths were heated at 80 °C for 30 minutes. The broths were centrifuged at 8000 rpm for 40 minutes. Suspended cell mass was removed while supernatant was used for Xanthan gum isolation. Three volume of chilled 96% alcohol was added to the supernatant solution. After sometime, Xanthan gum was precipitated and settled down. This precipitated gum was left in an oven at 50^{o}C. Finally the powder of Xanthan gum was obtained.

Viscosity of broth (Standard and Isolate): Viscosity of broth was measure on Brookfield viscometer. Readings were taken and then plotted the graph.

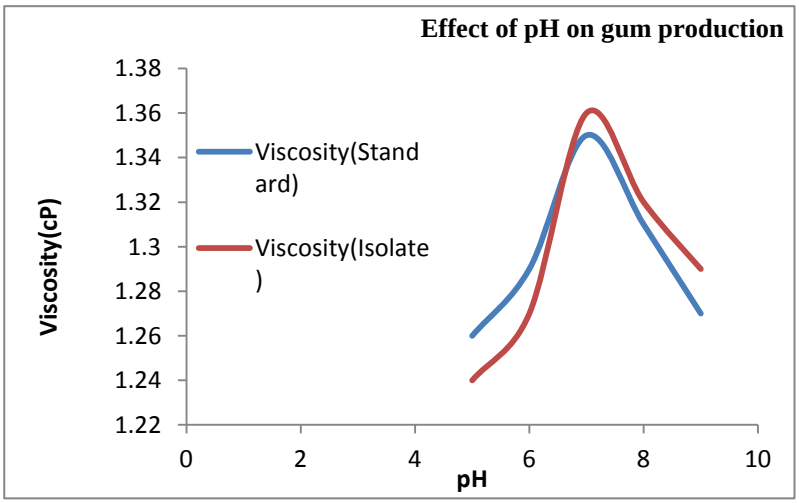
RESULTS & DISCUSSIONS:

 ISBN: 978-93-84663-07-0

A yellow mucoid *Xanthomonas* bacterium was successfully isolated from infected cabbage leaves sample and it was confirmed by various colony characteristics as given below:

Sr. No.	Characteristics	Standard	Isolate
1	Size	3 mm	3-4 mm
2	Shape	Circular	Circular
3	Margin	Entire	Entire
4	Opacity	Opaque	Opaque
5	Colour	Yellowish	Yellowish
6	Elevation	Convex	Convex
7	Surface	Smooth	Smooth
8	Gram Character	Gram negative	Gram negative
9	Motility	Motile	Motile
10	Consistency	Mucoid	Mucoid
11	Capsule	Present	Present

For confirmations, some biochemical s tests were also performed which revealed that, *Xanthomonas* have gelatin hydrolysis, starch utilization abilities and it also possess catalase positive property.



Optimization of parameters for Production of Xanthan gum:
Effect of pH on production:

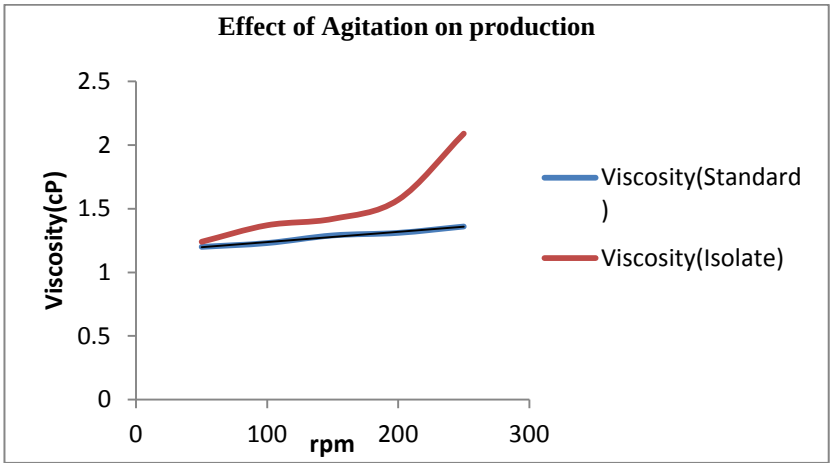
pH	Viscosity (Standard)	Viscosity (Isolate)
5	1.26	1.24
6	1.29	1.27
7	**1.35**	**1.36**
8	1.31	1.32
9	1.27	1.29

When flasks were incubated at 28°C for 6 days, after incubation period the Xanthan gum yield was measured in terms of viscosity for each flask and it revealed that optimum pH for optimum gum production was 7.

 ISBN: 978-93-84663-07-0

Effect of Agitation on production:

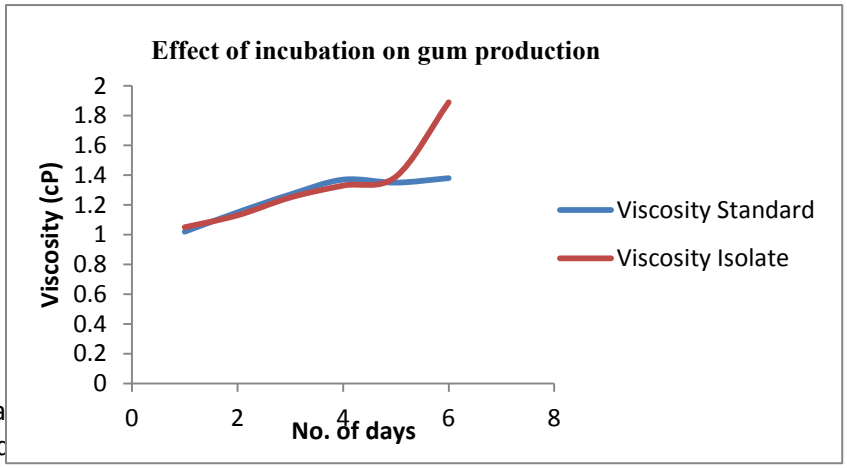
rpm	Viscosity (Standard)	Viscosity (Isolate)
50	1.2	1.24
100	1.23	1.37
150	1.29	1.42
200	1.31	1.57
250	**1.36**	**2.09**



When flasks were incubated at 28°C for 6 days at different agitation speed viz. 50, 100, 150, 200 and 250 rpm, after incubation period the Xanthan gum yield was measured in terms of viscosity for each flask and it revealed that optimum agitation for optimum gum production was 250 rpm.

Effect of time duration/incubation on production:

Days	Viscosity (Standard)	Viscosity (Isolate)
1	1.02	1.05
2	1.15	1.13
3	1.27	1.25
4	1.37	1.33
5	1.35	1.39
6	**1.38**	**1.89**



When flasks were incubated at 28°C
measured in terms of viscosity for ea
incubation time for optimum gum proc
After the optimization, again the yield of Xanthan gum was measured. The isolate shows yield of Xanthan gum 6.5 gm/lit (initially), even 6.9 gm/lit after optimization while standard shows less yield 6.1 gm/lit.

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BIODIVERSITY AND FIELD REPORT OF SNAKES OF AMBEGION, JUNNAR AND KHED TEHSIL INCLUDING BHIMASHANKAR FOREST

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ABSTRACT

Western Ghats are well-known biodiversity hotspot. The Western Ghats have unique ecosystem and biodiversity with large number of threatened and endemic species of animals and plants. Bhimashankar Wildlife Sanctuary covering area 130.78sq. k. m. was notified sensitive area by the state government of Maharashtra in 1985, under the Wildlife Protection Act 1972. Sanctuary is home to the state animal of Maharashtra popularly known as "Shekaru" *Ratufa indica elphistonii*, sub species of the Indian Giant squirrel that is one of three threatened Indo-Malayan squirrel species. The snake population of this region is rich. Narodi village of Ambegaon Tehsil from this region was found heavily occupied by cobra since 2007. Survey study of snakes have been carried out during 2009 to 2011 from Ambegaon, Junner and Khed Tehsils by the team of snake lovers and NGOs. A checklist of observed and released in to the forest and then snakes were recorded and documented including 21 species from six families.

Key words: Bhimashankar forest, limbless lizard, Poisonous snakes, Western Ghats.

INTRODUCTION:

Western Ghats are well-known biodiversity hotspot. The Western Ghats are a range of hills which were once covered with extensive forest all along the length from the Dangs in Gujarat to the southern part of Kerala. The Northern Western Ghats extend across the three states of Gujarat, Maharashtra and Goa. The western Ghats have unique ecosystem and biodiversity with large number of threatened and endemic species of animals and plants. Bhimashankar Wildlife Sanctuary covering area 130.78sq. km. was notified sensitive area by the state government of Maharashtra in 1985, under the Wildlife Protection Act 1972. The sanctuary is situated on the crest of north Western Ghats that is recognized as one of the 12-biodiversity hotspots of the world. Bhimashankar wild life sanctuary harbours large diversity of endemic & particular flora and fauna. Sanctuary is home to the state animal of Maharashtra popularly known as "Shekaru" *Ratufa indica elphistonii*, subspecies of the Indian Giant squirrel that is one of three threatened Indo-Malayan squirrel species. The snake population of this region is notified. Snakes are symbols of healthy environment performing the role predator in nature. These are fascinating, amazing creatures of limbless reptiles. There are few reasons why snakes are becoming endangered namely the venom they posses (Hudson and Wiokra Maratha 2006) and the misbelieve about snakes. Narodi village of Ambegaon Tehasil from this region was found heavily occupied by cobra since 2007. Survey study of snakes have been carried out during 2009 to 2011 from Ambegaon, Junner and Khed Tehasils by the team of snake lovers and NGos. A check list of observed and rescued snakes was recorded including 21 species from six families.

MATERIALS AND METHODS:

Snake lover team of ten person and two authors started snake survey as a part of UGC minor research project during 2009 to 2011 in Ambegaon, Junner and Khed Tehasils. The natural habitat of the snake from this region is disturbed due deforestation and agriculture in Bhimashankar and other region. Therefore snakes are easily observed in residential area. Snake lovers are experts in catching and we rescue the

snakes and release them in the forest with prier permission of Forest Department after the observation, study and photography. The snakes are catches scientifically with aluminum hooked snake catching sticks (Whitakar 1970). All are provided with field dairy in which they note all the information about snake i.e. length, colour and others including egg laying behavour. We all were connected with facebook and Email on mobile. Every day from different area phone calls of farmers and residents about occurrence of snake in the house, shops, cow shed etc were attend by us and possibly rescuer reaches as early as possible at that site. This service was free of charge. The all information about snake was shared via face book which certainly helpful for identification of Snakes and its rescue.

RESULT AND DISCUSSION

During study period 1234 snakes were rescued from the study region. It was observed that there was large population of Indian cobra in Ambegaon Tehasil. All the live snakes after observation and study are released in forest according to guide lines of forest department.21 species of snakes from 6 families were found to occur in study area. (Table 1)

Table: 1 Snakes of study area.

Sr. No.	Family& Common Name	Scientific Name of Snake	Max. Length of Snake (cm)	Status
	Elapidae			
1	Common Indian Krait	*Bungarus caeruleus*	*158*	Common
2	Indian Cobra	*Naja naja*	*177*	More common
	Pythonidae			
1	Mountain Rock Python	*Python molurus molurus*	*300*	Rare
	Viperidae			
1	Saw-scaled Viper	*Echis carinatus*	*28*	Uncommon
2	Russells Viper	*Dabola husseli*	*132*	Common
	Typhlopidae			
1	Common Worm Snake	*Ramphotyphlops braminus*	*13*	Common
	Boidae			
1	Common Sand Boa	*Eryx conicus*	*75*	Common
2	Red Sand (Johns Earth)Boa	*Eryx johnii*	*50*	Rare
	Colubridae			
1	Cat Snakes	*Boiga trigonata*	*78*	Common.
2	Forstens Cat Snake	*Boiga forsteni*	*145*	Common
3	Banded Racer	*Argyrogena fasciolata*	*87*	Common
4	Common Vine Snake	*Ahaetulla nasuta*	*78*	Rare
5	Common Kukri Snake	*Oligodon amensis*	*32*	Common
6	Common Fox Snakes	*Lycodon aulicus*	*50*	Common
7	Russells Kukri Snake	*Oligodon taeniolatus*	*32*	Rare
8	Green Keel Back	*Macropisthodon plumbicolor*	*50*	Common
9	Striped Keel Back	*Amphiesma stolatum*	*45*	Uncommon
10	Trinkat Snake	*Coelognathus helena helena*	*115*	Common
11	Common Rat Snake	*Ptyas mucosa*	*295*	Common
12	Common tree Snake	*Dendrelaphis tristis*	*67*	Rare
13	Montane Trinket Snake	*Coelognathus* Helena *monticollaris*	*63*	Rare

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The Sustainable Growth and Development of Indian Agriculture

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ABSTRACT

India has been witnessing a blinding pace of growth and development in recent times. There is talk of the country leapfrogging into the league of developed nations sooner than later. But this growth has raised concerns from sundry quarters as regards its basic texture and health. Experts are now calling for "sustainable development" and the term has gained currency in the last few years. In spite of fast growth in various sectors, agriculture remains the backbone of the Indian economy. Sustainability entails attaining equilibrium between the demand and supply of agriculture produce. The green revolution may bring the efficiency in agriculture produce and thus, the productivity increases. The ultimate performance of agriculture depends on the performance of various resources, the strategies and methods adopted. To face dryness due to the decrease in the rainfall, the agriculturist has to use the innovative strategies.

