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Relative Analysis of Biogas from Kitchen Waste

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Abstract: Biogas production requires anaerobic digestion. We should go for creating an Organic Processing Facility to create biogas which will be more cost effective, eco-friendly, cut down on landfill waste, generate a high-quality renewable fuel, and reduce carbon dioxide & methane emissions. The anaerobic digestion of kitchen waste produces biogas, a valuable energy resource. Anaerobic digestion is a microbial process for production of biogas, which consists of primarily methane (CH_4) & carbon dioxide (CO_2). Mixture of vegetable wastes was an-aerobically digested in a 2 L capacity lab scale batch reactors. Biogas can be used as energy source and also for numerous purposes. But, any possible application requires knowledge & information about the composition and quantity of constituents in the biogas produced. The continuously-fed digester requires addition of sodium hydroxide (NaOH) to maintain the alkalinity and pH to 7. For this reactor we have prepared our Inoculum than we installed batch reactors, to which inoculum of previous cow dung slurry along with the kitchen waste was added to develop our own Inoculum. A combination of this mixed inoculum was used for biogas production at 37°C in laboratory (small scale) reactor (2 L capacity). In our study, the production of biogas and methane is done from the starch-rich and sugary material and is determined at laboratory scale using the simple digesters.

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I. INTRODUCTION

Everything, in essence, is about energy. There is no doubt now that energy is fundamental for our development. Energy is vital for the internal and external security of a country and energy issues are at the core of social, environmental and economic security challenges. The search for energy alternatives involving locally available renewable resources is one of the main concerns of governments, scientists and business people worldwide. Biogas is defined as a combustible mixture of gases produced by micro-organisms when biological wastes are allowed to ferment in the absence of air in closed container. Biogas is mainly composed of 50 to 70 percent methane (CH4), 30 to 40 percent carbon dioxide (CO2) and low amount of other gases. Biogas is about 20 % lighter than air and has an ignition temperature in the range of 6500C to 7500C. It is odourless and colourless gas that burns with clear blue flame similar to that of liquid petroleum (LPG) gas.

General waste from kitchen

Its caloric value is 20 Mega Joules (MJ) /m3 and burns with 60 %efficiency in a conventional biogas stove. Biogas refers to a gas made from anaerobic digestion of agricultural and animal waste. The gas is useful as a fuel substitute for firewood, dung, agricultural residues, petrol, diesel, and electricity, depending on the nature of the task, and local supply conditions.

II. BIOGAS

Biogas is a type of biofuel that is naturally produced from the decomposition of organic waste. When organic matter, such as food scraps and animal waste, break down in an anaerobic environment (an environment absent of oxygen) they release a blend of gases, primarily methane and carbon dioxide. Because this decomposition happens in an anaerobic environment, the process of producing biogas is also known as anaerobic digestion.

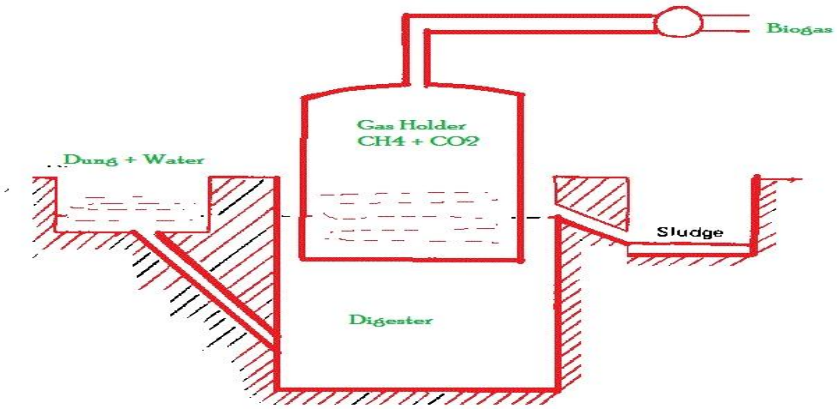
Anaerobic digestion is a natural form of waste-to-energy that uses the process of fermentation to breakdown organic matter. Animal manure, food scraps, wastewater, and sewage are all examples of organic matter that can produce biogas by anaerobic digestion. Due to the high content of biogas (typically 50-75%) biogas is combustible, and therefore produces a deep blue flame, and can be used as an energy source.

Typical 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

Properties of biogas

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



III. KITCHEN WASTE

Kitchen waste is organic materials having the high calorific value and nutritive value to microbes, which increases the efficiency of methane production. Food waste is any food substance raw (or) cooked, which is discarded in the hotels. Food waste is an untapped energy source that mostly ends up rotting in landfills, there by releasing greenhouse gases in to atmosphere which causes diseases like Cholera, Malaria, Typhoid. Hence a proper kitchen waste management strategy needs to be devised to ensure its eco-friendly and sustainable disposal.

IV. 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, mule 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.

V. 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 mule 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 35-40 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.

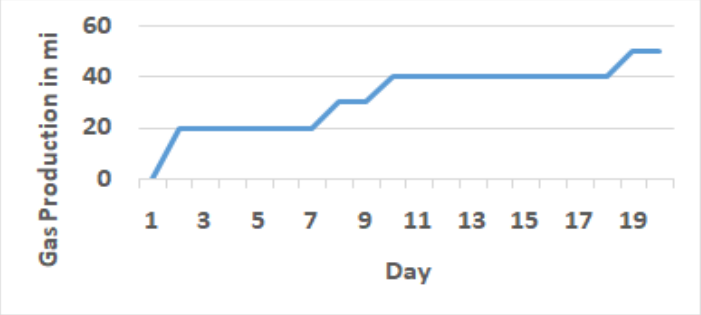
VI. EXPERIMENTAL PROCESS

Fresh 200 gm mule 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.

Day	ph	Temprature	Gas(ml)
1	7.1	39	-
2	6.9	36	20
3	6.6	35	20
4	6.4	37	20
5	6.2	38	20
6	6.6	38	20
7	6.1	38	20
8	6.3	36	30
9	6.5	36	30
10	6.2	38	40
11	6.3	36	40
12	6.5	38	40
13	6.4	37	40
14	6.3	36	40
15	6.2	35	40
16	6.5	36	40

17	6.2	36	40
18	6.3	37	40
19	6.4	38	50
20	6.1	38	50

Table-5.1 Generated Values of Biogas with Their pH Values



Gas Production V/S Day

VII. 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.

VIII. FACTORS AFFECTING THE PRODUCTION OF BIOGAS

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

1) The quantity and nature of organic matter
2)The temperature
3)Acidity and alkanity (PH value) of substrate
4)The flow and dilution of material

IX. CONCLUSION

The study evaluates biogas production from the kitchen waste through anaerobic digestion of 2L capacity designed and built in lab. In the duration of 20 days, biogas production started from2nd day. The total amount of gas production recorded up to 45 days.

Kitchen waste getting converted in the biogas not only becomes an alternative source of energy but also burning the biogas help in reducing the methane production from organic waste which is one of the green house gases. From our study it is evidentthat kitchen waste can become a good feedstock for the biogas production. Kitchen waste contain more biodegradable solid (9.5%), with higher volatile sold (95.6%) than cow dung.

Thus biogas production from kitchen waste higher than the biogas produced from cow dung.

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