ISSN No.: 2454- 2024 (online)

International Journal of Technical Research & Science

GENERATION AND ANALYSIS OF BIOGAS BY USING KITCHEN WASTE

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Abstract-Biogas is a type of renewable source of energy which is playing a very vital role for various applications such as for cooking, water heating, operating small engines, pumping water etc. Biogas energy is generated when the wet biomass like cow dung, leaves garbage, pig dung, human excreta, sewage, kitchen waste etc. released by anaerobic decomposition.

Anaerobic decomposition of organic materials produces biogas which is a mixture of methane and carbon di-oxide (nearly 70% and 30 %). But best waste material which can be easily available is kitchen waste in a community level biogas plant. But, biogas is distinct from other renewable energies because of its characteristics of using ,controlling and collecting organic wastes and at the same time producing fertilizer and water for use in agricultural irrigation. Biogas does not have any geographical limitations nor does it require advanced technology for producing energy, also it is very simple to use and apply. In this Paper we have studied the operations for generating biogas from different types of kitchen waste.

Keywords: Renewable energy, Biogas, Kitchen waste, Methane, Carbon dioxide, Digester, Slurry

1. INTRODUCTION

Several studies predicted that a long period of use of conventional sources like petroleum, coal etc. these will finished from the earth surface, it's a very big problem for the whole world, so all are working to get the energy from renewable sources like solar energy, wind energy, geothermal energy, biomass etc.

Biomass alone currently meets 57% of the national energy demand, (Tata, 1998) yet is rarely featured in any 'official' statistics of energy use, given perhaps its scattered nature, and its low status as fuel. Indeed, according to statistics, in 1995, 63.3% of India's energy production was from its reserves of low-grade coal, 18.6% from petroleum, while hydroelectricity, natural gas and nuclear accounted for 8.9%, 8.2%, and 1% respectively (EIA, 1998) [1].

Fig. 1.1 A General Waste from Kitchen

At this time there are several United States patents for biogas digestion technology, many negotiating with biodiesel generation, although biogas each specific building on digestion.

Out of various renewable sources and biogas is one of the best source of energy due to its characteristics and the use of monitoring and collection of organic waste at the same time, production of fertilizers and water to be used in irrigation agricultural. Biogas has no geographic restrictions and does not require advanced technology to produce

energy, but is also very simple to use and apply. Organic materials from kitchen waste is having a high calorific value and nutritive value of microbes, and that is why it can increase the efficiency of methane gas production from several orders of magnitude before as previously stated. This means increased efficiency and reactor size and the cost of biogas production is reduced. It can be unboiled or boiled waste so each type of wastecan be used to generate biogas.

2. BIOGAS

Biogas produced by the remainder of livestock processing residues (manure, compost and unconsumed food), food production (fruit and vegetable waste and residues from meat, fish, dairy processing, and Waste beer factory, food waste, and much more) and the liquid waste industry as well as municipal sewage treatment plants. With the construction of a biogas plant, agriculture and make an important contribution in the supply of energy from renewable resources, as well as the disposal of organic waste.

It implements to the recycling and the law of waste management to perfection with the construction of biogas plants of energy in the rural zones from an economic perspective and an environmental perspective.

Composition of biogas is listed in Table-2.1.

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

There are following components:

- Substrate inlet - This consists of a receptacle for the raw fresh organic waste and pipe of at least 10 cm diameter leading to the digester. The connection between the inlet pipe and the digester must be air tight.
- Digester- This is the reservoir of organic wastes in which the substrate is acted on by anaerobic microorganisms to produce biogas.
- Gas Storage /Reservoir- Depending on the proposed design, this may be simply an empty but enclosed space above the slurry in the digester, an inverted floating drum whose diameter is just slightly smaller than that of the cylindrical digester or an air tight polythene tube with an inlet – outlet outfit.
- Gas Burner-This may be a special lighting lamp or a modified burner for cooking.
- Exhaust outlet- This consists of a pipe of similar size to the inlet pipe connected to the digester at a slightly lower level than the inlet pipe to facilitate outflow of exhausted slurry. [2]

2.1 Working of Biogas Plant is Shown Below

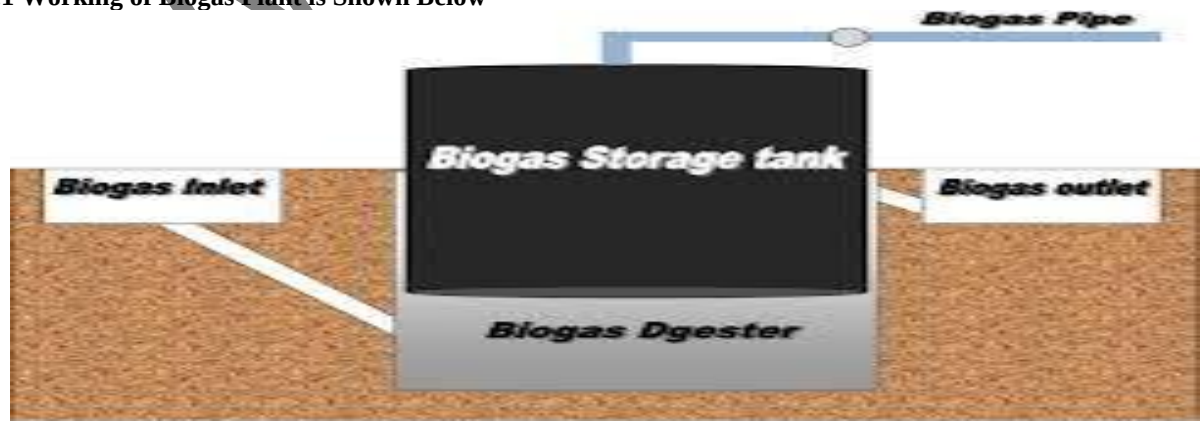

Fig.2.1 Biogas Power Plant

2.2 Kitchen Waste Based Biogas Plant

Utilization of kitchen waste as fuel in Bio digester helps to cater the disposal of waste and in house generation of biogas for cooking and heating purposes. Kitchen waste biogas plant is floating drum type, compact, portable plant. Kitchen waste includes spoilt vegetables, peelings and trimmings, fruit skins and spoilt fruit, cooked and uncooked meat, used teabags, coffee grounds, bread and cooked food waste etc. It is a low manufacturing cost solution to the waste disposal and energy generation. The retention time of waste material is low in comparison with conventional biogas plants. Keeping in view the daily generation rate of kitchen waste the plant can be designed specifically for urban domestic needs.

Fig. 2.2 A kitchen Waste Biogas Plant[3]

3. 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 kitchen waste, 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 35 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. With the help of biogas produced in the mesophilic tank, it attains the constant thermophilic temperature at 550^0C. 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.

4. EXPERIMENTAL PROCESS

Fresh 500gm cow dung, 250gm kitchen waste and rest water is collected and mixed by hand and poured into 10 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.
The amount of generated biogas and ph value of slurry is given in following list.

Table-4.1 Generated Values of Biogas With Their ph Values

Day	ph	Gas (ml)
1	5.5	-
2	5.56	-
3	5.25	-
4	5.01	250
5	4.12	200
6	4.35	350
7	4.21	1500
8	4.11	3100
9	4.09	3200
10	4.08	4500
11	4.07	5100
12	4.06	6200
13	4.04	6300
14	4.03	5200
15	4.00	5100
16	4.01	5000
17	4.02	4900
18	4.12	4850
19	3.99	4800
20	4.00	4750

5. 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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