Keywords: Agriculture, Sustainable growth, Resources, Development, trends, economy, etc.

INTRODUCTION

Agriculture occupies the most important position in Indian economy, as it is one of the largest private enterprises in India, which continues to dominate the change in economy through its links of various sectors of production and markets. The role of agricultural sector in Indian economy can be seen through its contribution to GDP (Gross domestic Product) and employment. This sector also contributes significantly to sustainable economic development of the country. The sustainable agriculture development of any country depends upon the judicious mix of their available natural resources. In fact agriculture determine the fate of a country like India where about two-thirds of the population still lives in rural India with agriculture as its livelihood, in spite of the increasing urbanization that has been taking place since many decades. Therefore if agriculture goes wrong, it will be really bad for the economy as the falling of agricultural growth not only affects employment but GDP too (thus increasing poverty).The larger objective for the improvement of agriculture sector can be realized through rapid growth of agriculture which depends upon increasing the area of cultivation, cropping intensity and productivity. But for a country like India, increasing productivity is more important than the rest of the two. This is simply because of increasing urbanization, industrialization and the limited land size of the country. The productivity can be increased by two ways. First, increasing output by efficient utilization of available resources second, increasing output by variation of input. The first method is better with respect to productivity and sustainability. But due to increasing population, this method cannot provide a permanent solution. Thus we can go for the second method which may potentially cause environmental degradation in the economy and affect its sustainability. Therefore there is need to tackle the issues related to sustainable agriculture development.

SIGNIFICANCE OF THE STUDY

The basic purpose of this research paper is to study the growth and sustainability in agriculture sector. It also helps to explain the innovative strategies & achieving the growth in this sector.

RESEARCH METHODOLOGY

The prepared paper is a descriptive study in nature. The study has been carried out based on the collection of the relevant secondary data. Secondary data collection was based on various sources such as published books, articles published in different journals & news papers, periodicals, conference paper, working paper and websites, etc

OBJECTIVES

The objectives of study were based on:

6. To help to know conceptual development of agriculture growth.
7. To help to understand the Advantages of sustainable agriculture.
8. To help to understand the Economic Sustainability.
9. To help to understand the Issues & Challenges.
10. To help to understand Future Prospects and Solution for India.

MEANING & DEFINITION

Sustainable agriculture is the act of farming using principles of ecology, the study of relationships between organisms and their environment. Sustainable agriculture can be understood as an ecosystem approach to agriculture.

It has been defined as "an integrated system of plant and animal production practices having a site-specific application that will last over the long term" For Example:

- Satisfy human food and fibre needs.
- Enhance environmental quality and the natural resource base upon which the agricultural economy depends.
- Make the most efficient use of non-renewable resources and on-farm resources and integrate, where appropriate, natural biological cycles and controls.
- Sustain the economic viability of farm operations.
- Enhance the quality of life for farmers and society as a whole.

CONCEPTUAL DEVELOPMENT OF AGRICULTURE GROWTH

Since 2000, there has been strong progress in the agricultural sector (which includes crops, livestock, forestry, aquaculture and fisheries) overall agricultural growth has averaged 4 percent a year.

This is partly due to policy reforms including ongoing impacts of allocating land use rights to individuals, and the result of market-based incentives such as higher prices for crops. The agriculture performance linkages with rural poverty and household nutrition, supply response and investments in agriculture, performance and potential of rain fed agriculture, efficiency in Indian edible oilseed sector, progress and potential of horticulture, linkages between urban consumption and rural nonfarm employment and agriculture income, subsidies and investment in livestock sector, post harvest management of fish, and cooperative credit.

ADVANTAGES OF SUSTAINABLE AGRICULTURE OVER TRADITIONAL PRACTICES

- **Soil Fertility:** Continuous fall in soil fertility is one of the major problems in many parts of India. Sustainable agriculture improves fertility and soil structure.
- **Water:** Irrigation is the biggest consumer of fresh water, and fertilizer and pesticides contaminate both surface and ground water. Sustainable agriculture increase the organic matter content of the top soil, thus raising its ability to retain and store water that falls as rain.
- **Biodiversity:** Sustainable agriculture practices involve mixed cropping, thus increasing the diversity of crops produced and raising the diversity of insects and other animals and plants in and around the fields.
- **Health & Pollution:** Chemicals, pesticides and fertilizers badly affect the local ecology as well as the population. Indiscriminate use of pesticides, improper storage etc. may lead to health problems. Sustainable agriculture reduces the use of hazardous chemical and control pests.

- **Land use Pattern:** Over-exploitation of land causes erosion, land slides and flooding clogs irrigation channels and reduces the arability of the land. Sustainable agriculture avoids these problems by improving productivity, conserving the soil etc.

Climate: Conventional agriculture contributes to the production of green house gases in various ways like reducing the amount of carbon stored in the soil and in vegetation, through the

- production of Methane in irrigated field and production of artificial fertilizers etc. By adopting sustainable agriculture system, one can easily overcome this problem.

ECONOMIC SUSTAINABILITY

For agriculture to be sustainable it should be economically viable over the long term. Conventional agriculture involves more economic risk than sustainable agriculture in the long term. Sometimes governments are inclined to view export-oriented production systems as more important than supply domestic demands. This is not right. Focusing on exports alone involves hidden costs: in transport, in assuring local food security, etc. Policies should treat domestic demand and in particular food security as equally important to the visible trade balance.

It is a popular misconception that specific commodities promise high economic returns. But market production implies certain risks as markets are fickle and change quickly. Cheap foreign food may sweep into the national market, leaving Indian farmers without a market. As a World Trade Organization signatory, the Indian government is under pressure to deregulate and open its economy to the world market so it cannot protect its farmers behind tariff walls.

The main source of employment for rural people is farming. Trends towards specialization and mechanization may increase narrowly measured "efficiency", but they reduce employment on the land. The welfare costs of unemployment must be taken into account when designing national agricultural support programs. Sustainable agriculture, with its emphasis on small-scale, labour-intensive activities, helps overcome these problems.

ISSUES & CHALLENGES

The central issue in agricultural development is the necessity to improve productivity, generate employment and provide a source of income to the poor segments of population. Studies by FAO have shown that small farms in developing countries contribute around 30-35% to the total agricultural output.

The pace of adoption of modern technology in India is slow and the farming practices are too haphazard and unscientific. Some of the basic issues for development of Indian agriculture sector are revitalization of cooperative institutions, improving rural credits, research, human resource development, trade and export promotion, land reforms and education.

FUTURE PROSPECTS AND SOLUTION FOR INDIA

Agriculture sector is an important contributor to the Indian economy around which socio-economic privileges and deprivations revolve and any change in its structure is likely to have a corresponding impact on the existing pattern of social equity. Sustainable agricultural production depends upon the efficient use of soil, water, livestock, plant genetics, forest, climate, rainfall and topology. Indian agriculture faces resource constraints, infrastructural constraints, institutional constraints, technological constraints and policy induced limitations.

Sustainable development is the management and conservation of the natural resource base and the orientation of technological and institutional change in such a manner as to ensure the attainment and continued satisfaction of human needs for the present and future generations. Such sustainable development (in the agriculture, forestry and fisheries sector) conserves land, water, plant and animal genetic resources, is environmentally non-degrading, technically appropriate, economically viable and socially acceptable. So, to achieve sustainable agriculture development the optimum use of natural resources, human resources, capital resources and technical resources are required.

In India the crop yield is heavily dependent on rain which is the main reason for the declining growth rate of agriculture sector. These uncertainties hit the small farmers and labours worst which are usually leading a hand to mouth life. Therefore something must be done to support farmers and sufficient

amount of water and electricity must be supplied to them as they feel insecure and continue to die of drought, flood, and fire. India is the second largest country of the world in terms of population; it should realize it is a great resource for the country. India has a huge number of idle people. There is a need to find ways to explore their talent and make the numbers contribute towards the growth. Especially in agriculture passive unemployment can be noticed.

The sustainable development in India can also be achieved by full utilization of human resources .A large part of poor population of the country is engaged in agriculture, unless we increase their living standard, overall growth of this country is not possible. If we keep ignoring the poor, this disparity will keep on increasing between classes. Debt traps in country are forcing farmers to commit suicides. People are migrating towards city with the hope of better livelihood but it is also increasing the slum population in cities. Therefore rural population must be given employment in their areas and a chance to prosper. India has been carrying the tag of "developing" country for quite long now; for making the move towards "developed" countries we must shed this huge dependence on agriculture sector.

CONCLUSION

The growth and development in the agriculture is achieved by Green Revolution. It is the need of the tense to maintain the resources and to respond the climate change. The conservation of water resources is required to be focused. To face the difficulties in summer and the decrement in the rain fall, it is important to save a single drop of water, for this one of the strategies that to pour the water collected by the roof in the land, other strategies may be dividing land in to several other parts to match the demand and supply for food grains and the vegetables.

The agricultural technology needs to move from production oriented to profit oriented sustainable farming. The conditions for development of sustainable agriculture are becoming more and more favourable. New opportunities are opening the eyes of farmers, development workers, researchers and policy makers like agric related businesses, dairy farming, poultry farming castle farming and fisheries. Now the time is to see the potential and importance of these practices not only for their economic interest but also as the basis for further intensification and ecological sustainability. To conclude, a small-farm management to improve productivity, profitability and sustainability of the farming system will go a long way to ensure all round sustainability.

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Environment and Energy

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ABSTRACT

The universe is made up to matter number of different energy can found in a number of different form. It can be chemical energy, electrical energy, heat (thermal energy light energy radiant) mechanical energy, nuclear energy "Energy is the Ability to do work" Energy has a few important properties for one energy is always conserved" it cannot be created or destroyed. Energy use and supply is of fundamental importance to society with the possible exception of agriculture & forestry, has made the greatest impact on the environment of any human activity a result of the large scales pervasive nature of energy related to activities. All though energy and environment concerns were originally local in character for ex. Problems associated with extraction transport emission they have now widened to cover regional and global issues such as acid raid, global warming, ozone deflection and solid west management. Such problem has now become major political issues and the subject of international debate and regulation. It is for this reason that there is a need for awareness or dedicated to energy and environmental issues.

The environmental studies have to incorporate the natural hazards as the significant attribute because at local level the interaction between the physical and human elements does influence the environment of the region or the locality.

The impact of energy usage on the environment can be evaluated at the 3 stages.

1. The preventive stage prior to consumption.
2. The act of consumption itself and
3. The after match of consumption.

Key Words: Environment, Energy resources, Renewable Energy, Energy Conservation

INTRODUCTION

An energy resource, Energy is needed by all living organism and vegetation for biochemical reaction of their cells. It is a power which is needed in one form or other for work done long before most of the power available to human society was limited to solar energy trapped by green plants which produce organic matter. Biological oxidation of the organic matter provided fuel muscle power. The fire was the first form of known energy used for cooking heating purposes the formation of fossil fuels oil, coal natural gas is also due to photosynthesis carried on by plants which occurred million of years ago. Now the things are changed drastically. Energy consumption of a nation is usually considering an index of its development.

India is a fast growing developing economy with the GDP growth rate exceeding 6% in recent years X^{th} plan projected 8% growth rate.

All energy sources have some impact on our environment fossil fuels-coal, oil and natural gas do substantially more harm than renewable energy sources by most measures including air and water pollution damage to public health, wildlife and habitat loss, water use land use and global emissions.

The movement of wind and water the heat & light of the sun, the carbohydrates in plants & the warmth in the Earth all are energy sources that can supply our needs in a sustainable way. A variety of methods are used to convert these renewable resources into electricity. Each comes with its own unique set of technology benefits, and challenges.

OBJECTIVE

1. To know energy conservation and environmental problem.
2. To understand the interaction of energy forms and system with the physical environment.

3. To cover the social economic and political dimension.

METHODOLOGY

The present papers study based on secondary sources of data collecting of various articles, journals, website, newspapers and reference books etc.

DISCUSSION:

With the increase in population & with the multiplicity of wants the world demands greater and more efficient production of goods & services, so as to bring material welfare of the people quick efficient and large scale production at a reasonable cost requires greater use of cheep power.

