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BIOMETHANATION OF KITCHEN WASTE

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Abstract-Kitchen waste is the best alternative for biogas production in community level biogas plant. It is produce when bacteria degrade organic matter in the absence of air. Biogas contains around 55-65% methane, 30-40% of carbon dioxide. The calorific value of biogas appreciably high. The gas can effectively be utilized for generation of power through a biogas based power generation system after dewatering and cleaning of the gas. In addition, the slurry produced in the process provides valuables, organic manure for farming and sustaining the soil fertility. Each of the biogas plant 2kg slurry capacity in batch system for all measurement. During the seperiod, the temperature, solar radiation and relative humidity have been measured. We have so analyzed the constituent of biogas, pH, volume and rate of biogas production at different level of temperature observation on daily basis. Here we also compare the rate of biogas production from kitchen waste with the other energy sources used for cooking purpose like LPG, Kerosene and coal.

1. INTRODUCTION

Waste minimization and energy generation is the recent emerging concepts. The conventional energy resources are declining now a days, hence a suitable substitute for conventional resources are being explored. In general typically produce solid waste 0.4-0.5Kg /person /day. Solid wastes can be used for production of biogas.

Biogas comprises of 68% methane, 31% carbon dioxide, 1% nitrogen, It also forms a combustible mixture in range of 6% to 15% concentration in air. Anaerobic digestion is a known process to treat organic wastes. Resource recycling and energy saving systems for processing organic solid waste in urban areas need to be established. The advantages of such processes over conventional aerobic processes are low energy requirement for operation, a low initial investment cost and a low sludge production. Food waste (falls into a broader category of biodegradable waste) means all sorts of food wastes coming from restaurants, catering facilities and as well as home kitchens. Kitchen waste makes up a significant part of biodegradable waste and thus it should be further processed.

Fig. 1.1 General Waste from Kitchen

The present study is concerned with the alternative energy production from solid waste especially Kitchen waste. The objectives of present work are to investigate the biogas production and organic matter degradation. The alternative energy resource is the need of time but as the management of solid waste is a big problem.

2. BIOGAS

BIOGAS is produced by bacteria through the bio-degradation of organic material under anaerobic conditions. Natural generation of biogas is an important part of bio-geochemical carbon cycle. It can be used both in rural and urban areas.

Table-2.1 Composition of Biogas

Compound	Formula	%
Methane	CH_4	50-75
Carbon dioxide	CO_2	25-50
Nitrogen	N_2	0-10
Hydrogen	H_2	0-1
Hydrogen sulphide	H_2S	0-3
Oxygen	O_2	0-0

3. CHARACTERSTICS AND PROPERTIES OF BIOGAS

Composition of biogas depends upon feed material also. Biogas is about 20% lighter than air has an ignition temperature in range of 650 to 750 0C.An odorless & colourless gas that burns with blue flame similar to LPG gas. Its caloric value is 20 Mega Joules (MJ) /m3 and it usually burns with 60 % efficiency in a conventional biogas stove.

This gas is useful as fuel to substitute firewood, cow-dung, petrol, LPG, diesel, & electricity, depending on the nature of the task, and local supply conditions and constraints.

Biogas digestor systems provides a residue organic waste, after its anaerobic digestion(AD) that has superior nutrient qualities over normal organic fertilizer, as it is in the form of ammonia and can be used as manure. Anaerobic biogas digesters also function as waste disposal systems, particularly for human wastes, and can, therefore, prevent potential sources of environmental contamination and the spread of pathogens and disease causing bacteria. Biogas technology is particularly valuable in agricultural residual treatment of animal excreta and kitchen refuse(residuals).

- Change in volume as a function of temperature and pressure.
- Change in calorific value as function of temperature ,pressure and water vapour content.
- Change in water vapour as a function of temperature and pressure.

