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Municipal Organic Waste Management

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Abstract: Increase of population density and the rural cities, urbanization is assuming extreme proportions and presents a tremendous urban problem related to waste generation. The organic waste generation in India is increasing so rapidly around 315 million tons per year and per capita is 0.708 kg per day that it can't be controlled with the growing population. In this paper it attempts to show that how much organic waste is generated in the Karwar city (31 wards, Market waste, Hotels and other waste related organic) and how to manage these organic waste and to create awareness among the society regarding the organic waste management and also explained the production of Biogas from organic waste and the production of Bioethanol from the Cashew Apple and Watermelon waste.
Keywords: Organic waste, Biogas, Bioethanol.

I. INTRODUCTION

With the increase of population density and the rural cities, urbanization is assuming extreme proportions and presents a tremendous urban problem related to waste generation. The increase of waste generation has been considered a significant challenge to urban centre, not only in India, but also worldwide and represents a critical issues for countries with accelerated population growth in cities. Thus waste management is a name given to a waste collection system including its transportation, disposal, and recycling. It's also attributed to waste material that is produced through a human activity which must be handled to avoid its adverse effect for health and for the environment.

Organic waste is that waste which is garbage derived from organic waste. These are mainly generated in residences, restaurants, and commercial establishments that work with food. They must be separated from other types of waste since they are mostly destined to municipal landfills, composting, and for producing biogas for the betterment of the society.

In further cases organic or biodegradable waste includes organic matter in which the waste which can be broken down into carbon dioxide, water, methane or simple organic molecules by micro-organisms and other living things by composting, aerobic digestion, and anaerobic digestion. There are some other inorganic materials which can be decomposed by bacteria. Some these bacteria include gypsum, sulfates which decompose to yield hydrogen and sulphide in land-fill conditions.

Karwar is port city in the south Indian state of Karnataka. The total population of this city is 1, 51,739 and having 27.9 km^2 areas and the waste generated in this city is 30TPD and in this around 90% is organic waste and rest of 10% is inorganic waste. Comparing other major city's it's not that much of waste is producing. But municipal solid waste management should produce proper management system.

Now in India some of the companies have come front to develop new techniques to control the solid waste management (SWM). By the principles of thermodynamics, they have discovered the patent of "controlled oxygen rotating technology" [CORT] has evolved from the concept of excess enthalpy combustion and is characterized by reactants of low oxygen concentration and high temperature through which they will turn the produced waste into ashes, further it can be used as fertilizers.

II. SURVEY ON ORGANIC WASTE GENERATED IN KARWAR CITY.

According to municipal solid waste (MSW), currently 2.10 billion metric tons per year of waste is generated worldwide and per captia waste generated by a person is 1.6 kg per day. India is the second most populated country in the world and nearly around 18% to the word population and the 2.49% of the world is land. In India municipal solid waste production is around 350 million tons /year and the organic waste production in India is approximately 315 million tons/year and per capita is 0.708 kg per day among the entire southern India city generated maximum per person is 700 grams per day.

Karwar is the headquarters of Uttar Kannada district and also the population is larger than other district. Karwar municipal council (KMC) comprises of 31 wards and it is situated on National Highway No. 17. Area of the Karwar city is 27.15 sq kms and the percent population of the Karwar city is 155213 and this city having around 16369 houses, number of commercial establishments are around 1205, marriage halls, apartments, markets are 117 are there in Karwar city.

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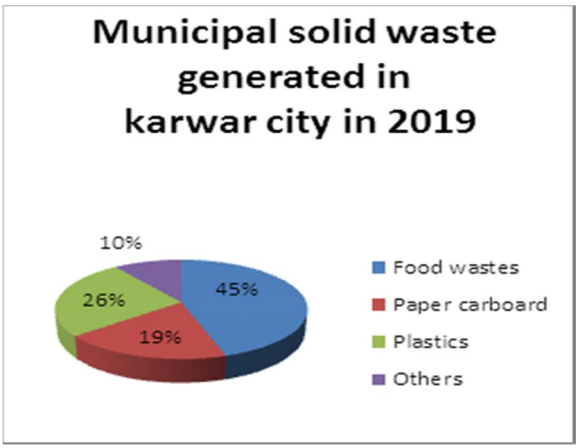


