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ANAEROBIC DIGESTION OF BIODEGRADABLE ORGANICS IN MUNICIPAL SOLID WASTES IN NASHIK CITY

Dr M. Husain[1] F. I.Chavhan[2] kalyani navale[3]

[1]Prof, Department of civil engineering, SSBT College of Engineering, Bambori, North Maharashtra University, India.

[2]Asst. Professor Department of civil engineering, SSBT College of Engineering, Bambori, North Maharashtra University, India.

[3]PG Research Scholar, Department of civil engineering, SSBT College of Engineering, Bambori, North Maharashtra University, India.

Abstract - Solid waste is the unwanted or useless solid materials generated from combined residential, industrial and commercial activities in a given area. It may be categorized according to its origin (domestic, industrial, commercial, construction or institutional); according to its contents (organic material, glass, metal, plastic paper etc); or according to hazard potential (toxic, non-toxin, flammable, radioactive, infectious etc). Management of solid waste reduces or eliminates adverse impacts on the environment and human health and supports economic development and improved quality of life. A number of processes are involved in effectively managing waste for a municipality. These include monitoring, collection, transport, processing, recycling and disposal.

***Key Words*: Municipal, solid, waste, Municipal Solid Waste management, and handling**,

1.INTRODUCTION

Anaerobic digestion like composting uses biological processes to decompose organic waste. However, where composting can use a variety of microbes and must have air, anaerobic digestion uses bacteria and an oxygen free environment to decompose the waste. Aerobic respiration, typical of composting, results in the formation of Carbon dioxide and water. While the anaerobic respiration results in the formation of Carbon Dioxide and methane. In addition to generating the humus which is used as a soil enhancer, Anaerobic Digestion is also used as a method of producing biogas which can be used to generate electricity. Optimal conditions for the process require nutrients such as nitrogen, phosphorous and potassium, it requires that the pH be maintained around 7 and the alkalinity be appropriate to buffer pH changes, temperature should also be controlled.

2 LITERATURE REVIEW

Kumar et al., (2004) investigated the reactivity of methane. They concluded that it has more than 20 times the global warming potential of carbon dioxide and that the concentration of it in the atmosphere is increasing with one to two per cent per year. The article continues by highlighting that about 3 to 19% of anthropogenic sources of methane originate from landfills

Murphy, McKeog, and Kiely (2004) completed a study in Ireland analyzing the usages of biogas and bio fuels. This study provides a detailed summary of comparisons with other fuel sources with regards to its effect on the environment, finical dependence, and functioning of the plant. One of the conclusions the study found was a greater economic advantage with utilizing bio fuels for transport rather than power production; however, power generation was more permanent and has less maintenance demands

Thomsen et al. (2004) found that increasing oxygen pressure during wet oxidation on the digested bio waste increased the total amount of methane yield. Specifically, the yield which is normally 50 to 60% increased by 35 to 40% demonstrating the increased ability to retrieve methane to produce economic benefits.

3. SCOPE OF PRESENT STUDY

1. Solid and liquid waste of food is collected from kitchen and their characteristic has been studied.
2. Before discharging waste water to water bodies it has to be treated to reduce the Chemical Oxygen Demand, Sulphide content.
3. As a result of this treatment Biogas liberated can be used for domestic purpose.

4. Data collection and survey work

4.1 Site used for Pilot model

1 Open Space For gas generation at adequate rate, there should be a sufficient open space for the sunlight to fall on the plant to provide essential temperature between 35 to 40ºc.
2. Space Requirements: To carry out day to day operation and maintenance, sufficient space must be available. As a guideline 10 to 12m^2
3. area is required per m^3 of the gas.
4. Availability of water: Availability of plenty water must be ensured, to prepare proper cattle dung slurry and water mixed with food waste for gas generation.