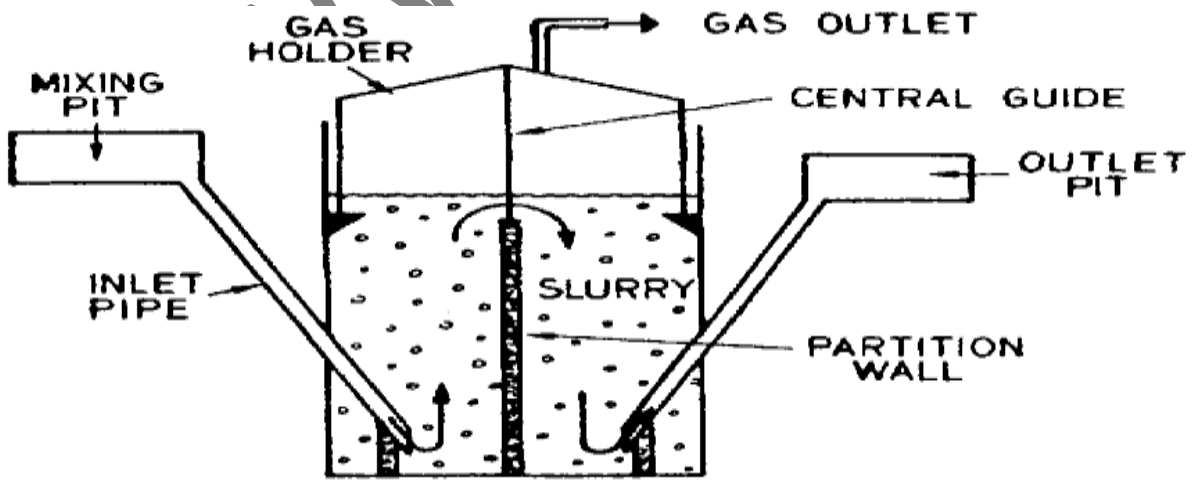

Fig. 3.1 Biogas Power Plant

3.1 Kitchen Waste Based Biogas Plant

The main aim of this research work is to set-up biogas digester to produce biogas by using cow dung, waste food, Vegetable market waste & poultry dropping as biomass and monitoring characteristics of influent, effluent, gas production and utilizing this data for biogas digester design.

Fig. 3.2 A Kitchen Waste Biogas Plant

4. METHODOLOGY

Process of biogas generation from kitchen waste is given below:
An amalgam of finely ground kitchen waste and water is made in 1:1 proportion. For 1 liter of solid organic waste(800 gm kitchen waste and 200 gm cow dung), 1 liter of water is used as feed to the mesophilic tank. Adding sufficient amount of water to the organic matter is essential as it creates a suitable environment for easy degradation and provides the substrate with fluid properties. A constant temperature of 36 degree Celsius is maintained using a solar heater. Production of biogas due to bacterial action will occur within 30-40 days with the complete decomposition of the substrate. Furthermore, to improve degradation and improve gas production regular stirring is done. The gas gets collected in the dome while the substrate commences to move towards the balancing tank due to the pressure difference. The substrate is directed through the outlet pipe towards the second tank where it undergoes thermophilic reaction. Thus, remaining gas production takes place which is drawn through the gas valve. Slurry is then taken out from the draining pipe from the bottom of the tank.

5. EXPERIMENTAL PROCESS

Fresh 200 gm cow dung, 800 gm kitchen waste and rest water is collected and mixed by hand and poured into 2 lit. bottle digester. As it contains the required microorganism for anaerobic digestion. After the inoculation digester is kept for some days and gas production and ph value is checked. During checking the production of biogas, we found that generation is increased with the day and when the slurry become dry the generation also reduced so increase the generation of biogas we mixed the water with the slurry.

