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EFFECTING PARAMETERS OF BIOGAS PRODUCTION

Ashok Maan[1], Pradeep Kumar Meena[2]

[1]*Department of Mechanical Engineering, Suresh Gyan Vihar University, Jaipur*

[2]*Department of Mechanical Engineering, Delhi Technological University*

ashokmaangvit@gmail.com[1]

ABSTRACT

In this paper we are examining the effective parameters of biogas production. First day we used feed stock rate 150 kg cow dung along with 160 litr water and 5th day again we used 160 kg cow dung along with 250 litr water. After successfully production of methanogenic bacteria we used 10 liter, 13 litr, 20 litr algae at different time of period. We used % of solid content, % of volatile solid, % of ash content, and % of moisture content in feed stock. pH value of different wastage can be calculated by pH meter. Slurry temperature, Volume w.r.t days calculated from 11th days to 40th days.

Keywords- Effecting Parameters, pH value, Feed stock, Ash and moisture content.

1. Introduction:-

The risk of decay of petroleum products because of constant utilize, environmental change in atmosphere conditions and look for interchange assets focuses towards bio-energizes. So utilization of bio-powers with or without petroleum product is a superior method to decrease these kinds of admonitions in the field of vitality and condition. India is in best five nations for utilization of bio-fills. About 2% of aggregate vitality utilization is created from bio-fills in India. Presently days, center is around second era bio-fills because of different disadvantages of original bio-energizes. These second era bio-fills are gotten from lignocelluloses matter or green growth. This undertaking centers around improvement of a green growth based biogas framework. Biogas from green growth is an option in contrast to customary petroleum derivatives and a complementation to first era bio-energizes. In the wake of gathering, vitality transformation process for green growth biomass to biogas will be engaged. Anaerobic absorption process is the most ideal approach to create biogas from green growth biomass on the grounds that different procedures are vitality concentrated or less productive.

The wide goal of this undertaking is to build up a biogas framework for green growth. In this undertaking, center will associate with advancement of an anaerobic digester to expand biogas creation through anaerobic assimilation process by thinking about various influencing parameters. To do contextual investigations of different existing biogas plants with a mean to comprehend the preparing, properties and amounts of crude materials included and parameters which influence the anaerobic assimilation process and nature of biogas delivered. To configuration, create and setting up of anaerobic digester for generation of biogas from green growth. To investigate the execution of anaerobic digester for age of biogas from green growth.

2. Literature review:-

The green growth biomass contains starches, fats and proteins. The green growth species which have just single cell is called microalgae. Green growth are delivered in open lakes and in shut photograph bioreactors [1]. The span of microalgae is

**Corresponding author: Ashok Maan*

little and can be seen with magnifying lens just [2].Main types of microalgae are chlorella and spirulina, which are utilized for the generation of bio-fuel [3].The development time of green growth is short, and mass of green growth will be twofold in one to four days. Green growth which have least 30%lipids are increasingly appropriate for bio-fuel creation [4]. Starch in the green growth is the primary constituent for generation of biogas, which is created by the change of sugar. Sugar is created by photosynthesis process. [5]. CO2 is required for development of green growth and it is given in the water. Sharpness and alkalinity of the water, with some physical conditions influence the development of green growth [6]. Open lakes of raceway type can create green growth biomass in the scope of 10 to 25 gram for every square meter [7]. Biogas can be created from wet biomass of green growth by anaerobic absorption process. At present numerous investigations have been completed on the anaerobic processing of green growth [8]. Anaerobic assimilation of green growth is a test because of its thick cell dividers. Thickness of cell dividers of green growth is 0.1 to 0.3 micrometer [9].

3. Methodology and Result-

3.1 Calculation for anaerobic digester

Under mesophilic conditions and Retention time=30 days

Considering Volume of digester = 1000 liter with a drifting drum limit of 500 liter. For this a water tank of 1000 liter and 500 liter limit can be utilized.

Slurry volume= volume of digester/Retention to time = 1000/6 = 170 liter =1000-170=830 liter

(1/6 part of digester is utilized as dead territory and rest for slurry)

Slurry volume= 830 liter

Gas storage= 170 liter

Rate of feedstock=Active digester volume/Retention time = .830/30=.02785 m3/day

From Bus well condition, Algae: water=1:1.3

Mass of algae= (1/2.3)*.02785=.0121m3/day

Thickness of green growth =800 kg per shape meter =.0121*800=9.7Kg/day

Thickness of water=1000Kg/day

Mass of Water=(1.3/2.3)*.02785=.01575m3 /day =.01575*1000=15.75 kg/day

Volume of slurry=9.7+15.75=25.45 Kg/day

Add up to slurry after 30 days=25.45*30=763 kg

Organization of lake green growth is appeared in table 1.