4.2 Raw material collection:

The amount of waste collected from each family is 42 kg/week. It includes 0.300 kg of paper waste, 2 kg of kitchen waste and 3 kg of gardening waste. Average temperature inside the bin due to gunny bags is 25ºc.The model works on the starchy, sugary, cellosic, fatty substances. The waste contains cooked rice, vegetables, rotten fruits, flour. This waste is crushed by mixer grinder and slurry was prepared mixing with water. Composition of Solid waste**:** Average composition of waste was analyzed on various occasions. Over 50% of waste was composed of uncooked vegetable & fruit waste. Cooked rice was of 20%. Roti or chapatti was composed of 16%. Rotten fruits was composed of 8 %. Breads, cheese was composed of 6%.

Table 1: Salient features of pilot model

Method adopted	Anaerobic Digestion method
Source of waste	Kitchen waste
Daily feeding	3 kg
Temperature Maintained in Digester	37ºc
Capacity of tanks: Pre-digester Main digester	 20 Lit. 50 Lit.
Avg. daily gas generated	1.248 m^3
Overall cost of pilot model	Rs. 1500 /-
Maximum Capacity of pilot model	6 kg

Table 2: Biogas is a mixture of various percentages of components

Biogas Component	% of Biogas
Methane (CH_4)	55-65%
Carbon Dioxide (CO_2)	30-40%
Hydrogen Sulphide (H_2S)	0-6%
Moisture H_2O	1-5%

4.3 Component parts of pilot model

1. Predigester: - Firstly we have modified our model by adding a predigester. It helps to increase retention time of feedstock, resulting in overall reduction of retention time of the plant. It has capacity of 20.lit. The predigester is kept at 1/3rd above the height of main digester i.e. 0.35m above G.L. The pH of the predigester range is 4 – 6 at temperature from 30 to 40^0 c.

2. Digester: - In Digester, slurry undergoes anaerobic digestion by *Archae* Bacteria belonging to *Methanococcus* which produce biogas consisting of methane. Digester is made of syntax tank of capacity 50 lit.. The retention period of digester is maintained 20-25 days. This increases gas producing capacity of slurry also the biogas is produced in this tank and, it holds the slurry for sufficiently long time to complete the digestion.

3. Inlet Pipe: - The provision of inlet pipe is made for the feeding of feedstock. It is connected from the outlet of predigester to the inlet of main digester4. Outlet pipe: - The provision of an outlet is made to take out the digested portion of slurry. Also it helps to regulate outlet slurry depending upon amount of feeding done. Whenever the plant is running for full capacity i.e. 3kg then 50 lit. outlet is in operation.

5 LAB WORK AND TESTING

The samples were collected at the inlet and outlet of the plant is tested. The more common analyses used to characterized food waste plant are:
1. Moisture Content
2. pH Value
3. BOD
4. COD
5. Total Solids (Fixed solids, Volatile solids)
6. NPK Value
7. Carbon/Nitrogen Ratio

6. RESULT AND DISCUSSION

Table 3: Organic food waste characteristics

Composition	Quantity	Unit
Moisture content	75-90	**%**
pH	7.0-7.5	**-**
BOD	110-400	mg/ lit
COD	250-1000	mg/ lit

Table 4: Day to day pH and temperature values

Day	PH	Temp
1	7.9	36
2	7.8	36
3	7.5	36
4	7.4	37
5	7.2	36
6	7.1	37

There is variations in the main digester performance were observed in the period of digestion, the observed pH of 7.1 to 7.9 were primarily within the acceptable range for anaerobic digestion for the entire operation. This implies average buffering capacity of the mixed substrate

7. CONCLUSION

In this paper concluded that AD is excellent method of treating the food waste with controlled environmental issues. The rate of loading increases slowly to stabilize the digester. Biogas production rate in batch condition is directly equal to specific growth of Methonogenic bacteria. The value of BOD 50-55% and COD 35-40% is reducing. A decrease in the processes pH was observed in the first few days of the digestion and this is due to high volatile fatty acid (VFA) formation. The pH increased to its normal operating value after VFAs metabolism. The pH was observed to increase substantially with little variation on the commencement of the batch operation and also the gas production increases. Finally the authors concluded that AD of Food Waste Leachate is good for the conversion of waste to biogas still the project work is continued with different substrate.

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