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# PRODUCTION AND ANALYSIS OF BIOGAS FROM CANTEEN WASTE

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**Abstract**

The study focused on production of biogas from Canteen waste. The kitchen waste collected from REC Canteen in different days. The pH and mL of gas collection was recorded here. The pH range between 5.5 to 8.5 found during the experiment. The maximum gas collection at pH 8.0 was 3700 ml from the experiment. Food waste is a very good substitute for L P G gas because India is self-reliant in food production.

**Keywords:** Biogas, kitchen waste, pH and LPG Gas.

## 1 INTRODUCTION

The lack of petroleum and coal fuel products leads to a fear throughout the world also the problem caused because of the combustion has lead to search of different energy sources which should also be a renewable source. Wind energy, solar energy, different hydro and thermal energy sources, are one of the major renewable sources in biogas. But, this biogas as a source is different from other renewable sources because of its major characteristics of utilizing, controlling and gathering natural wastes and in the meantime delivering compost or by-products for use in agrarian and watering system.

Deforestation which is one of the major problems faced by developing countries like Indonesia, India, most of the people in these parts mainly depends on fuel-wood and charcoal for supply of fuel which requires the cutting of trees. Also, due to the cutting of forest, leads to soil erosion which is caused by reduction in the fertility of soil. Use of firewood, dung as source of energy also affects the health of humans as well as plants and animals due to the smoke released leads to causing of air pollution. So, that we are provided with eco-friendly sources of energy as a substitute for the above.

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This type of renewable source of energy does not have any kind of topographical limitations or it require any advanced or high powered technology for energy production, it is also very easy and simple to utilize and apply it. Biogas is delivered from natural wastes by concerned activity of different gatherings of anaerobic microbes through anaerobic deterioration. Anaerobic disintegration is a two-stage process as particular microorganisms bolstered on certain natural materials. In the main stage, acidic microorganisms disassemble the intricate natural atoms into peptides, glycerol, liquor and the more straightforward sugars. At the point when these mixes have been created in adequate amounts, a second kind of microscopic organisms begins to change over these less complex mixes into methane. These methane creating microscopic organisms are especially impacted by the encompassing conditions, which can stop or moderate the procedure completely.

**Advantages of Biogas Technology**

- The organic waste can be converted into a good fertilizer.
- It acts as a best renewable source of energy.
- It provides environmental advantages by protecting water, soil, air etc.
- Pathogens contents are reduced thus it creates a hygienic environment.
- Fertilizer and energy substitute leads to micro economical benefits.
- The decentralization leads to energy generation and environmental protection which leads to macro economical benefits.

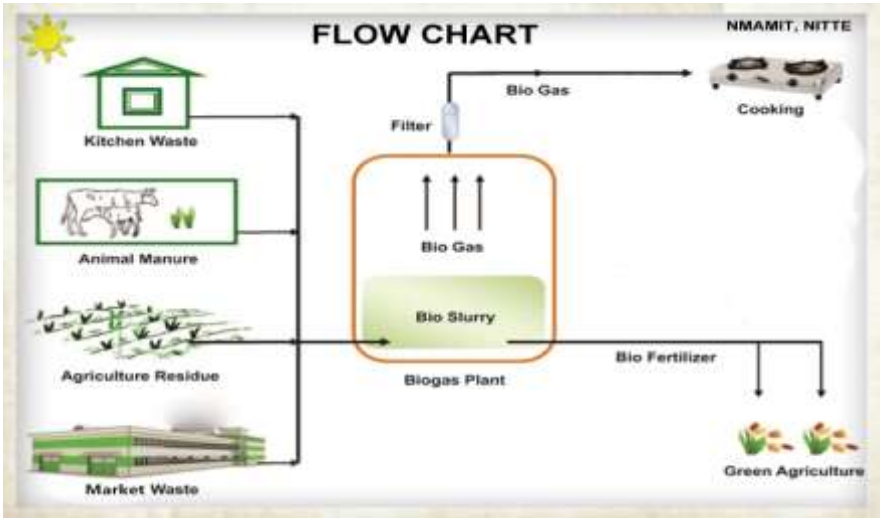


**Fig. 1 Flow chart of anaerobic digestion**

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## 2 MATERIALS AND METHODS

### 2.1 Methodology adopted

### 2.2 Construction of biogas-digester.

#### 2.2.1 Feeding the natural waste to biogas digester-

The waste is blended with water and made into slurry. This slurry is then encouraged into the digester through the inlet. The slurry is left in the digester for extensive measure of time for processing. Institutionalization of parameters like pH, temperature and introductory time prerequisite for biogas era and anaerobic processing is made.