Fig-1 Different types of waste generation in Karwar city in 2019

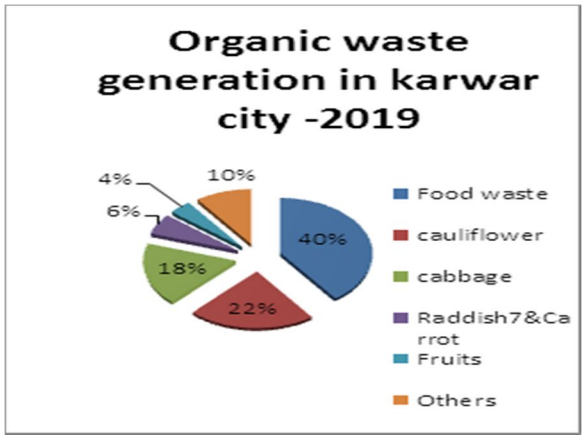


Fig-2 Organic waste generation in Karwar city in 2019

Table -1collection of organic waste from 31 wards in Karwar city-2019

Sl.no	DAYS	Collection of waste in 31 wards in T/D
1	Monday	3
2	Tuesday	2
3	Wednesday	2.5
4	Thursday	2.3
5	Friday	1.9
6	Saturday	1.7
7	Sunday	1.2
Total		14.6 Tons per week

The above tables show the collected organic wastes in 31 wards of karwar city is 14.6 tonnes per week, from market 10 tonnes per week and hotels and marriage halls generates waste around 1 tonnes per week. Totally around 25.6 tonnes per week organic waste generated from Karwar city. .

As per the survey done, the total population of the karwar city in 2019 is 155213.Thus back in 2011 censes, karwar had only 637555 population , this shows that karwar population is increasing growing faster year by year. So the wastes generated day by day. Thus solid waste generated in Karwar is around 921.6 tonnes per year. So per capita waste generated is 5.94 kg per year.

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A. Major issues related to the Organic Wastes generated in Karwar City.

1) Majority of the municipal authorities do not have awareness to proven waste processing and disposal facilities.

2) Biogas plant must be installed to make complete use of the organic waste.

3) Bioethanol plant should be installed in Karwar city.



Fig-3 Vegetable market in karwar city



Fig- 4 Collection and dumping of organic wastes in Shirwar area Karwar city.

The collection of organic waste generated in karwar city is dumped in shirward. This waste is then put up to dry around 3 months and further process is done.



Fig- 5 Segregation machine in Karwar dump yard Shirwad.

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Fig-6 Compost powder.

Drying process of organic waste is completed. It's then put into the segregation machine, to make the compost. After it's processed in segregation machine, the compost powder is known ready to use as fertilizers.



Fig-7 Biogas plant in Science centre karwar.

III. METHODS AND METHODOLOGY

The major methods of converting municipal organic wastes into useful products are as follows.

A. Biogas Production From The Municipal Organic Solid Wastes

In this most organic waste materials undergo a natural anaerobic digestion in the presence of moisture and absence of oxygen and produce biogas. The obtained is a mixture of methane (CH_4) around 55-65% and carbon dioxide (CO_2) around 30-40%. It also contains some amount of H_2, H_2S, and N_2. It has a calorific valve which ranges from 5000 to 5500 Kcal/kg (19.9 to 26.4 MJ/m^3).

1) *Collection of Wastes:* The collected waste from the market and various other wastes are separated into organic and inorganic wastes, since inorganic wastes such as plastics are indigestable.
2) *Pretreatment Processing:* In this process, it takes place mechanical, thermal, Chemical and biological pretreatments. For the process of the Homogenization, the organic waste materials are put to it. In this stage, the particles of larger size are mixed and then crushed into smaller particles, so that the microbes can easily digested crushed particles. Then it is treated by water and other chemicals which aid in the digestion process.

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3) *Process of Feeding:* The processed organic waste materials are then fed to the digester tank along with the organic waste water and bacteria's are added to the digester.
4) *Anaerobic Digestion Process:* This is the last process were it converts large organic waste polymers that make up biomass are broken down into smaller molecules by chemicals and microorganisms. After the completion of anaerobic digestion process. The biomass is then converted into biogas.

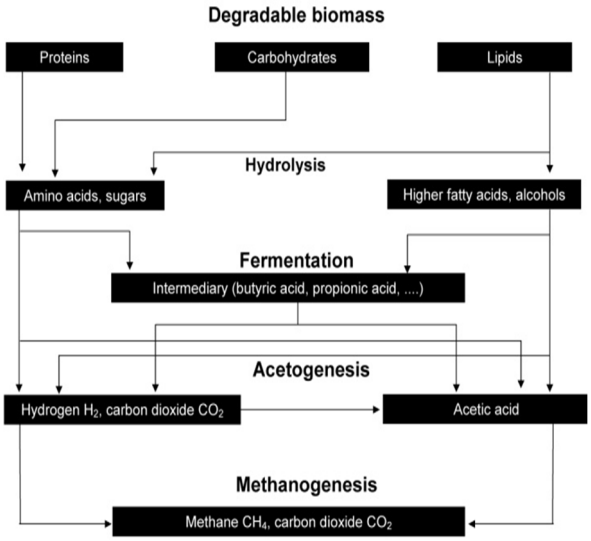


Fig-8 Flow Diagram of Anaerobic Digestion



Fig-9 Installing biogas plant with a capacity of 750lts in Girijabai Sail Institute of Technology is in progress.