There is no doubt that social & economic development of any country has a direct co-relation with the increase in the consumption of energy up to now, the growing demand of energy in a developing country like ours is being met mainly by burning the fossil fuels. How ever it is being mint mainly a part from these fuels being non renewable, there are other drawbacks associated with their extensive use such as the green house effect due to generation of carbon dioxide particulate emission during coal combustion, heavy infrastructural costs of production & transportation of these fossil fuels.

This consideration has led to the attention being focused on alternative, renewable, pollution free energy resources.

India is particularly fortunate in this respect since it happens to be located in the equatorial sun belt of the earth, thereby receiving abundant radiant energy from the sun. By a happy coincidence large dream in the country mostly in India suitable location for power generation through solar, wind & bio-energy.

Wind is an important renewable source in of energy in India, in which power of wind is converted into mechanical & electrical energy through scientific methods.

Wind speed varies from place to place & also with the time of day and with the season hence power output also varies accordingly. The average normally increases with the height above the ground. Each time height above the ground is doubled (10 to 20 m) the wind speed increase by at least 10% this increase the available power by 30%.

Sites within the range of 6.5 m to 8 m from m.s. / higher are excellent location for wind power generation. The wind as power resources can be studies by obtaining information regarding (a) monthly wind speed which help us to estimate the monthly power availability in an area & it will also help to select a suitable device in that area (b) frequency distribution of wind speed (% of time duration the wind blows at a given velocity) . These data provide an estimation of potential power & help identify the best location for a wind energy system.

Power Generation capacity in India Total installed Power generation Capacity (June 2014)

SOURCE	Total capacity (MW)	Percentage
Coal	148,478.39	59.51
Hydroelectricity	40,730.09	16.33
Renewable energy source	40,730.09	12.70
Natural Gas	22,607.95	9.06
Nuclear	4780	1.92
Oil	1,199.75	0.48
Total	**249,488.32**	

Source: GWEC/Green peace India (2014)

 ISBN: 978-93-84663-07-0

Power Generation capacity Sector wise in India

Sector	Total Capacity (MW)	Percentage
State Sector	93,540.7	37.49
Central Sector	68,324.63	27.38
Private Sector	87,622.99	35.13
Total	**249,488.32**	**100%**

Energy conservation

Energy conservation has emerged as a major policy objective, and the Energy Conservation Act 2001 was passed by the Indian Parliament in September 2001, 35.5% of the population still lives without access to electricity. This Act requires large energy consumers to adhere to energy consumption norms; new buildings to follow the Energy Conservation Building Code; and appliances to meet energy performance standards and to display energy consumption labels. The Act also created the Bureau of Energy Efficiency to implement the provisions of the Act.

Energy Consumption in the world

Energy Source	Consumption	Percentage
Oil	21678.10^6 boords	34.2
Coal	4765.10^6 tans	30.2
Ceas	1923.109 cbm	19.1
Nuclear	1670TWH	5.0
Hydropower	2050 TWH	6.1
Wood/biomais	1219.10^6 tans	5.3
Wind	3TWH	1.10^{-2}
Solar	0.1 twh	1.10^{-3}
Geo-thermal energy	76TWH	0.1

Wind Speed Ranges

REDA has classified 4 range of wind speed which is to be considered during the process of power generation.

1. **Less than 8 km/h: -** In such circumstances wind machine will rotate, but would not generate and power.
2. **8 to 18 km/h:** It stands for average potentiality to produce mechanical power. But here the potentially will vary according to the wind speed.
3. **18-30 km/h:** Is the best condition regarding electrical power generation & in such velocity power output remains usually constant.
4. **More than 30 km/h:** This range of speed in rather harmful as many a time wind machine gets totally shut down.

ENVIRONMENTAL IMPACT

Wind is a clean energy sources. It produces no air/water pollution because no fuels are burned to generate electricity. The most serious environment impact from wind energy may be its effect on bird & bat mortality. Wing turbine design has changed dramatically in the last couple of decades to reduce this impact Turbine bladders are now solid, so there are no lattice structures that entice birds to perch also the blades surface area is much larger, so they don't have to spin as fast to generate power slower-moving blades mean fewer bird collisions.

 ISBN: 978-93-84663-07-0

Energy Security

One of the main drivers for adoption of bio diesel is energy security. This means that a nation's dependence on or is reduces, substituted with use to locally available sources such as coal gas/renewable sources. Thus a country can benefit from adoption of bio fuels, without a reduction in green house gas emission. While the total energy balance is debated it is clear that the dependence on oil is reduces one example is the energy used to manufacture fertilizers which could come from variety of sources other than petroleum.

The us national renewal energy laboratory (NRE 1) Status that energy security is the number one driving force behind the us bio fuels programmed and a white house. An "Energy security for the 21st century" paper makes clear that energy security is a major reason for programming bio diesel. The EU commission president Jose Manuel Barroso, Speaking at a recent EU Bio fuels have the conference stressed that the EU's security of supply though diversification of energy Sources. The surge of interest in bio diesel has highlighted a no of environment effects associated with its use. These potentially include reduction in green house gas emissions deforestation pollution & the rate of bio degradation according to the EPA's renewal fuel standards programmed regulatory, Impact analysis released in Feb.2010, bio diesel from soy oil results on average in a 57% reduction in green house gases compared to fossil diesel, and bio diesels produced from waste grease results in an 86% reduction.

Energy Policy act of (2005)

The energy policy Act of 2005(Pub.L.109-58) is a bill passed by the united states congress on July 29, 2005 & signed into law by president George W Bush on August 8, 2005, at Sandia National Laboratories in Albuquerque, New Mexico the act described by proponents as an attempt to content growing energy problems changed us energy policy by providing tax incentives & load guarantees for energy production of various types.

CONCLUSION:

Renewable Energy is reliable, Affordable & beneficial for our health our economy and our environment. By increasing renewable energy, we can. Reduce Air pollution, Cut global warming emissions, Create new jobs & industries, Diversify our power supply, Decrease dependence on coal & other fossil fuels, Move India toward a cleaner, health their energy future.

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Numerical Investigation of Solar Chimney Induced Natural Convection in Room at Different Window Positions

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Abstract

Ventilation is very important to remove indoor air contaminants and to maintain fresh air level in the room. Solar chimney is the passive way of obtaining the natural convection by using the stack effect. In the present study solar chimney concept is used for improving natural convection.2-D and 3-D room models were studied numerically with the help of ANSYS-FLUENT software. Detailed inner air flow pattern was studied for the room domain. This would help to optimize the design parameters. 2-D results were compared with the available published data. There was acceptable trend match between present results and published results. The simulation for windows at upper, middle and lower position is carried out. Results showed that windows at middle position give the proper air stream lines throughout the room domain.

Keywords: Solar chimney, Natural convection, stack effect.

Introduction

Outdoor air quality is generally better than indoor air quality due to the pollutants and contaminants present in the room. The concentration of pollutant released due to the equipments and materials or by the physiological processes of occupants. Ventilation is the intentional supply of fresh outdoor air to a space to dilute and remove indoor air contaminants. Natural ventilation occurs due to two causes: Firstly due to aero motive or wind driving force: which occurs due to pressure gradient in the environment, secondly due to buoyancy driving force (stack effect) which occurs due to temperature difference between indoor and outdoor air temperatures. Use of solar energy can create such a large temperature difference, and hence improve the stack effect for space natural ventilation.

Solar chimney consists of absorber, transparent cover (glass), apertures (inlet and outlet). During the day solar energy heats the chimney and the air within it, creating an updraft of air in the chimney. The suction created at the chimney's base can be used to ventilate and cool the building below. In most parts of the world it is easier to harness wind power for such ventilation as with a wind catcher, but on hot windless days a solar chimney can provide ventilation where otherwise there would be none.

Mathur et al. did theoretical and experimental study to evaluate the possibility of making use of solar radiation to induce room ventilation in hot climates. They found out that air flow increases linearly with the increase in solar radiation or the air gap between absorber and the glass cover. Z.D. Chen et al carried out experiments using an experimental solar chimney model with uniform heat flux on one chimney wall with a variable chimney gap-to-height ratio between 1:15 and 2:5 and different heat % expand inclination angles. Results showed that the air flow rate reached a maximum at a chimney inclination angle of around 45◦ for a 200 mm gap and 1.5 m high chimney, which is about 45% higher than that for a vertical chimney under otherwise identical conditions. Sompop Punyasompun et al. They investigated performance of solar chimney for prototype of 3 storey building. They compared 2 designs first design 3 inlets and 3 outlets and second design 3 inlets with single outlet at top and found the second design gives best results. Ramdan Bassiouny et al. studied Solar Chimney concept for improving room natural ventilation analytically and numerically. It was noticed that the chimney width has a more significant effect on ACH compared to the

chimney inlet size. They concluded that increasing the inlet size three times only improved the ACH by almost 11%. However, increasing the chimney width by a factor of three improved the ACH by almost 25%, keeping the inlet size fixed. Rmdan Bassiouny et al. investigated the effect of chimney inclination angle on air change per hour and indoor flow pattern numerically and analytically. A numerical simulation using Ansys, a FEM-based code, was used to predict flow pattern. The analytical results showed that an optimum air flow rate value was achieved when the chimney inclination is between (degrees) 45 and 70 for latitude of 28.4. Wenting Ding et al. made a prototype of an eight storey building (1/25 th of actual dimensions) and compared the experimental results with CFD results. The numerical simulations for this research are done using a general three-dimensional computational fluid dynamics model. To ensure preferable airflow through the top floor, opening areas between outside and the atrium are recommended to be not less than 16 m2 (2 m2 each floor). J. Arce et al. investigated thermal performance of solar chimney experimentally and validated results numerically .The results show that for a maximum irradiance of 604 W/m2, occurring around 13:00 h on September 15th, 2007, a maximum air temperature increment of 7 _C was obtained through the solar chimney. Also, a volumetric air flow rate ranging from 50 to 374 m3/h was measured on that day. Karima E. Amori investigated heat transfer and fluid flow in solar chimney numerically as well experimentally. Solar chimney was designed, manufactured and tested by selecting different positions of air entrance namely: bottom entrance, side entrance, and both side and bottom entrances.

From above literature we can conclude that a lot of studies are done on solar chimney experimentally and numerically as well. Different geometrical aspects of solar chimney greatly affect the mass flow rate of air through the room. Solar chimney inclination also affects the mass flow rate. They got better results for inclined solar chimney. As the heat flux is increased the mass flow rate is increasing accordingly.

Previous available studies have not shown the detailed inner space flow pattern in 3-D room through computational simulation. Further for better air distribution window positions of room have to be studied.

Objective

The objective of the present study is to numerically investigate and study the natural convection through the solar chimney. In that first objective is to validate the results with the published data. The project aims at to study detailed air inner space flow pattern for windows at upper, middle and lower position in the room.

Problem definition

In the present paper problem is consists of two cases.

Case (I): A 2-D model of room with inclined solar chimney. This 2-D room is considered with dimensions 3m by 3m. Solar chimney with 1 m in length is inclined by 45 degrees. This model is studied for 500W to 750W heat flux.

Case (II): A 3-D model with vertical solar chimney. This 3-D model is 3m by 3m by 2m in dimension. Solar chimney is taken with length 3m, depth 0.5m and width 0.3m. This model is studied for windows at different positions.

Mathematical Modelling & Numerical Implementation

To analyze the natural convection through the room by using solar chimney as a passive way flow through room and chimney is considered laminar, incompressible and under steady state. Air inlet and outlet temperatures are at room temperature, other heat losses are neglected.

For the present problem governing equations are considered as follows:

MassEquattion:

$$\frac{\partial u}{\partial x}+\frac{\partial v}{\partial y}+\frac{\partial w}{\partial z}=0$$

Momentum Equation in Y direction:

$$u\frac{\partial v}{\partial x}+ v\frac{\partial u}{\partial y}+ w\frac{\partial u}{\partial z} = g\beta(T-T_\infty)+\mu\left[\frac{\partial^2 v}{\partial x^2}+\frac{\partial^2 v}{\partial y^2}+\frac{\partial^2 v}{\partial z^2}\right]$$

It includes 'Thermal buoyancy term' to take care of stack effect.

Energy Conservation:

$$\rho C_p\left(u\frac{\partial T}{\partial x}+ v\frac{\partial T}{\partial y}+ w\frac{\partial T}{\partial z}\right)= k\left[\frac{\partial^2 T}{\partial y^2}+\frac{\partial^2 T}{\partial z^2}+\frac{\partial^2 T}{\partial z^2}\right]$$

Room windows are taken as inlet for the domain where as solar chimney upper cross section is taken as outlet. Absorber wall has been given a constant heat flux 'q'. And rest other walls are kept adiabatic.
For the present studies 2-D and 3-D solid models are designed as shown:

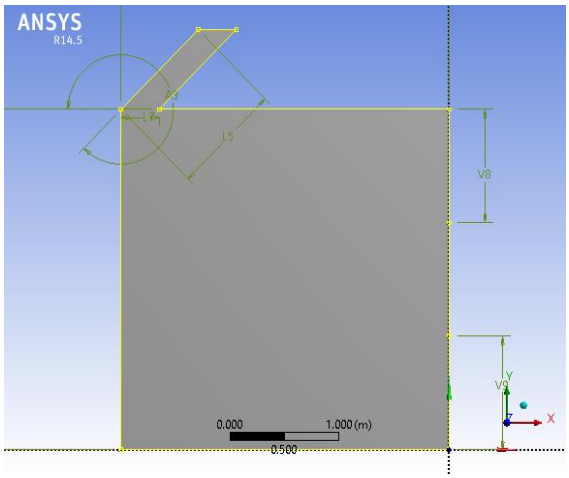

Fig 4.1 2-D solid model with inclined solar chimney.