#### 2.2.2 Process occurring in the digester-

Anaerobic microscopic organisms and water in the slurry causes disintegration of slurry. Because of maturation, development of biogas takes place which begins gathering in upper tank gave in the digester.

#### 2.2.3 Collection of gas in upper tank of digester-

The by-results of absorption are biogas and it gets gathered in upper tank of digester.

#### 2.2.4 Removal of carbon dioxide-

Lime water is added in it to evacuate the CO2 present. So, that the CO2 is get converted into Calcium Carbonate.

#### 2.2.5 Collection of effluents-

As the creation of biogas increments, delivered gas applies a weight on the spent slurry. The spent slurry moves out through the outlet. The spent slurry is known as effluents.

#### 2.2.6 Utilization of items-

The slurry must be bolstered ceaselessly to acquire consistent supply of biogas.

### 2.3 Fabrication of Biogas Plant

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**Table 1 Materials List**

| Sl. No. | Materials | Size | No's |
|---|---|---|---|
| 1 | Ball wall | 3/4" | 3 |
| 2 | Cross joint | - | 1 |
| 3 | Gas pipe | 59"(L), 1"(ϕ) | 1 |
| 4 | Water can | 25L | 1 |
| 5 | Digester can | 25L | 1 |
| 6 | Tube | M | 1 |
| 7 | House clamp | - | 8 |
| 8 | Rubber visor | 1" | 2 |
| 9 | Elbow | 3/4" | 2 |

### 2.3.1 Cutting and Placing of tanks

A 25L tank is used as a digester, which is provided with inlet and outlet. The inlet is provided at the top of the digester and outlet at the bottom side of the digester by means of cutting and drilling.

**Fig 2 Digester**

### 2.4 Making the Inlet and Outlet

### 2.4.1 Inlet

Make a hole of 3/4" diameter at the top of the tank and a small pipe is inserted which is used as feedstock inlet. The fittings should be pushed all the way onto the pipe. This may require tapping with a hammer. Use plenty of PVC glue on both the pipe and the fitting to join them together.

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**Fig.3 Inlet of digester**

**Fig. 4 Outlet of digester**

**2.4.2 Outlet**

Holes in the tank for the outlet are made using a jigsaw:

• Mark out the hole of 3/4" diameter and drill a small hole for the jigsaw blade to pass through.

• Cut with the jigsaw – lay the cutting surface horizontally if possible for accuracy

• Finish the hole to the line you have marked using a file. Make the initial cut based on the hole you have marked.

**2.4.3 Residue Outlet**

The existing outlet to the large tank can be used for the residue outlet. However it must be widened to 1".

The female fitting used on the inside of the tank for the residue outlet must be cut short with a hacksaw. If it is not cut there will not be enough space for the gas holder to fit inside the fermentation tank.

**2.4.4 Gas outlet**

A new hole is made at the top of the digester and gas pipe is provided to transfer gas from the digester to the tube.

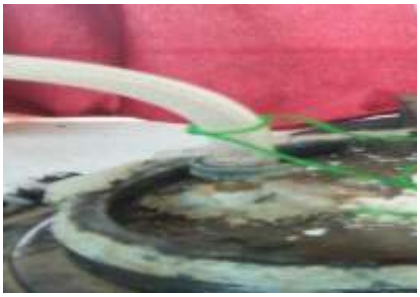

**Fig.5 Gas outlet**

**Fig.6 Gas burner**

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### 2.4.5 Gas Burner

The fittings needed to attach the gas hose to the burner are as follows: (Gas hose)

## 3 RESULTS AND DISCUSSION

### 3.1 Total solids

W1 = Weight of oven dried crucible (grams).

= 26.917

W2 = Final weight of crucible with residue(grams).

= 29.524

$$\text{Total solids (mg/L)} = \frac{(29.524-26.917)10\text{^}6}{20}$$

= 130350 mg/L

### 3.2 Total Volatile solids

W1 = Weight of oven dried crucible (grams).