B. Bioethanol Production from waste Cashew Apple

In the generation of wastes produced so largely and the fossil fuels are depleting faster. The bio-fuels form an amazing solution to both solid waste management and energy generation. It can also be used as alternate fuels. Bioethanol is bio fuel produced sugar rich biomass. It can be produced from various sources such as cashew apple, watermelon, sugarcane bagasse.

In this present study the feed stocks selected are cashew apple, as it is one of the things we commonly get to see in our karwar area. As per the data Karnataka itself produce 75 thousand tones of cashews, none of it has been used to produce nothing and Uttara Kannad and Belagavi District produces 30 thousand tonnes of cashews, Majorly in Karwar Majali and Mudgeri area as they have been using it making alcoholic beverages and most of the tones of fruits are wasted. So these are some major organic waste which can be made useful into biofuels.

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Following are the steps involved in the process of Bioethanol from waste Cashew Apple.

1) *Crushing of cashew apple or Hydrolysis:* The cashew apple is collected first and then the cashew apple is stomped using feet. Then the juice from cashew apple flow to container and where juice is made to undergo further process.



Fig-10 Collection of cashew apples

2) *Fermentation of Cashew juice:* Fermentation refers to the metabolic process by which the organic molecules are converted into acids, gases or alcohol in the absence of oxygen. In this process sucrose sugar is converted into glucose and fructose. Then glucose and fructose sugar then react to produce ethanol and carbon dioxide. The juice collected in tank is left untouched for two days. When the process of forth is formed and top surface bubbling action takes place, the fermentation begins. Later on day two of fermentation, fermented juice is then transferred into distillation tank.
3) *Distillation:* Basically it consists of vessel, furnace, considering unit and collecting tank. The juice is first transferred into the vessel and it is heated from the bottom through burning of wood. Thus at around 84□the ethanol vaporizes and moves towards the condenser unit. It consists of pipe which passes through water tank. Thus the water from water tank extracts heat from ethanol vapour and converts it into liquid ethanol and collected in the collecting tank.



Fig-11 Distillation of ethanol collected in the tank.

Thus through we can avoid the wastage of the cashew apple present largely in city and we can use this as an alternate fuel for IC engine.

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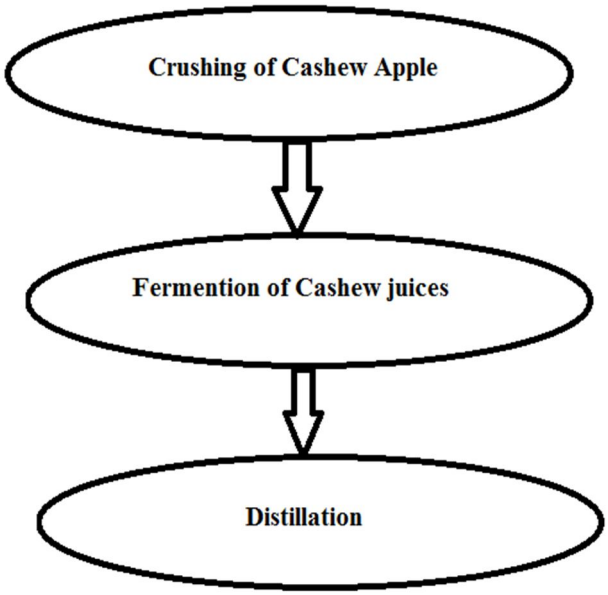


Fig-12 Flow diagram of Bioethanol produced from cashew apple.

C. Bioethanol production from waste watermelon fruit

.Basically the production of watermelon started from CORDELE, GEORGIA is located in crispy country were it is produces world's no one watermelon. As per data of National horticulture hub, Karnataka itself produces 370.04 tonnes of watermelon and its second largest producer of watermelon in India.

Here in Karwar also we have some areas of producing watermelon around 3-5 tons of watermelon is produced. Thus from the wastes of these watermelon are not been used as a useful majors and we can make most useful of this present sources by making biofuels, oils etc.

Steps involving to converting waste watermelon into bioethanol.

1) *Collection of Waste Watermelon:* First of all waste watermelon fruits are collected. Then it is chopped into smaller pieces. After that 200 to 600 ppm of Natural (Pectinex ultra SP-L) enzymes are added to it. And were incubated at 40□for 2 hrs and the constant stirring of reaction stops after heating 90□for 10 minutes.
2) *Extraction of Watermelon Juice:* Here the juice extracted from the watermelon through the muslin cloth to separate the seeds and coarse Parts. Later on it is concentrated in vaccum rotary evaporator at 40□.
3) *Fermentation Process:* In this process, the juice extracted is used and the yeast Saccharomyces Cerevisiae is added for conversion for the glucose into fructose. Then its reacts to produce ethanol. Thus here the ph level is 3-5 and the temperature is around 35-40□.
4) *Distillation Process:* After the fermentation process, the collected liquid is then transferred to the collective tank for further distillation.