In this 2-D model solar chimney is inclined by 45 degrees with horizontal.
Chimney considered for the 3-D model is vertical at middle position of the room.

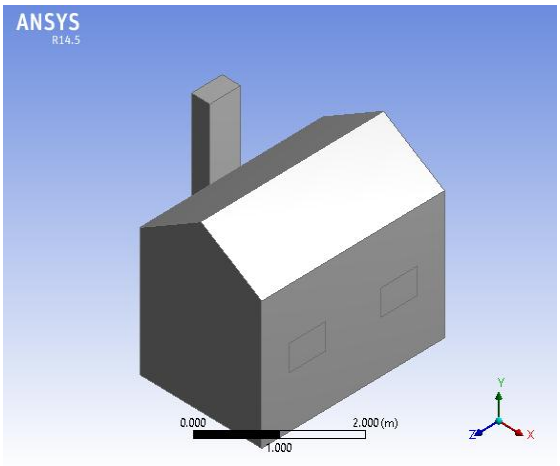

Fig. 4.2 3-D model with vertical chimney

Numerical implementation: The above 2-D and 3-D models are meshed in Ansys workbench meshing software. For 2-D vey fine mesh was done so that low velocity of air can be captured perfectly. For 3-D model advanced size function was kept on for proximity and curvature which fines mesh at corners and curvatures and coarser mesh on plane surfaces. No of elements for 2-D model are 7602 where as no of elements for 3-D model are 160400.

Pressure based solver is used to solve the present problem. Model Viscous lamina is taken. For the operating condition operating pressure is taken as atmosphere pressure and variable density parameter is

considered with acceleration in negative Y direction. For solution method simple scheme is used with pressure as 'body forced method'.

Results and discussions:

Case (I) 2-D model Results:

As we go on increasing the heat flux mass flow rate through the room increases. As heat flux is increased temperature of absorber plate increases which increases the density difference of air. Hence buoyancy force increases which enhances the mass flow rate through the room domain. These mass flow rates are compared and validated with the previous paper [Energy and Buildings 41 (2009) 190-196 by Ramdan Bassiouny et al.2008]

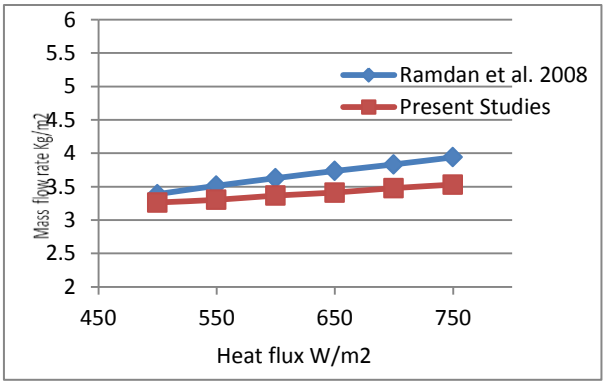

Fig. 5.1graph mass flow rate Vs. Heat flux.

Present results were compared with the previous results from the paper Ramdan Bassiouny et al.2008. Present study results are in good agreement with the mentioned paper maximum result variation was found to be around 10.3%.

Air distribution through the room is in the direction of less air density area. Air streamlines through the room domain for the simulation of heat flux 500 W/sq.ms as shown in the given figure. As we can observe that air is directed through the inclined solar chimney and it is having more number of stream lines of air in the solar chimney direction. Velocity of stream lines is increasing in the solar chimney area as buoyancy effect is much dominant in that region.

Fig. 5.2 Air streamlines for heat flux 500W/sq,m

Case (II) 3-D model Results:

Results for windows at different positions in the room.

Results are obtained by keeping the room windows at upper, middle and lower position. Different quantities were studied for three cases which gave the following results:

Table 5.1 Results for windows at different positions.

Windows Position	Mass flow rate (Kg/min)	Volume flow rate (m3/min)	Average exit velocity. (m/s)
Upper	4.38	3.88	0.44
Middle	4.49	3.94	0.44
Lower	4.59	3.99	0.44

Above table shows that the when windows are at different positions mass flow rate and volume flow rate through the room domain are almost equal. There is no change in average exit velocity through the solar chimney. Hence for selecting the ideal window position for the room inner flow pattern of the room is studied which are shown:

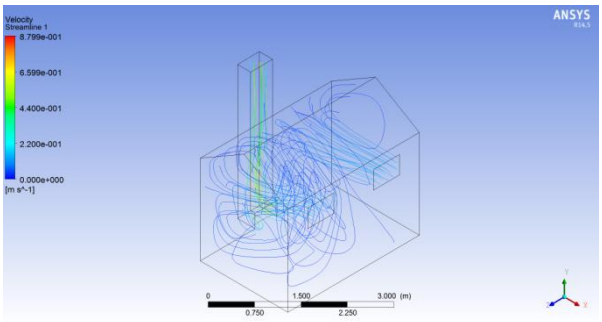

Fig 5.3 Air streamlines for windows at upper position

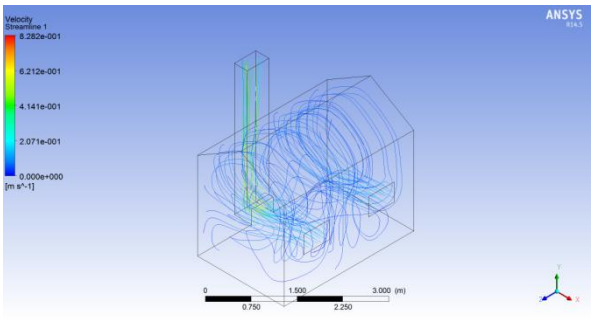

Fig 5.4 Air streamlines for windows at middle position

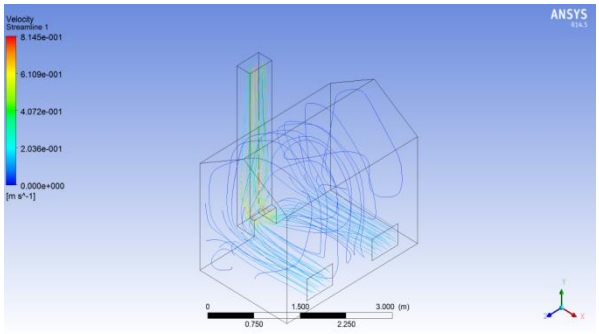

Fig5.5 Air streamlines for windows at upper position

Air streamlines for upper window position doesn't cover whole room domain where as windows at lower position shows that air escapes from the chimney without being circulated. As compared with them middle windows shows proper air stream lines covering the whole room domain. When windows are kept at middle position air streamlines are covering the whole room domain.

CONCLUSIONS

- From 2-D results we can conclude that as solar flux is increase mass flow rate is increased and which gives more natural convection through the room domain.
- From 3-D results windows at middle gives better air distribution in the room domain as it covers the whole room domain.
- Further studies are required for optimisation of design parameters for solar chimney.

This passive of natural convection is very useful and these solar chimneys can be used to enhance natural convection in grain storage godowns, green buildings, car parking areas, etc

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Use of Solar Thermal Energy in India

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ABSTRACT

There is no doubt that *Renewables* have to play an important role in the future energy system of the world. And, Solar Heat has the potential for a high contribution to the future energy supply. The sun is the source of the vast majority of the energy we use on earth. Most of the energy we use has undergone various transformations before it is finally utilized, but it is also possible to tap this source of solar energy as it arrives on the earth's surface. Today, solar thermal systems are regarded as a well-established, low-tech technology with an enormous potential for energy production in the low- to medium temperature range, all over the world - cold climates to hot climates. Key reasons for the utilization of solar heat are: The energy need for heating and cooling, for crop drying and for process heating is large and growing; the solar resource is large and inexhaustible; the environmental benefits and the economic benefits are substantial. Therefore, solar thermal technologies are essential components of a sustainable energy future. Solar heat can cover a substantial part of the energy use in a cost effective and sustainable way. Any long term vision for economic development must include solar thermal technologies, to save finite energy sources and to build up an industry of strategic importance. For the country like India it is of great significance. Necessary is the willingness for the transition from fossil fuels to renewable sources and therefore also to solar heat.

KEYWORDS: Renewable or Renewable Energy, Solar Thermal Energy, Future Sustainable Energy System, Solar Thermal Energy.

INTRODUCTION:

The sun is the source of the vast majority of the energy we use on earth. Most of the energy we use has undergone various transformations before it is finally utilized, but it is also possible to tap this source of energy as it arrives on the earth's surface. There are many applications for the direct use of solar thermal energy which mainly includes space heating and cooling, water heating, crop drying and solar cooking. It is a technology which is well understood and widely used in many countries throughout the world. Most of the solar thermal technologies have been in existence in one form or another for centuries and have a well established manufacturing base in most sun-rich developed countries (J. Twidell et al., 1990; J. Rozi et. El., 1996; Ben Sills, 2011).

The most common use of solar thermal technology is for domestic water heating. A number of domestic hot water systems are in use throughout the world, where there is high solar insolation (the total energy per unit area received from the sun). It is a technology which is rapidly gaining acceptance as an energy saving measure in both domestic and commercial and other applications. Presently, domestic water heaters are found only amongst wealthier sections of the community in developing countries. Besides the water heating there are many possible use of solar thermal energy in developing countries like India. Most importantly commercialization of solar thermal energy on a large scale is necessary. The fact is that in the country like India the solar source for solar thermal systems is immense and inexhaustible. And the environmental and economic benefits are substantial. The ultimate aim of this writing is to make the applications and benefits of solar thermal energy more clear, understandable and known to all.

Figure 1: Solar Heat for Developing Countries

What is a Renewable Energy? Renewable energy flows involve natural phenomena such as sunlight, wind, tides, plant growth, and geothermal heat. As the International Energy Agency (IEA) explains: "Renewable energy is derived from natural processes that are replenished constantly". In its various forms, it derives directly from the sun, or from heat generated deep within the earth. Included in the definition are electricity and heat generated from solar, wind, ocean, hydropower, biomass, geothermal resources, bio-fuels and hydrogen derived from renewable resources (Garg H. P. et al., 1997).

Renewable Energy Alternatives: Renewable energy is generally defined as energy that comes from resources which are naturally replenished on a human timescale such as sunlight, wind, rain, tides, waves, geothermal heat etc. Renewable energy replaces conventional fuels in four distinct areas: electricity generation, hot water/space heating, motor fuels, and rural (off-grid) energy services.

Figure 1: Solar Heat for Developing Countries

At present a large number of renewable energies are made available in the hands of a human being. They are - Bio-fuel, Biomass, Geothermal, Hydropower, Solar energy, Tidal power, Wave power and Wind power. Amongst wind, solar, and biomass is the emerging one.

Other renewable energy technologies are still under development, and include cellulosic ethanol, hot-dry-rock geothermal power, and ocean energy. These technologies are not yet widely demonstrated or have limited commercialization. Many are on the horizon and may have potential comparable to other renewable energy technologies, but still depend on attracting sufficient attention and research, development and demonstration (RD&D) funding (REN21, 2012).

What is a Solar Thermal? Basically, Solar Thermal is one of the important renewable energy. "Solar Thermal" energy designate all technologies that collect solar rays and transform their energy into usable heat, either for directly satisfying heating needs (notably space heating, water heating and space cooling) or for producing electricity and fuels. The latter includes concentrating Collector, CPC-Collector, and Plastic/Synthetic Absorber (Werner Weiss, 2003). concepts such as solar updraft towers and ocean thermal energy (Garg H. P. et. Al., 1997). Use of Solar Thermal Energy in India: Possible key applications for solar thermal technologies are those that require low temperature heat, such as for swimming pools, for domestic hot water and space heating, drying processes, and process heat in the low to medium temperature range etc.