= 26.917

W2 = Final weight of crucible with residue

= 29.524

W3 = After igniting at 600˚c for 30min

= 27.108

$$\text{Total volile solids(mg/L)} = \frac{(29.524-27.108)10\text{^}6}{20}$$

= 120800 mg/L

Volatile solids = Total solids – Total volatile solids

= 130350 – 120800

= 9550 mg/L

### 3.3 Daily pH values

**Table 2 Daily pH values shown here**

| Sl. No. | Date | pH |
|---|---|---|
| 1 | 24-04-2017 | 4 |
| 2 | 25-04-2017 | 5.34 |
| 3 | 26-04-2017 | 5.5 |
| 4 | 27-04-2017 | 5.8 |
| 5 | 28-04-2017 | 6.0 |
| 6 | 02-05-2017 | 6.4 |

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| | | |
|---|---|---|
| 7 | 03-05-2017 | 6.8 |
| 8 | 04-05-2017 | 7.0 |
| 9 | 05-05-2017 | 7.4 |
| 10 | 06-05-2017 | 7.6 |
| 11 | 09-05-2017 | 8.0 |
| 12 | 10-05-2017 | 8.5 |
| 13 | 11-05-2017 | 9.0 |
| 14 | 12-05-2017 | 9.3 |

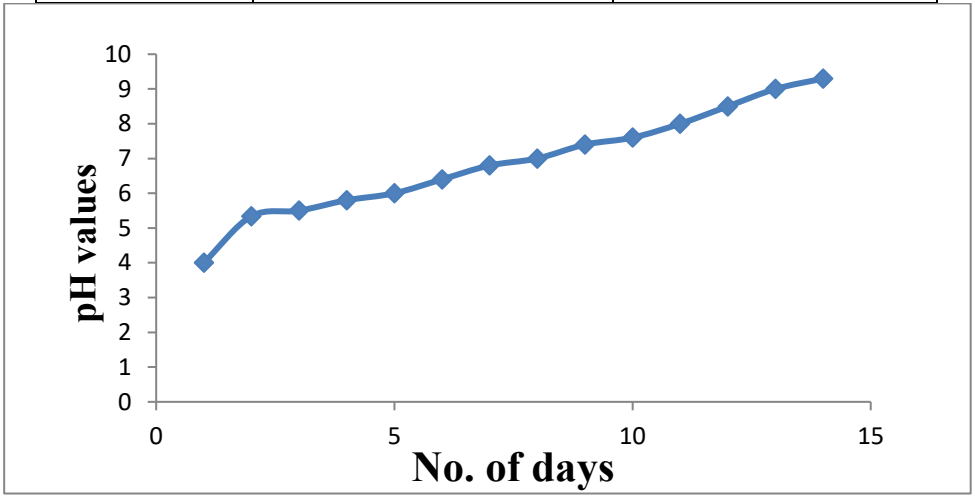


**Fig. 7 Different no. of days with pH values**

### 3.4 mL of gas produced

**Table 3 mL of gas produced daily shown here**

| SL. No. | Date | mL of gas produced |
|---|---|---|
| 1 | 24-04-2017 | 80 |
| 2 | 25-04-2017 | 150 |
| 3 | 26-04-2017 | 260 |
| 4 | 27-04-2017 | 350 |
| 5 | 28-04-2017 | 650 |
| 6 | 02-05-2017 | 850 |
| 7 | 03-05-2017 | 1290 |
| 8 | 04-05-2017 | 1620 |
| 9 | 05-05-2017 | 2125 |
| 10 | 06-05-2017 | 2800 |
| 11 | 09-05-2017 | 3700 |
| 12 | 10-05-2017 | 2800 |
| 13 | 11-05-2017 | 1200 |
| 14 | 12-05-2017 | 800 |