Table-5.1 Generated Values of Biogas with Their ph Values

Day	ph	Temprature	Gas(ml)
1	7.2	36	-
2	7.3	35	30
3	7.1	33	50
4	6.3	33	30
5	6.5	34	30
6	6.8	36.5	110
7	6.1	38	140
8	6.9	36	140
9	6.7	35	145
10	6.5	33	145
11	6.5	36	160

12	6.8	36	170
13	6.2	37	190
14	6.5	38	200
15	6.8	36	210
16	6.4	35.5	220
17	6.4	36	230
18	6.5	37	240
19	6.3	35	250
20	6.2	36	250

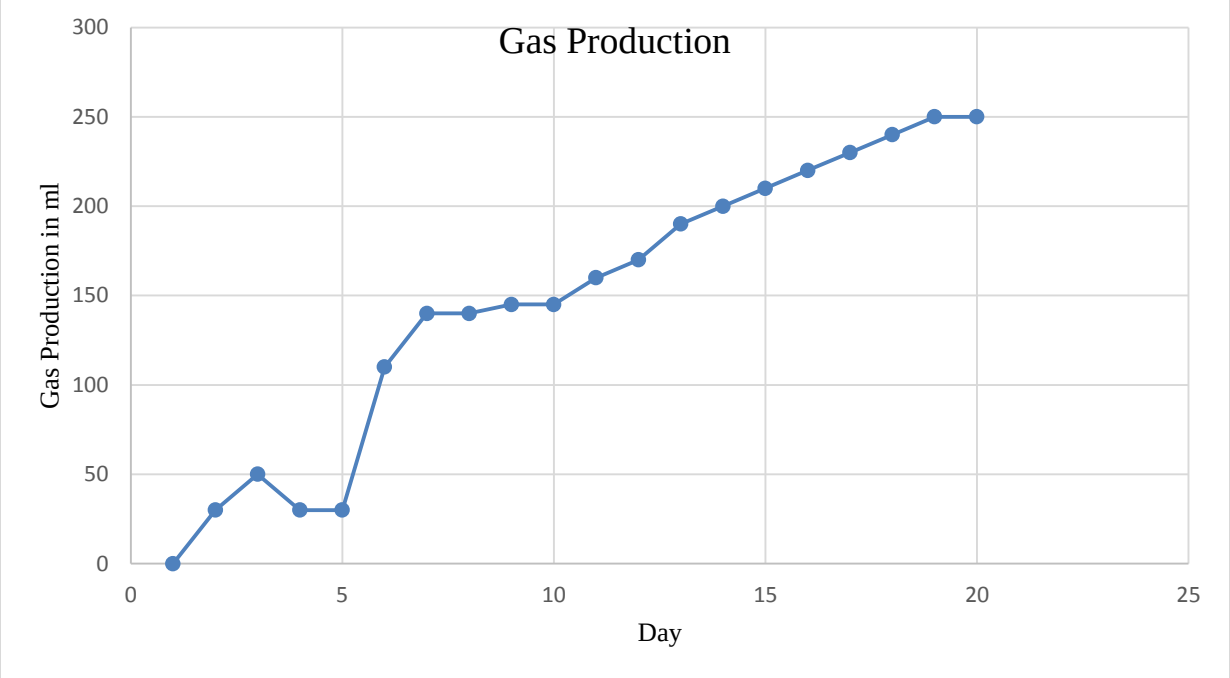

Fig. 5.1 Gas Production V/s day

6. RESULTS

In this experimental set up gas production occurs and gas burned with blue flame. process continues, volatile fatty acids(VFA) are produced which causes the decrease in PH of solution.

6.1 Factors Affecting the Production of Biogas

Many factors affecting the fermentation process of organic substances under anaerobic condition are :

- The quantity and nature of organic matter
- The temperature
- Acidity and alkanity (PH value) of substrate
- The flow and dilution of material

CONCLUSION

From the above facts this is very important to produce biogas and utilization for bio-energy generation for better utilization. This will be very useful for domestic waste management. This biogas plant is very helpful to minimize for LPG consumption, due to biogas production.

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