1) Solar Thermal Collectors: The component for the conversion of solar energy into heat is the solar thermal collector – either no concentrating or concentrating. For commercial applications, banks of collectors are used to provide larger quantities of hot water required. Many such systems are in use at hospitals in developing countries. Collector working temperatures are about 60°C to 80°C with a conversion-efficiency from 40 to 60 per cent can be achieved with flat-plate collectors. This type of collector is typically for hot water solar systems, the properties of this collector-type are well-known today and thus manufactured in many parts of the world. The major types of solar thermal collectors are - Advanced Flat-plate Collector, Concentrating Collector, Evacuated

Figure 2: Solar Thermal Systems in Operation in DCs

Hot Water and Space Heating, Thermo siphon Systems and District Heating

2) Solar Water Heating: Solar water heating, including pool heating, has been commercially available and can be considered a mature technology. Today, domestic hot water preparation with solar energy is standard in many countries. In the area of building renovation, solar hot water preparation is attractive to increase the efficiency of heating systems. Especially ineffective heating systems for hot water preparation outside the heating season have been replaced by solar hot water preparation. Thus pollutant emissions through heating (wood, coal, oil boilers) could be reduced and at the same time a high comfort in hot water preparation could be reached. Solar hot water preparation in high-performance houses is sensible. For hot water heating in transition-countries, such as China and India, and also in countries without space heating systems such as Greece, Cyprus, and Malta etc. direct-electricity is used. Large amount of electricity is necessary to meet the hot water requirements in domestic, institutional and commercial sectors. With solar hot water systems, the electricity demand as well as the peak load can be reduced remarkably (Werner Weiss, 2003).

3) Solar Cooking: Solar cooking is a technology which has been given a lot of attention in recent years in developing countries. The basic design is that of a box with a glass cover. The box is lined with insulation and a reflective surface is applied to concentrate the heat onto the
pots. The pots can be painted black to help with heat absorption. The solar radiation raises the temperature sufficiently to boil the contents in the pots. Cooking time is often a lot slower than conventional cooking stoves but there is no fuel cost. Many variations have been developed on this theme but the main restriction has been one of reducing costs sufficiently to permit widespread dissemination. The cooker also has limitations in terms of only being effective during hours of strong sunlight. There have been large, subsidized solar cooking stove dissemination programmes in the countries like India, Pakistan and China.

4) Solar Crop Drying: One of the most promising agricultural applications for active solar heating worldwide is the drying of agricultural products. Wood and conventional fossil fuels are used extensively, and in many countries more expensive diesel and propane fuels are replacing wood. Now, solar crop drying is commercially available for specific crops in specific locations. Controlled drying is required for various crops and products, such as grain, coffee, tobacco, fruits vegetables and fish. Their quality can be enhanced

if the drying is properly carried out. Solar thermal technology can be used to assist with the drying of such products. Large systems can use large barns while smaller systems may have a few trays in a small wooden housing. Solar crop drying technologies can help reduce environmental degradation caused by the use of fuel wood or fossil fuels for crop drying and can also help to reduce the costs associated with these fuels and hence the cost of the product. Helping to improve and protect crops also has beneficial effects on health and nutrition.

5) Solar Space Heating: In colder areas of the world including high altitude areas within the tropics space heating is often required during the winter months. Vast quantities of energy can be used to achieve this. Solar heating systems for combined domestic hot water preparation and space heating are similar to solar water heaters in that they use the same collectors and transport the produced heat to a storage device. There is, however, one major difference, the installed collector area is generally larger for Solar Combo-systems, and in addition, this system has at least two energy sources to supply heat: The solar collectors and the auxiliary energy source. The auxiliary energy sources can be biomass, gas, oil or electricity. This dual system makes Solar Combo-systems more complex than solar domestic hot water systems with the additional interactions of the extra subsystems. These interactions profoundly affect the overall performance of the solar part of the system. The active and passive solar space heating systems are available. One example of a simple passive space heating technology is the Trombe wall. This type of technology is useful in areas where the nights are cold but the days are warm and sunny. An active solar space heating compare to the solar water heating is relatively higher in costs. But in recent years, systems that combine water and space heating, called Solar Combo-systems, have emerged and show great promise for success in future.

6) Solar Space Cooling and Air-Refrigeration: The majority of the world's developing countries, however, lies within the tropics and have little need of space heating. There is a demand, however, for space cooling. The majority of the world's warm-climate cultures have again developed traditional, simple, elegant techniques for cooling their dwellings, often using effects promoted by passive solar phenomenon. There are many methods for minimizing heat gain. These include constructing a building in shade or near water, using vegetation or landscaping to direct wind into the building, good town planning to optimize the prevailing wind and available shade. There are as many options as there are people.

While active solar cooling was developed in the 1980s, it was never able to compete economically with conventional air conditioning systems. In recent years, advanced solar cooling systems coupled with changed market conditions, suggests that active solar cooling will soon enter the market in a significant way. Solar assisted air-conditioning of commercial buildings is a promising concept. The advantage of solar is that the demand for cooling coincides with the availability of high solar radiation.

7) Day-lighting: A simple and obvious use for solar energy is to provide light for use in buildings. Many modern buildings, office blocks and commercial premises for example, are designed in such a way that electric light has to be provided during the daytime to provide sufficient light for the activities taking place within. An obvious improvement would be to design buildings in such a way that the light of the sun can be used instead of electricity. The energy savings are significant and natural lighting is often preferred to artificial electric lighting. Day-lighting designs have matured to the point where they can provide significant economic benefits and are expected to gain increasing use in new commercial buildings. In offices, day-lighting applications alone can reduce electricity demand for lighting. The day-lighting systems allow for significant dimming of the lights resulting in energy savings ranging from 50% to 70% for the south and west facing windows.

8) Solar Process Heat: In factories, solar collectors used in different processes, such as cleaning, drying, sterilization and pasteurization, heating of productions halls, can lead to a large energy savings. The energy needed by commercial and industrial organizations in their production processes and to heat their factories can be covered by solar thermal collectors. The majority of the energy used by commercial and industrial organizations is below 250°C, a temperature range perfect for solar technologies. Continued development of high performance collectors and system components will improve the cost effectiveness of higher temperature applications.

9) Thermal Storage: A heating system needs thermal storage when there is a mismatch between energy supply and energy demand, e.g. when intermittent energy sources are utilized. The need for thermal storage in solar hot water systems is often short-term. In such instances, water is a very efficient storage medium. Water storages are sensible heat energy storage with the advantage of being relatively inexpensive but the energy density is low and decreases during the storage time. The hot water tank is one of the best known thermal energy storage technologies. The hot water tank serves to bridge sunless periods in the case of solar hot water and combined heating system, to increase the system efficiency in combination with co-generation systems, and to minimize the electricity demand and improve the efficiency of electricity supply in the case of an electrically heated hot water tank. Water tank storage technology is mature and reliable. Sensible heat storage in water is still unbeaten regarding simplicity and cost. In refined systems the inlet/outlet heights in the tank can vary according to supply and storage temperatures.

10) Solar Thermal Power Stations: There are two basic types of solar thermal power station. The first is the 'Power Tower' design which uses thousands of sun-tracking reflectors or heliostats to direct and concentrate solar radiation onto boiler. The temperature in the boiler rises to 500-700EC and the steam raised can be used to drive a turbine, which in turn drives an electricity producing turbine. The second type is the distributed collector system. This system uses a series of specially designed 'Trough' collectors which have an absorber tube running along their length. Large arrays of these collectors are coupled to provide high temperature water for driving a steam turbine. Such power stations can produce many megawatts of electricity, but are confined to areas where there is ample solar insolation (Gerhand Faniager, 2011; W. Hulscher et al., 1994).

Besides the above there are many other uses for solar thermal technology such as refrigeration, air conditioning, solar stills and desalination of salt water and many more.

Solar Towers of the PS10 and PS20 solar plants in Spain.

Ivanpah solar plant in the Mojave Desert, California, USA.

The 354 MW SEGS solar complex in San Bernardino, California USA.

The 150 MW Andasol Solar Power, Station in Andalusia, Spain

Figure 3: Solar Thermal Power Stations operating in America and Spain

Main Reasons/Arguments for utilization of Solar Thermal Energy:

- The energy demand/need is large and growing.
- Increase in conventional energy costs as demand for resources heats up.
- The solar resource is large and inexhaustible.
- The environmental and economic benefits are substantial.
- The potential of solar thermal systems in buildings is enormous.
- Contribution to energy security and energy services at point of end use.

- Promote employment, and therefore contribute to sustainable socio-economic development of nation.
- Global pressure to reduce carbon emissions.
- Worldwide common problem of global warming.
- Increasing green awareness among the people in the country.
- Green initiative and green movement encountered worldwide.
- Ideal climate for solar energy in the sun belt of the country.
- Feasible Return on Investment (ROI) in this resource.

Thus, solar thermal energy can be suitable and beneficial for our country.

The First Solar Thermal Station in India: The countries like America, Spain, Germany and Turksthan have solar thermal power stations. But most of these are running on trial basis. In the year 2013 two big thermal power plants have been started in America. The commercial production is started and present plant capacity is - Plant1 - 110 MW and Plant2 - 600 MW.

India has decided to enter in the field of Solar Thermal Power. India's first thermal power station is going to be established in Jaisalmer district of Rajasthan. Till date America was the only country in the world producing electricity by using thermal power technology. Now, India will be the second country in the world producing electricity by using this technology. The Central Government has chosen Rajasthan as the place for the first solar thermal power station in the country. Proposed power station at Nokh in Jaisalmer will have the capacity of 50 MW and Tower Heating Technology is going to be use at this station. The station will be operated under the control of Rajasthan Renewable Energy Corporation (Source PTI).

CONCLUSION:

The renewable energy sources i.e. solar thermal, biomass, geothermal etc. have a huge potential for growth and can replace substantial amount of fossil fuels and electricity currently used in the world. The existing technologies are becoming more expensive, due to higher and fluctuating prices and economy-wide carbon externality costs. The environmental or ecological problems are also increasing in numbers.
Summarized, it can be said that -

1. The solar thermal systems whether centralized or decentralized can provide immense benefits to the users.
2. These systems can provide significant local and global environmental benefits.
3. The systems are helpful in minimize the gap between demand for energy and its supply.
4. Particularly, in India, in rural and remote areas, producing renewable energy locally can offer a viable alternative.
5. The potential for solar thermal applications in the housing sector and industry will increase dramatically once suitable technical solutions are made available.
6. The solar thermal systems can become cost-effective when R&D efforts, economies of scale and learning by doing processes will have reduced costs.
7. In near future highly efficient, innovative and intelligent solar thermal energy systems providing hot water, space heating and cooling etc. will be available, and will offer a high level of reliability and comfort.
8. More efficient and cost-effective compact storage technologies have to be developed considering indigenous needs.

Most importantly, the developing countries like India must have to such a kind of technologies as an opportunity.

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The Clean Renewable Wind Energy Source

-A Study of Brahmanvel wind farm Dist. Dhule (MS. India)

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ABSTRACT

The present paper is the outlooks of the CO2 emission by wind power. Electricity generated by wind turbines does not pollute the water we drink or the air we breathe, so wind energy means less smoke, less acid rain, and fewer greenhouse gas emissions. A single one megawatt wind turbine can displace 1,800 tons of carbon dioxide (CO2) in one year (equivalent to planting one square mile of forest). Achieving 20% wind energy by 2030 would provide significant environmental benefits, such as avoiding approximately 825 million metric tons of CO2 emissions in the electric sector. Because it is a clean energy source, wind energy reduces health care and environmental costs associated with air pollution. Wind energy is plentiful and readily available in Dhule and Nandurbar. And wind energy does not affect our natural resources. The Dhule and Nandurbar wind farm areas have tremendous untapped wind energy potential. Brahmanvel has an ideal geographical location for wind farm installation.

Key words: Wind energy, clean energy, Renewable energy, CO2 emissions, Green House Gas (GHG).

INTRODUCTION-

Wind energy is an alternative clean energy source and has been the world's fastest growing renewable energy source growing at a rate of 28 % in the lasted decade. Wind energy has the advantage of being harnessed on a local basis for application rural and remote areas. Wind energy offers both an energy source that completely avoids the emission of carbon dioxide, the main GHG, but also produces none of the other pollutants associated with either fossil fuel or nuclear generation. Wind power can deliver industrial scale on-grid capacity. Starting from the 1997 Kyoto protocol, a series Of GHG reduction target has cascaded down to a regional and national level. Indian economy is highly dependent on "Coal" as fuel to generate energy and for production processes. Thermal power plants are the major consumers of coal in India yet the basic electricity needs of a larger section of population are not being met. This results in excessive demands for electricity and places immense stress on the environment by producting abundant pollution. Changing coal consumption patterns will require a multi-branched strategy focusing on demand, reducing wastage of energy and the optimum use of Renewable Energy (RE) sourcees. The main purpose of the project activity is to generate eletrical energy through sustainable means using wind power resources, and to utilize the generate output for selling it to the State Eletricity Distribution Company for meeting the energy shortages in the state and to contribute to climate change mitigation efforts. This explains that the project activity reduces GHG emissions.