Table 1: Pond algae analysis:-

Moisture	% air dried volatile matter	Fixed carbon	Ash	% dry ash free (VM)
4.01	64.60	6.4	25	90.99

Unstable solid= 64.9%

Stacking rate:- Total VS produced=amount of green growth feedstock*VS% = 9.7*.65=6.3 kg/day

Expect 60% VS expulsion at 30 days SRT under mesophilic conditions

Versus removed= VS loading*VS evacuation effectiveness = 6.3*.60 Kg/day= 3.8 kg/day

One kg VS produce=0.271m3 biogas under perfect conditions 3.8 Kg VS deliver =1.025m^3 biogas

Thickness of biogas=1.15 Kg/m^3

Mass of biogas produced=1.15*1.025 =1.18 Kg every day

Add up to strong waste from digester

(Add up to solids-Volatile solids)+ (Total unstable VS evacuation) (9.7-6.3) + (6.3-3.8)= 5.9 kg every day

3.2 Steering framework:-

Thickness of green growth is 800 kg for every cubic meter. So a legitimate blending of green growth biomass with slurry in the digester is fundamental. For this instigator is utilized. This can be physically, mechanically or electrically. In this digester, outspread sort instigator which is worked physically is utilized. Spiral sort instigator is utilized for legitimate blending. By legitimate blending microorganism in the digester have more region for processing. So processing rate of feedstock is expanded. Fomenter has four sharp edges at an edge of 45°. At this position edge of fomenter connected greatest power to the slurry. This instigator is settled in the drifting drum. By turning the drifting drum blend the crisp feed stock is blended with slurry.

3.3 Digester Heating:-

For effective creation of biogas, great conditions ought to be kept up in the digester on the grounds that anaerobic absorption is an unpredictable procedure. Execution parameters like strong stacking rate, blending, pH are autonomous of condition. Be that as it may, temperature of digester is influenced by encompassing temperature. So it is most influenced parameter in the assimilation procedure. For a mesophilic digester temperature ought to be kept up at 35-40 degree C.

At that point two conditions ought to be satisfied in the digester:-

- Raising the digester temperature up to mesophilic temperature through a warmth source;
- Maintaining the temperature in digester by ideal protection of digester.
- Two kinds of misfortunes from the digester,
- Heat lost from the assemblage of digester because of encompassing conditions,
- Adding the feedstock in the digester.

Warmth lost from the digester can be lessened by giving the protection.

To bring the temperature up in digester a curl sort of warmth exchanger is utilized. The working liquid in warmth exchanger is water.

Figure 1:

In the wake of setting up of digester, diverse operational and execution parameters, for example, feed rate, nature of feed material, maintenance time, temperature, pH, volume of gas created, and nature of gas are watched. On 18 March, 2018 the digester was begun with 300kg slurry (150kg bovine dung+ 150 liter water). Following five days, 23 March, 2018 slurry in digester was additionally included (160 kg dairy animals manure and 250 liter water) and left for multi week. The nature of biogas delivered was checked with a 10 days hole. The temperature and ascent of skimming drum were noted to gauge volume of biogas delivered on hourly premise.

3.4 Feedstock rate:-

The feed rate of feedstock (cow dung and algae) in the digester is given in table 2.

Table 2: Feedstock rate for digester

1st day	150kg cow dung+160 liter water
5th day	160 kg cow dung + 250 liter water
20th day	10 liter algae
25th day	13 liter algae
30th day	20 liter algae

3.5 Composition of feedstock:-

3.5.1 Solid substance in feedstock: - To decide the strong substance in feedstock, take the example of feedstock. Taken the underlying weight of the example and set in stove for one hour at 105 °C for expelling dampness. Following one hour taken the heaviness of dried example and ascertain the strong substance.

$$\%\ \text{Solid content} = \frac{\text{final weight}}{\text{Initial Weight}} \times 100\text{---------}1$$

Solid content in cow dung and algae is given in table 3.

Table 3: Solid Content in feedstock

Feedstock	Initial weight(gm)	Final weight(gm)	% Solid content
Fresh cow dung	1.0199	0.4976	48.79
Algae	1.0494	0.2578	24.56

3.5.2 Volatile solid in feedstock:-To determine volatile material one gram sample was put in a muffle furnace at 650°C for 7 minutes. The sample was partially covered in the crucible.

$$\%\ \text{Volatile content} = \frac{\text{Initial weight} - \text{final weight}}{\text{Initial Weight}} \times 100$$

---------------- (ii)

Volatile matter in cow dung, algae and in digestive material is given in table 4.