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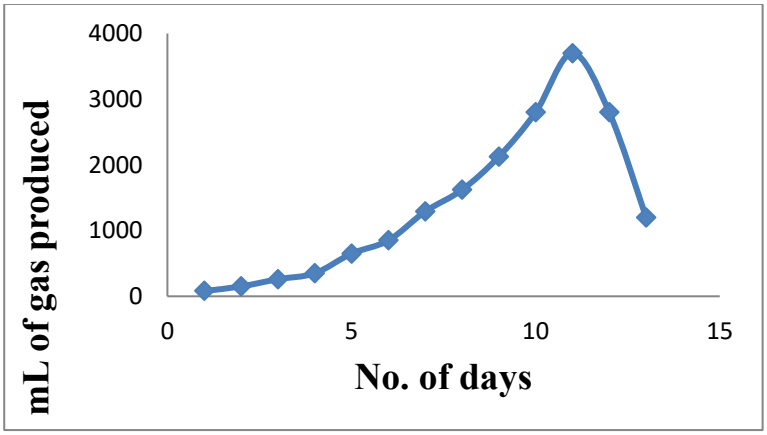


**Fig. 8 Different number of days with mL of gas produced**

### 3.5 pH values and mL of gas produced

**Table 4 Different pH with mL of gas produced**

| Sl. No. | pH | mL of gas produced |
|---|---|---|
| 1 | 4.0 | 80 |
| 2 | 5.34 | 150 |
| 3 | 5.5 | 260 |
| 4 | 5.8 | 350 |
| 5 | 6.0 | 650 |
| 6 | 6.4 | 850 |
| 7 | 6.8 | 1290 |
| 8 | 7.0 | 1620 |
| 9 | 7.4 | 2125 |
| 10 | 7.6 | 2800 |
| 11 | 8.0 | 3700 |
| 12 | 8.5 | 2800 |
| 13 | 9.0 | 1200 |
| 14 | 9.3 | 800 |

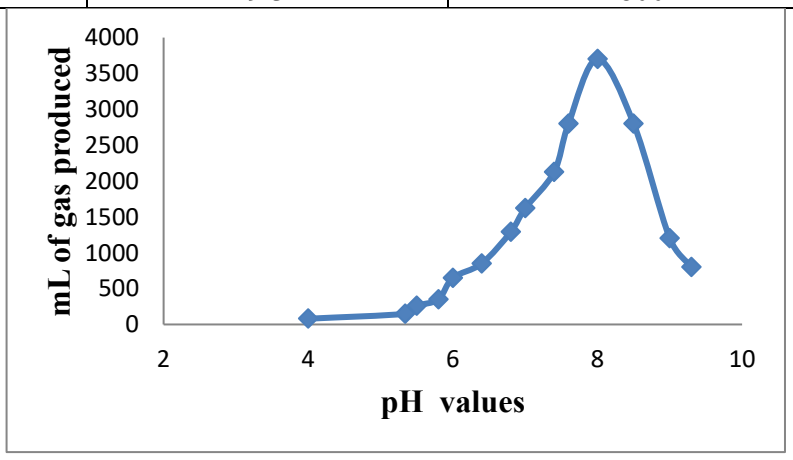


**Fig. 9 Different pH with mL of gas produced**

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**3.6 Discussion**

- As per IS code IS 16087:2013 the total solids content should not exceed 7% and as per our results the total solids content present is 5%.
- The pH value should be in the range 5.5 to 8.5.
- As pH value increase the amount of gas produced also increases up to pH 8.5.
- Hence the gas goes on decreasing the pH increases above 8.5.
- The amount of gas liberated as per the methane content present in it, the blue flame appears when the burner is lighted with the help of candle and match box.

**4 CONCLUSIONS**

Based on experimental work and with the help of a Biogas Digester the following results are obtained:

1. Food waste is a very good substitute for L P G gas because India is self-reliant in food production and crude oil is imported.
2. A regular feeding of biogas plant with proper amount will ensure consistent release of biogas and ensures uninterrupted production of gas.
3. Even if the plant is not fed for one or two days, the efficiency of the plant is not affected.
4. Crushed and blended food improves the liberation of biogas as digestion becomes easy.
5. Underfeeding or overfeeding of plant should be avoided. Underfeeding keeps the plant inefficient and overfeeding increases the pH value of food waste and reduces the development of microbes.
6. The local distribution system in any small location between plants and canteens ensures continuous supply of food waste with an added advantage of reduction in environmental hazards.
7. Can easily reduce large amount of the greenhouse gases into the atmosphere.
8. This project can be very much helpful for the rural practice.
9. It is most advantageous on bases of cost since it requires only high installation cost.

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