Thus through the watermelon produced here in karwar can use this process for the betterment of the society.

IV. CONCLUSION

A. Presently Karwar produces around 921.6 tonnes per year of organic waste is generated and per captia of waste generated is around 5.94 kg/year.
B. Around 90% of the waste is organic waste, so the Karwar municipal council must make use of these wastes for the betterment of the society.
C. A single unit of biogas plant is present in Karwar city, since 90% is organic waste it is not capable to complete use of it, around 10-15 biogas plant should have been installed for the complete use of these organic wastes.
D. From fruits waste like Cashew Apple, Water Melon we can produce Bioethanol, produced Bioethanol can be used as an alternative fuel for IC engine.
E. Awareness should be created among the society to make the waste completely useful.

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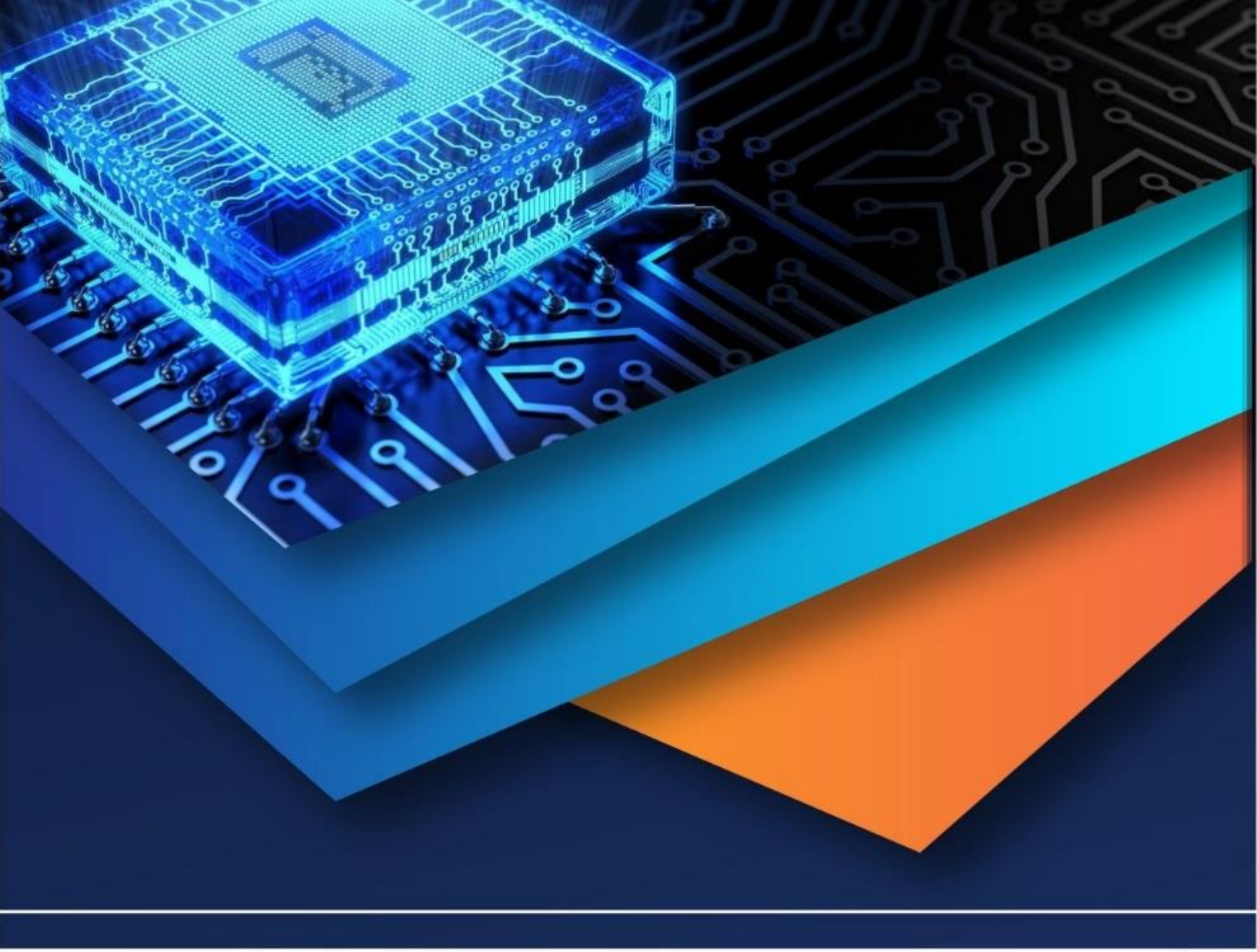
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