Table 4: Volatile Solid in Feedstock

Feedstock	Initial weight(gm)	Final weight(gm)	% Volatile Solid
Fresh cow dung	1.0557	0.1843	82.54
Algae	1.0017	0.2650	73.54
Digestive material	1.0030	0.2021	79.85

3.5.3 Ash content: -To determine ash content placed the sample in muffle furnace at 650°C for 30 minutes.

$$\%\ \text{Ash content} = \frac{\text{Final weight}}{\text{Initial Weight}} \times 100\ldots\ldots\ldots\ldots\ldots\ldots(\text{iii})$$

Ash content in cow dung, algae and in digestive material is given in table 5.

Table 5: Ash Content in Feedstock

Feedstock	Initial weight(gm)	Final weight(gm)	% Ash content
Fresh cow dung	1.1669	0.1485	12.72
Algae	1.1468	0.0664	5.79
Digestive material	1.0464	0.0940	8.98

3.5.4 Moisture content:-To decide dampness in feedstock, squashed the example in powder frame and set in boiler at 105°C in a silica pot for two hours. At that point following two hours, cooled the example and weighted. At that point procedure was rehashed for 3 hours.

$$\%\ \text{Moisture content} = \frac{\text{Initial weight of Solid} - \text{Weight of dry solid}}{\text{Initial Weight}} \times 100$$

------------------ (12)

Moisture content in cow dung, algae and in digestive material is given in table 6 .

Table 6: Moisture Content in Feedstock

Feedstock	Initial weight(gm)	Final weight(gm)	% Moisture content
Fresh cow dung	1.0199	0.9942	2.52
Algae	1.0640	1.0143	4.67
Digestive material	1.0494	0.9905	5.61

3.5.5 Fixed carbon: 100-(%VM-%Ash-Moisture)

Summary of composition of feed stocks is given in table 7.

Table 7: Composition of feedstock

Feedstock	VM (%)	Ash content (%)	Moisture (%)	Fixed carbon (%)
Cow dung(fresh)	84.34	11.72	2.52	1.42
Algae	73.54	10.82	4.67	10.97
Cow dung(digestive)	79.85	8.98	5.61	5.56

3.6 pH Value:

pH esteem is a proportion of nature of slurry. For small scale living being development in digester pH esteem ought to be over 6 and underneath 8. To quantify the pH of slurry an advanced pH meter was utilized. An example of slurry was taken in a spotless test cylinder to quantify pH. The test of pH meter was plunged in slurry test. It gave the incentive at computerized marker. The estimations of pH are inside the range as given in table 8.

Table 8: pH value of slurry

Parameter	Fresh cow dung slurry	Fresh Algae slurry	Digester slurry
pH	6.56	6.62	6.54

3.7 Slurry temperature, Volume vs. days:-

To gauge the slurry temperature a thermocouple with a computerized pointer was utilized. Perusing was taken from10:00 AM to 5:00 PM. Volume of delivered biogas was estimated with a chart paper which was settled at the gliding drum. Ascending of drum show the generation of biogas. By seeing the stature ascent of the skimming drum, the volume of created gas was determined.

Figure 1: Thermocouple for temperature measurement

Figure 2: Graph scale to measure rising height of floating drum

Slurry temperature and volume of produced biogas on 11th day is shown in figure 3**.**

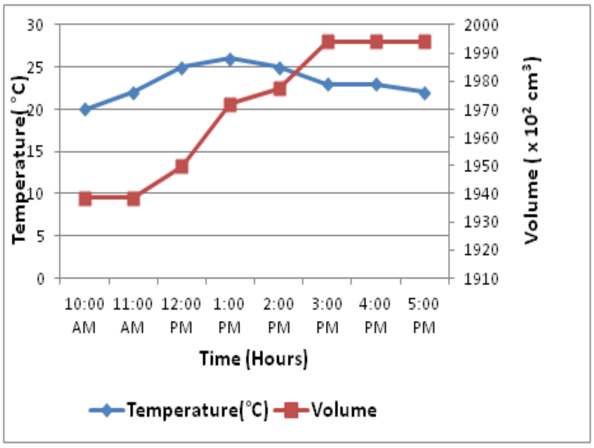

Figure 3: Temperature and volume on 11th day

This diagram demonstrates that slurry temperature is low. This is beginning of mesosphilic temperature go. Volume of biogas created is less. Slurry temperature and volume of created biogas on twelth day is appeared in figure 4.