Objectives of the study:

The present paper study objectives are as follows:

1) To understanding of wind energy project activity would reduce the Greenhouse Gas (GHG) emissions of the Brahmanvel village in Sakri Tahsil of Dhule District.

2) To study wind power is an environmental friendly power generation technology.

3) To understanding of having a monitoring system is to have a constant check on the emission reductions.

Methods and Material:-

The present paper study is based on secondary sources of data colleting of Clean Development Mechanism (CDM) Form for Submission of Bundled Small Scale Project Activities (SSC-CDM-BUNDLE)

district gazetteers. Calculation of GHG emission reductions by sources collected data are clean development mechanism simplified project design document for small-scale project activities (ssc-cdm-bundle) Version 03**.**

Geographical Location of Study Region

Details of physical location the project activity involves installation of windmills located at Brahmanvel Village, Sakri Tahsil Dhule district in the state of Maharashtra India. The nearest connectivity is National Asian Highway No 46. WEG wise location details are as follows the latitude and longitude for the district is 21°8'60 N and 74°13'0 E respectively. Mean annual wind speed 23.1 km/h at 30m height . mean annual wind power density 324 w/m2 at 50m height and 278 w/m^2 at mast.

Discussion:-

3.00 MW bundled Wind Power Project by Shree Jai Ambe Associates at Brahmanvel, Dist. Dhule (Maharashtra), India. The project consists of implementation of 3.oo MW

windmill farm at Brahmanvel in dhule district. This promoted project is a bundled project by 'Shree Jai Ambe Associated (Power Division)'. They are the genereate wind power energy .

The bundled project activity consists of 4 bundles

	Capacity (MW)	**Name of project participants**
Bundle I:	0.750 MW	windmill by Shree Jai Ambe Associates (Power Division).
Bundle II:	0.750 MW	windmill by Automotive Valves Pvt. Ltd.
Bundle III:	0.750 MW	windmill by M.G. Patel & Brothers (Power Division).
Bundle IV:	0.750 MW	windmill by Gayson & Company Pvt. Ltd.
	= 3.00 MW	

Source:- CDM-SSC-PDD (version 03)

All windmills are installed at Brahmanvel village Sakri Tahsil Dhule District in the state of Maharashtra.

Daitals of individual windmills installed in project are given following table:

Sr.	**Capacity of windmill**[1]	**StartingDate of Installation Work** [2]	**Date of commissioning** [3]
1	0.750 MW	02/11/2006	23/01/2007
2	0.750 MW	02/11/2006	23/01/2007
3	0.750 MW	02/11/2006	23/01/2007
4	0.750 MW	02/11/2006	23/01/2007

Source:- CDM-SSC-PDD (version 03)

[1] Commissioning Reports from Superintending Engineer MSEDCL O&M Circle Dhule.

[2] Performa Innovices from VESTAS.

[3] Commissioning Reports from Superintending Engineer MSEDCL O&M Circle Dhule.

To fulfill their commitment towards sustainable development and a cleaner environment the project participants have invested in green renewable energy based power generation by establishing a wind farm of 3.00 mw installed capacity at village Brahmanvel district Dhule in the state of Maharashtra. The project mainly aims at generating electricity from renewable source namely wind energy and consists of four wind mills of 0.75 MW capacity each. The electricity generated is supplied to western regional grid of India. The project activity will result in avoidance of Green House Gas (GHG) emission generation, which would have

otherwise occurred due to CO2 emission from electricity generation by fossil fuel, based power plants that is supplied to MSEDCL.

The expected emission reductions are calculated based on the electricity fed to the Western regional grid and combined margin emission factor of 0.8975 tCO2/MWh5 based on "Tool to calculate the emission factor for an electricity system (Version 01.1)" which is fixed over the crediting period. Central Electricity Authority (CEA) bases emission factor on compiled database for the fiscal year 2006-07. The estimated annual quantity of emission reductions due to the project activity is 5313 tCO2e. A fixed crediting period of 10 (ten) years is selected for the small-scale project activity.

Estimated amount of emission reductions over the chosen crediting period: The chosen crediting period is 10 years which is fixed crediting period. Estimated amount of emission reductions over these 10 years is as follows:

EMISSION REDUCTIONS OVER CREDITING PERIOD				
Years	**Estimation of Baseline Emissions**	**Estimation of Project Emissions**	**Estimation of Leakage**	**Estimation of Emission Reductions**
2009	5313	0	0	5313
2010	5313	0	0	5313
2011	5313	0	0	5313
2012	5313	0	0	5313
2013	5313	0	0	5313
2014	5313	0	0	5313
2015	5313	0	0	5313
2016	5313	0	0	5313
2017	5313	0	0	5313
2018	5313	0	0	5313
Total estimated reductions (tonnes of CO_2e) Over Crediting Period				**53130**
Total number of crediting years				**10**
Annual average over the crediting period of estimated reductions (tonnes of CO_2 e)				**5313**

Source:- CDM-SSC-PDD (version 03)

In the above table the year 2009 corresponds to the period starting from 01.08.2009 to 31.07.2010. Similar interpretation shall apply for subsequent years.

PROJECT NAME:

3.00 MW Bundled Windmill Power Project by Shree Jai Ambe Associates at Brahmanvel, Dist. Dhule (Maharashtra), India.

EMISSION FACTOR CALCULATION as per "Tool to calculate the emission factor for an electricity system" Version 01.1 (ex-ante & fixed throughout the crediting period)		
Build Margin CO_2 Emission Factor in year 2006-07 ($EF_{grid,BM,y}$)	tCO_2/MWh	0.59
Weighting of Build Margin Emission Factor (w_{BM})		0.25
Operating Margin CO_2 Emission Factor in average of three year 2004 to 2007 ($EF_{grid,OM,y}$)	tCO_2/MWh	1.00
Weighting of Operating Margin Emission Factor (w_{OM})		0.75
Combined Margin CO_2 Emission Factor for year 2006-07 ($EF_{grid,CM,y}$)	tCO_2/MWh	**0.8975**

Source:- CDM-SSC-PDD (version 03)

Calculation of combined margin (CM) emissions factor – Emission factor for the grid Electricity (EFCM,y) The emission factor for grid electricity or grid emission factor (also referred as CO2 Emission facto) is calculated as the weighted average of the operating margin emission factor (EFOM, y) and the build margin emission factor (EFBM,y), where the weights wOM and wBM for wind projects, by default, are 0.75 and 0.25 respectively. CM calculation has been done ex-ante and hence CM value will remain fixed and need not be monitored during the crediting period.

EFCM,y = Combined margin emission factor for Western regional grid (tCO2/MWh)

EFCM, y = [(EFBM, y x wBM) + (EFOM, y x wOM)]

Where:

EFBmy = Build Margin Emission Factor for year y (tCO2/MWh) = 0.59

EFOM, y = Operating Margin Emission Factor for year y (tCO2/MWh) = 1.00

wBM = Weighting of Build margin emission factor (%) = 0.25

wOM = Weighting of operating margin emission factor (%) = 0.75

EFCM,y = [(0.59 x 0.25) + (1.00 x 0.75)]

= 0.8975 tCO2/MWh

= 0.0008975 tCO2/KWh

EMISSION REDUCTION CALCULATION		
Total Capacity of Windmills	MW	**3**
Plant Load Factor (@ CUF)	%	22.53%
Operating Day per Year		365
Operating Hour per Day		24
Operating Hour per Year		8760
Estimated Annual Average Generation as per Supply Agreement for four WEGs	MWh	5920.00
Combined Margin CO_2 Emission Factor for year 2006-07	tCO_2/MWh	0.8975
Baseline Emission	tCO_2e/year	5313.20
Total Emission Reduction	tCO_2e/year	**5313**

Source:- CDM-SSC-PDD (version 03)

Conclusion:-

Reduce the prevalent regulatory risks for this wind park through revenues the CDM. From sustainable development point of view the stake holders, (socially, environmentally and economically Project promoters) believe that the project actively contributed in shaping the environmental and social life of the people of this region.

Environmental benefits–The project utilizes wind energy for generating electricity which otherwise would have been generated through alternate fuels (most likely – fossil fuel) based power plants, contributing to reduction in specific emissions (emissions of pollutant/unit of energy generated including GHG emissions. As wind power projects produce no end products in the form of solid waste (ash etc.), they address the problem of solid waste disposal encountered by most other sources of power. Being a renewable resource, using wind energy to generate electricity contributes to resource conservation. Thus the project causes no negative impact on the surrounding environment contributing to environmental well-being.

LIST OF ABBREVIATIONS

CDM- Clean Development Mechanism

CEA-Central Electricity Authority

CM- Combined margin

CO2 - Carbon dioxide

EFBmy - Build Margin Emission Factor for year y

EFOM, y - Operating Margin Emission Factor for year y
EF- Emission Factor
GHG- Green House Gases
KW - Kilo Watts
KWH - Kilo Watts Hour
MSEDCL-Maharashtra electricity Distribution Company limited
MW - Mega Watts
MWh- Mega Watt's hour
PDD- Project Designed Document
RE- Renewable Energy
WBM- Weighting of Build Margin
WEG - Wind Energy Generator
WOM- Weighting of Operating Margin
WTG - Wind Turbine Generator

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Practical Strategies in Managing Hazardous Waste: A special reference to Borivali (Mumbai)

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ABSTRACT

Generation of solid and hazardous waste is an emerging problem in many of the developing nations today. Solid and hazardous waste along with other categories are given much prominence because of their ill effect they generate. People are being adversely affected by it. In the current paper light is thrown on the type of hazardous waste and the problems they create. Case studies were taken from Borivali ward where people were interviewed. Their opinion formed a base for the author to make observations on the types of waste created and to find out immediate remedial measures. Best practices which will help nation survive of its dreading effect out of it were analyzed. Finally significance was given to public participation and cooperation which holds a prime position in itself.

***Keywords**: Hazardous Waste, Waste Management, Landfill, Incineration, Public Participation.*

INTRODUCTION:

"Wastes are materials that are not prime products (that is products produced for the market) for which the generator has no further use in terms of his/her own purposes of production, transformation or consumption, and of which he/she wants to dispose. Wastes may be generated during the extraction of raw materials, the processing of raw materials into intermediate and final products, the consumption of final products, and other human activities. Residuals recycled or reused at the place of generation are excluded.

There are many issues that surround reporting waste. It is most commonly measured by size or weight, and there is a stark difference between the two. For example, organic waste is much heavier when it is wet and plastic or glass bottles can have different weights but be the same size. On a global scale it is difficult to report waste because countries have different definitions of waste and what falls into waste categories, as well as different ways of reporting. Based on incomplete reports from its parties, the Basel Convention estimated 338 million tonnes of waste was generated in 2001. For the same year, OECD estimated 4 billion tonnes from its member countries.

The purpose of this article is to provide an overview of emergent trends in environmentally sound and economically viable approaches to 'waste management' in the contemporary world. This article deals with the management of waste of all kinds in the urban environment. The article, especially, focuses on alternatives to centralized electro-mechanical treatment technologies such as activated sludge facilities and offers alternatives to sanitation systems dependent on large distance water-borne conveyance and high energy inputs for their operation.

Literature Review

Waste is a continually growing problem at global and regional as well as at local levels. Solid wastes arise from human and animal activities that are normally discarded as useless or unwanted. In other words, solid wastes may be defined as the organic and inorganic waste materials produced by various activities of the society and which have lost their value to the first user. As the result of rapid increase in production and consumption, urban society rejects and generates solid material regularly which leads to considerable increase in the volume of waste generated from several sources such as, domestic wastes, commercial wastes, institutional wastes and industrial wastes of most diverse categories. Management of solid waste

may be defined as that discipline associated with the control of generation, storage, collection, transfer and transport, processing, and disposal of solid wastes in a manner that is in accord with the best principles of public health, economics, engineering, conservation, aesthetics, and other environmental considerations. In its scope, solid waste management includes all administrative, financial, legal, planning, and engineering functions involved in the whole spectrum of solutions to problems of solid wastes thrust upon the community by its inhabitants (Tchobanaglous, G. et al, 1997). Solid wastes have the potential to pollute all the vital components of living environment (i.e., air, land and water) at local and at global levels. The problem is compounded by trends in consumption and production patterns and by continuing urbanization of the world. The problem is more acute in developing nations than in developed nations as the economic growth as well as urbanization is more rapid.

Objectives of the Study:

With due consideration to the problem, the main objectives of the study are to find out the remedial measures for disposal of hazards waste and throw light on best practices which will help nation survive of its dreading effect out of it. Also public involvement in waste management strategy will also be studied.

Case Study of Waste Management in Borivali:

To examine the waste management strategies and the role of citizens in the same, a small survey was conducted in the Borivali ward of Mumbai suburban region. For this survey, randomly 50 families were interviewed and their opinion was recorded. Primary focus was laid down on what type of waste was generated in their houses and what are their strategies of disposal of such wastes. From their opinions following observations were drawn.