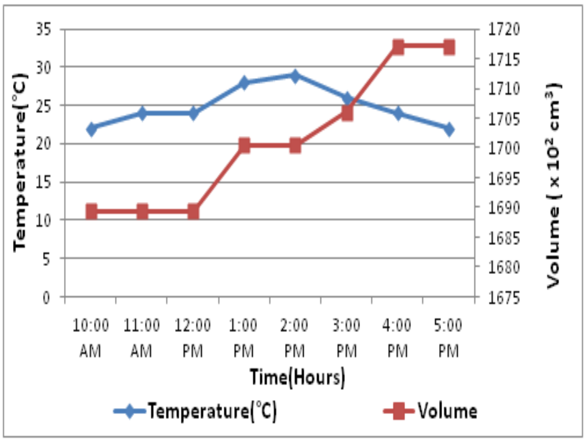

Figure 4: Temperature and volume on 12th day

This diagram demonstrates that as the temperature builds, volume of created biogas likewise increments. Amid morning time temperature is low, volume of biogas is additionally less. As the temperature is at top between 1:00 to 2:00 pm, more volume of biogas is delivered. Slurry temperature and volume of delivered biogas on thirteenth day is appeared in figure 5.

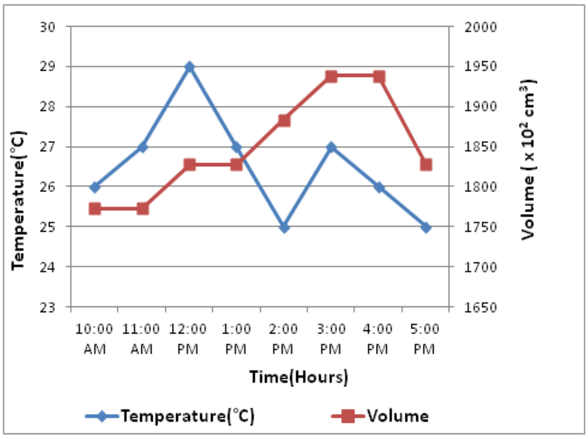

Figure 5: Temperature and volume on 13th day

Similarly we found out volume of production w.r.t temperature from 14th days to 40th days. This graph shows that as the temperature changes, volume of production of biogas also changes. This shows the direct effect on production of biogas. Slurry temperature and volume of produced biogas on 40th day is shown in figure 6**.**

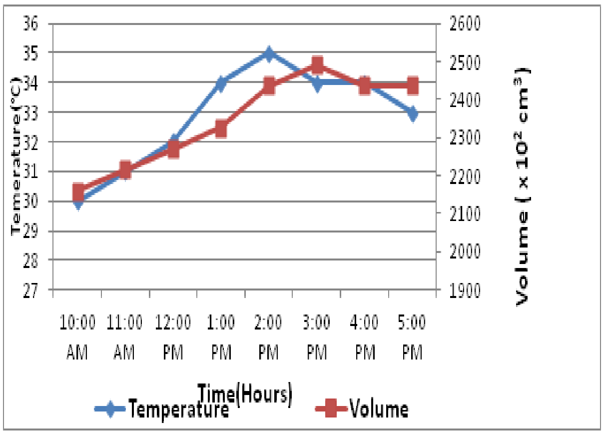

Figure: 6: Temperature and volume on40th day

Digester slurry attains 30 days retention time, feeding in proper ratio and slurry temperature was good. Digester was working in efficient way and production of biogas was increased day by day.

4. Conclusions:-

- Case thinks about demonstrate that biogas can be created from a productive biogas plant by utilizing diverse substrates.
- Results demonstrate that nourishing ought to be appropriate. High stacking rate can influence the biogas generation.

- Retention time assumes an imperative job underway of biogas from a digester. There ought to be least 20 days maintenance time for generation of biogas. Methane focus in biogas created for the most part relies on maintenance time.
- Temperature is a central point for development of smaller scale life forms. Temperature of slurry in the digester ought to in the mesophilic go. Amid summer, temperature is adequate for biogas digester and amid winter, a warmth source is required to keep up the temperature in the digester. Generation of biogas was less during the evening and all the more amid day time. This shows impact of temperature on creation of biogas.
- Methane focus was about 15% following 10 days and about 54% following 30 days. Methane focus was expanded step by step.
- Volume of biogas created was expanded as more maintenance time achieved by digester.
- After bolstering green growth in digester comparable outcomes were seen likewise with dairy animals fertilizer. Green growths are great substrate for biogas digester.

5. Future Scope of Work

1. In the biogas digester

- In this digester about 25% cow excrement is supplanted with green growth. In continuation of this venture 100% dairy animals waste can be supplanted with green growth
- Cow compost and green growth have low C: N proportion. A carbon rich co-substrate can be utilized with green growth.

2. Usage of biogas

- For the usage of biogas in vehicles, scouring is required. A proficient cleaning procedure can be utilized.
- Easy stockpiling and transportation of biogas are required for better usage of biogas.

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