1) When the people were asked about the problems they feel regarding the solid waste in Mumbai Metropolitan city, all were of the opinion that they do feel that solid waste is creating problem for them (Fig 1).

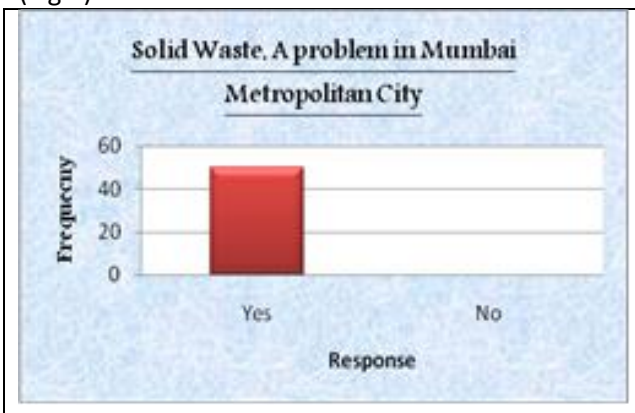

Fig 1: Graph showing public response on solid waste, as a problem in Mumbai Metropolitan city

Plate 1: Though all the people find the solid waste as a problem, but the above photo shows that still public is not well aware of proper disposal methods.

Fig 2: Graph showing people's idea of solid waste management

Fig 3: Graph showing support of citizens in waste minimization principle.

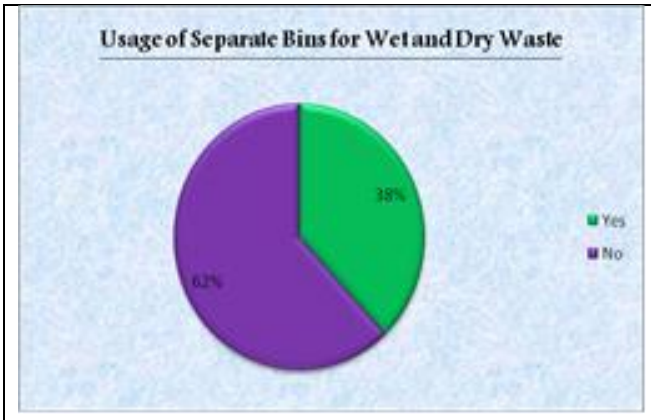

Fig 4: Graph showing usage of separate bins for wet and dry waste by people.

Plate 2: People are reluctant to use two separate bins because they don't find enough space for allocation of bins.

Plate 3: Some people do maintain two separate bins to carry wet and dry waste.

Plate 4: However, the sweepers dump both of the type of waste into one collecting bin itself without segregating them.

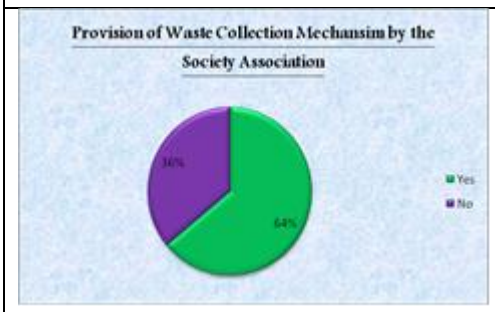

Fig 5: Graph showing provision of waste collection mechanism by the society association.

Plate 5: Society is providing the people with dustbins to collect the waste separately, but people themselves are not segregating the waste.

After noting their reply, surveyor was keen to know whether they have any idea about the solid waste management. In the above question nearly 66%f of the people replied that they do know of the techniques that can either reduce the generation of solid waste or reduce at least the effects of the same on the environment and society.

From the above graph (Fig 2), it was not that nearly 34% of them were ignorant about the solid waste management techniques. This was particularly because of their low level of education and also because of their over dependency on the BMC and other local sweepers. When asked they were of the opinion that their job is only to collect the household waste in the dustbins which will be latter collected and disposed by BMC according to their processes.

People were interviewed on their support to the principle of waste management where around 72% people agreed to support such kind of movement (Fig 3).

This was because these people were aware of the hazardous problem that would crop up due to mishandling of solid waste. Their moral and education push them towards participation in reducing waste generation and also in reducing the impacts of the waste generated.

Wet and dry waste can be disposed of separately more effectively than one together. But this fact was known to a very few surveyed people. Even who were aware were not using separate dustbins. They idea was to collect both type of waste together. When asked about this attitude of their, it was observed that firstly they don't want to waste their time in segregating the wastes and secondly it was very uneconomical to keep two separate dustbins.

2) Majority of the surveyed people kept their dustbins in the kitchen under their washing sinks. Thus from the survey it was found that only 38% people used two separate bins and remaining dumped their waste in one bin itself.

People were later interviewed regarding the waste collection mechanism provided by their society association. Here we observed that most of the societies had such mechanism, for which majority of them were collecting some type of maintenance charges. These charges were particularly drawn on account of hiring separate sweepers for the society who will be collecting the waste from the houses everyday and would sweep the society so that the surrounding can be kept clean. In this case 64% of the people interviewed claimed that their society does provide them with different alternatives so that the surrounding can be kept clean.

Thought the society is providing assistance to the people and helping them to collect of the waste, but they are failing to provide separate bins for dry and wet waste. Hardly 32% of the societies do provide separate bins for dry and wet waste.

When the society official were asked about this, they were of the opinion that when the people themselves were not segregating wet and dry wastes, there was no use in providing the sweepers with two separate bins to collect different types of wastes.

People were asked about how many times a day the sweepers were collecting the garbage from their homes, where nearly 68% of the respondents replied that the wastes were been collected only once a day (probably every morning), 24% replied that there is no fix schedule for collection of the wastes i.e. the sweepers come everyday but then some of the days, they don't collect the wastes. They just sweep the roads and go. In such cases the people have no option left but to throw out the garbage themselves in the nearly bins (which are located on the corners of the crossroads, under the trees or near the creeks or nalas). This is because the amount of garbage collected everyday tremendous and if the sweepers fail to collect it, the accumulated quantity of the same results in extra littering in the houses.

When the respondents were asked about the reuse of the items generated, 75% of them replied that they do not use the items that are generated as the waste. They are usually disposing all the items. On the other hand nearly 25% of the people replied that they do use the items that are generated in waste. Particularly they use the plastic bags again for carrying articles. Majority of the papers which are wastes are also used as a cover to pack the articles or these papers are used to clean the furniture when dust is accumulated on it. Secondly, the tea leaves which is remained after the preparation of the tea is used by some of the ladies to clean their skin. Thermocols, waste bags, bottles, coconut, cardboard, soaked water from rice, etc.

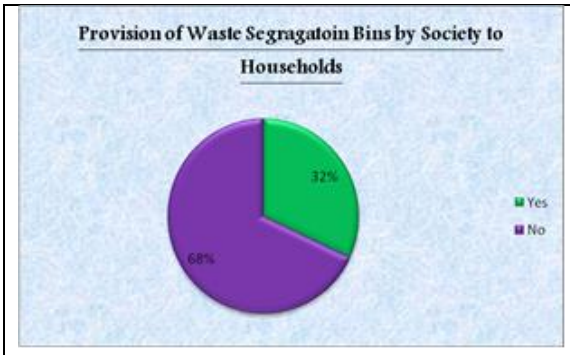

Fig 6: Graph showing provision of waste segregating bins by society to household

Fig 7: Frequency of disposal of waste from houses.

Plate 6: When the waste is not collected by the municipality or the sweepers the people throw the same under the tree……..

Plate 7: Photo showing people using waste paper to cover the things.

Fig 8: Graph showing usage of waste items generated by the people.

Fig 9: Graph showing responsible authority for street cleaning

10) The public waste management especially collection and treatment of municipal waste is basically ruled by the waste management by the municipalities of the city. The main responsibility of the municipalities is separately collection of used packaging, collection and recycling of bulky waste, waste treatment, sewage

sludge, etc. When the respondents of the interview were questioned on their opinion of who are the main agencies in collecting the waste generated from their households, 64% replied it is the municipality, 28% replied that the waste is collected and disposed by the sweepers. However, there were 8% of the respondents who were unaware of any of these and also no one was employed to collect the waste from these houses. They were disposing the waste themselves.

11) Health and wellbeing is undoubtedly a chief concern of every human being. We need a proper body to check in for waste management. Health is achieved when we observe the individual and social hygienic standards. In the society of the surveyed people or more specifically in our city (Mumbai) hygienic standards are among the most neglected and absent standards. There is dirtiness on the streets due to solid waste which is reported by nearly 86% of the people.

Plate 8: Photo showing though the majority of the role of waste disposal is of municipality but hardly they do so during their duty hours….. which is reflected even from plate 11

Plate 9: Photo reflecting the garbage spread on the roads which is not collected by the municipality.

Plate 10: Sweeper hired by the society to keep the streets clean and to collect the garbages from the households.

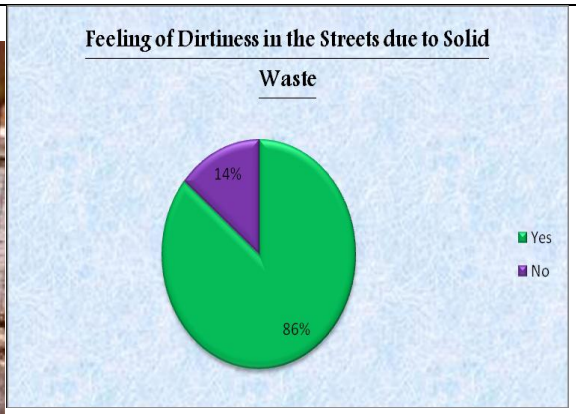

Fig 10: Graph showing response of the people of feeling dirtiness in the streets due to solid waste generation.

Plate 11: Photo reflecting the impact of solid waste lying on the open space.

Fig 11: Graph showing the amount of items generated in form of wastes.

Plate 12: Wastes of papers

Plate 13: Waste of food articles

Everyday million tons of waste is generated in our homes and communities. Part of the enormous amount of waste is generated through the construction renovation and demolition of homes. But severe thing can be noted from majority of the waste generated in form of food items (29%), Papers (26%), Disposables (21%), Garden waste (8%), and waste from other items comes to 21%. Such type of waste is collected in the same bin everyday and disposed off in the same place without segregating them

12) When the respondents were asked whether is there any role of municipality towards the waste management, nearly 82% of them replied positively.
13) People were asked that what were there expectations from the municipality with respect of three aspects – Collecting bulky waste for reuse and recycling, Collecting Kitchen and garden waste for composting, and Collecting all the recycling materials. Majority of them were of the opinion that definitely the municipality should carry all these functions.

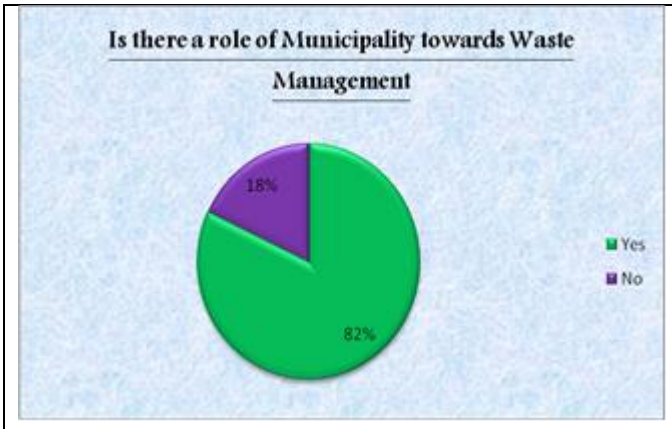

Fig 13: Graph showing the role of municipality towards waste management

Fig 14: Graph reflecting public opinion on the role of municipality in waste disposal

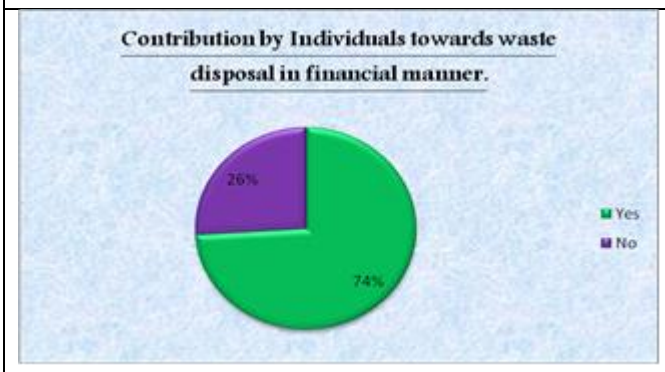

Fig 15: Graph showing contribution by individuals towards waste disposal in financial manner.

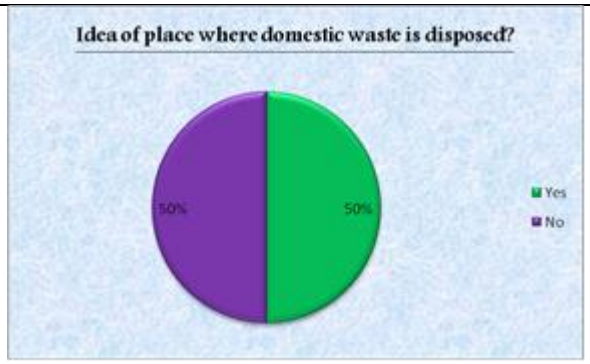

Fig 16: Graph showing the knowledge of people of the place where the wastes are disposed off.

All the interviewed people have replied that at individual level it becomes difficult for the collection of the waste, which if any organization would do on a grand scale can attend a great success. Other things that the people noted was that, neither they have any type of mechanism which (even if they desire) would retain them from the recycling of the waste materials. Whatever is possible at the domestic level, will be done by them, but seeing the amount of waste generated, only a grand scale project would be needed to satisfy the need.

When the question was raised about raising of the funds from the pockets of the people themselves to keep the environment clean, majority of the people (74%) of them replied that they would do so (Fig 15).

They are ready to spend, if they are getting clean environment. However, 26% of the interviewed people were of the opinion that there would be no use of spending on the waste disposal project, because these funds, according to them, would not be used in effective way and hence all the money spend will go in vain. Similarly people also said that support and funding should be dedicated effectively in minimization initiatives. Nearly 90% of the interviewed people agreed to this fact.

17) People were asked whether they have any idea where the waste is taken for disposal after it is collected from their households. Here the answer was 50 percent each. Exactly half the number of interviewed people replied that they knew that after the collection of the waste, the waste was taken to Gorai dumping ground for the process of decomposition. However, remaining half replied that it is not there look out where and how the waste collected was disposed. They were of the opinion that when they are paying the sweepers to collect the garbage, the sweepers would do so effectively and will dispose that off where they find it relevant. Because of this attitude of the interviewed people, they were unaware of the fact where exactly the garbage form home is dumped.

Landfills also have some sort of control over what goes in so the protection can be designed properly. When the people were asked about landfill as an effective measure of dumping the household waste nearly 46% replied positively. According to them, a landfill with, say, household garbage would be treated differently from a landfill that takes hazardous chemicals or radioactive waste. Landfills are also covered each day with soil to keep birds, insects, rats, and other animals from moving in and becoming a nuisance. The daily covering also keeps water and air out of the trash, which keeps the material from rotting too fast and creating bad smells.

Dumps, on the other hand, are just that - a big hole or a big pile of garbage and possibly other dangerous things. They do not prevent the waste from coming into contact with the ground, they are full of rats, roaches, and other vermin, and they stink.

However, nearly 54% of the people were literally, unaware of the landfill and dumping, thus they were of the opinion that it is not an appropriate measure for waste disposal

Landfills are really difficult and expensive to run. Finding enough landfill space gets more difficult as time goes by. It is important to create as little waste as possible and recycle whenever you can to preserve landfill space and help keep pollution to a minimum.

Finally the people were questioned about the most hazardous waste, according to them which can create maximum problem, where nearly 34% of the respondents replied it is the waste generated out of plastics. 22% were of the opinion that most hazardous is the nuclear waste, 18% replied it is the industrial waste and 12% chemical waste.

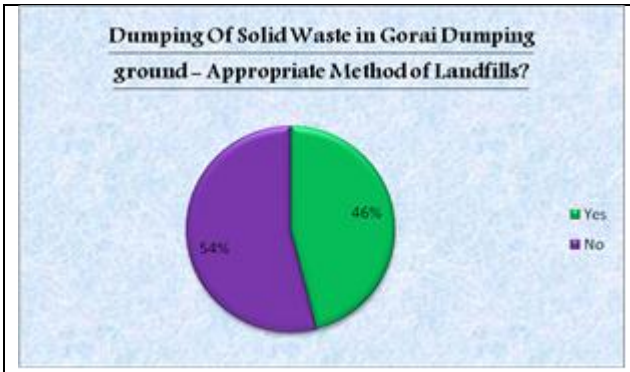

Fig 17: Graph showing whether dumping of solid waste in Gorai Dumping ground is appropriate way of landfill method.

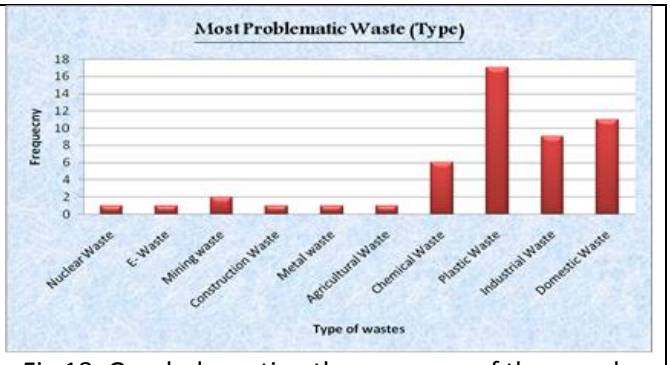

Fig 18: Graph depecting the response of the people regarding the most problematic waste.

Other respondents replied that part of mining waste, agricultural waste, construction waste, e – waste and metal waste is also harmful.

 ISBN: 978-93-84663-07-0

Waste Management Rules

India's Central Pollution Control Board prepared waste-management rules. At the Court's direction, these were issued by the Government of India's Ministry of Environment as the country's first *Municipal Solid Waste (Management and Handling) Rules 2000***,** issued under the Environment Protection Act 1986. This is now a mandatory blueprint for action by all urban local bodies having populations of 20,000 and over. Once citizens realize its potential, this is a powerful weapon in the hands of the public to enforce compliance, hygienic waste management, and responsible behaviour on the part of both elected and appointed city managers. However this also puts a responsibility on the public that generates the waste in the first place.

India's Best Practices for Waste Management

In Calcutta, 80% of house-to-house collection has been achieved in residential areas at no extra cost to citizens, using only existing Municipal sweepers since 1995. They cover two "beats" by moving in pairs with a wheelbarrow. One pushes the cart and blows a whistle at each gate at a fixed time daily, while the other empties waste-bins into it, and they exchange duties on alternate days. Commercial establishments are not cooperating so well: only 60% do. There is no waste-segregation. Waste-pickers forage at the transfer-points or landfill.

Doorstep collection is most successful in slums. Cities usually make the mistake of thinking that rich or upper-middle areas will not feel the pinch of such small monthly collections. However, they are always the most unwilling group to pay this, so such attempts often fail and municipalities get discouraged. Slum-dwellers, neglected everywhere, understand and appreciate the monetary value of cleanliness and are most willing to cooperate and pay willingly.

Temporary take-away bins work in extremely crowded slums where handcarts cannot move through the lanes. At Mumbai's Prem Nagar slum, stackable plastic bins are made available from 8.00-10.00 am at every gully corner and inner-lane crossing. From 10.00-11.00 am, these are emptied into waiting Municipal trucks and then stacked in a central place till next morning. Nobody minds a dustbin at their door for just 2 hours a day, and they are used in a very disciplined way. Residents pay Rs 1 per head per month, with a maximum of Rs 5 per household per month (US $0.10), to support the local cleaning boys, who are paid Rs 1500 per month (US $30) for 4 hours' work. Cooperation by slum-dwellers was 50% from the first month.

In Ahmadabad, the door-to-door bell carts have a special frame that can hold four to six 25-litre containers which can be directly emptied, when full, into waiting trucks or dumper placers, avoiding manual handling of waste which was formerly lifted off the street and into trucks.

Nasik is a city without dustbins, as trucks move from one street corner to another directly receiving waste from each household at fixed times. Loaders receive waste bins from residents, or fetch them from outside some houses where people are away at work. This is very popular with residents and cost effective for the city, but results in a lot of fuel wastage and pollution if the trucks keep their engines idling for 7-10 minutes while waiting at each road crossing. This system is ideal for smaller towns where tractor-trailers can be used.

Surat has spotless dumper placers and surroundings because of "pin-point beats", in which sweepers must take personal responsibility for the cleanliness of their stretch of road and any dustbins or dumper placers in their stretch. These rest on paved areas, slightly higher than the road, and slope towards a drain opening nearby**.** This system works only because of the extreme dedication of Commissioner S.R. Rao and the fine work ethic he initiated. In almost every other city, dustbins are surrounded by a huge permanent area of filth.

Waste separation at source is vital but difficult**.** Bangalore has opted for this as its official city policy. The entire sweeper force has been trained and sufficient 4-bucket handcarts have been donated by the corporate sector to cover 50% of the city which is served by the city's own sweepers. New contracts for the remaining 50% of the city now specify doorstep collection of source-separated wastes as part of the cleaning and transport contracts. Cooperation has been 20% in the first year. One drawback is that city sweepers keep the clean saleable recyclables for themselves, leaving less for traditional rag pickers. Also,

 ISBN: 978-93-84663-07-0

residents seeing their source-separated "dry" and "wet" waste go from the handcarts into the same truck wonder if their efforts are worth it and get discouraged.
Weekly doorstep collection of dry wastes is done in Ahmadabad by SEWA's rag-picker cooperative, which has a hotline to ensure punctual collection and solve absenteeism and crises. No money is paid or asked for. The waste-pickers get their earnings from the higher-value clean and unmixed waste.
Doorstep collection of both dry and wet wastes is done for a fee at Pune, by a 5,000 member rag pickers' union. They keep the dry waste for sale and dump the wet waste into municipal bins or into a nearby composting site if available. The rag pickers do not seem interested in learning composting skills and trying out an additional source of income.
Coorg District was cleaned up by having all schoolchildren bring dry recyclable wastes weekly from home to school, where an NGO arranged for its purchase by a waste-buyer visiting regularly every week. Funds collected were used for eco-club activities for the classes.

Public Participation and Cooperation

The experiment proved that mothers will do for their children what they will not do for rag pickers or the environment: keep dry wastes separate for their kids to take to school. Under the existing program for SUPW (Socially Useful and Productive Work), required in all schools today and for which marks are given, all children at the start of term should be required to prepare and hang at home a pretty bag for collecting dry waste, and bring it to a school exhibition. Local NGOs can help arrange for waste-buyers to regularly visit the schools to collect this waste. Thin plastic bags must be brought to school, for donation to the local jail etc. for weaving but not for sale**,** so that parents do not go out and buy or demand more plastic bags than required.
Pimpri-Chinchwad Municipal Corporation has an effective low-cost Public Awareness Campaign. Every letter or bill going out of the Municipality has one of several rubber stamped messages on it, like "Do not litter", "Use the bell-cart", "Keep dry wastes separate from food wastes" etc. Children in Municipal schools have to get their parents to sign not just the monthly mark-sheet but a checklist of similar items also, every month. It is an effective reminder.
Calcutta has distributed five lakh bookmarks to all schoolchildren of Standard 6 and upward. On the bookmarks is a year 2000 calendar and a brief civic message on separating dry and wet waste, using bell carts, not littering etc.
Spotless streets are seen in Chandigarh, where residents take pride in personally sweeping and washing their half of the road in front of their homes, every morning. There is personal responsibility by each property owner for the cleanliness of the pavement and road in front of their properties.
It is worth framing by-laws that require each and every ground floor commercial establishment to keep its frontage clean up to and including the curbside drains**.** This will also curb unauthorized pavement encroachments that keep returning after clearing.

Conclusion

Unrecycled waste quantities in developing countries are increasing exponentially. Calling a material "recyclable" is meaningless unless recycling is actually done**.** Thin plastic bags and PET bottles of mineral water and soft drinks clog India's drains and sewers. It also causes monsoon flooding, littering of the peri-urban landscape, and affects water percolation and seed germination. Tetrapaks are made into hardboard in dozens of countries, but not in India. Styrofoam continues to be used for shipping goods though it is banned elsewhere. No world class recycling technology has yet come to India because it still has no laws enacted to require this. It is a moral tragedy that in most developing countries, many multi-national corporations use cheap and dirty practices that their home countries stopped tolerating over a decade ago. Consumers pay for such corporate profits through city taxes for cleaning up the new one-time use wastes, or in health costs, filth or eco-damage. Hence, there is urgent need for new legislation and market strategies that promote product stewardship, producer responsibility and waste minimization. This is the next battle to be fought in India. Both Europe and North America have numerous examples of such legislation that developing countries can study and adopt before it is too late. A simple solution is to

restrict entry of new industries to the country only to those who bring in the same recycling and product life-cycle policies and standards that are complied with in the West.

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देवरुख शिक्षण प्रसारक मंडळ
॥ ज्ञान हाच पराक्रम ॥

Nya. Tatyasaheb Athalye Arts, Ved. S. R. Sapre Commerce and Vid. Dadasaheb Pitre Science College Devrukh (Dist. Ratnagiri)

ISBN 978-93-84663-07-0

RUT Printer and Publisher, Jalna (MS) India