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Development of Bio-digester for the Generation of Biogas from Domestic & Industrial Waste

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Abstract—*Biogas is a combustible mixture of gases. It consists mainly of methane (CH_4) and carbon dioxide (CO_2) and is formed from the anaerobic bacterial decomposition of organic compounds, i.e. without oxygen. The gases formed are the waste products of the respiration of these decomposer microorganisms and the composition of the gases depends on the substance that is being decomposed. If the material consists of mainly carbohydrates, such as glucose and other simple sugars and high-molecular compounds (polymers) such as cellulose and hemicellulose, the methane production is low. However, if the fat content is high, the methane production is likewise high.The main objective of our piece of research work is to develop a compact bio-digester for bio gas generation by using various domestic and Industrial wastes as feed stocks. The retention time of the bio digester is around 45 days and the efficiency of the bio-digestor is 0.8% .*

Keywords*:-Biogas, carbon dioxide, cellulose and hemicellulose etc.*

1. INTRODUCTION

Today there is a challenge of the scarcity of the utilization of conventional sources of energy around the world because of the increases of demand day by day and the economic barriers. The researchers and scientist is need to finding the new routes of energy and make alternative sources more effective for future. The conventional Biogas plants of cattle dung, distillery effluent, municipal solid wastes or sewage are employed to overcome these threats. But these plants are inefficient because of lower calorific value of biogas andlesser methane generation.[1-2] The major task for the future is to improvement of precision, reproducibility and representativeness of the methods used for emission of methane.Biogas typically consists of 50 to 65 % (volume) CH_4, 35 to 50 % (volume) CO_2, 4 to 6 g/m³ of H_2S and 30-160 g/m3 of water [3].Biogas can be used for heat and electricity production or can be upgraded to vehicle fuel [4]. The numerous methods have been developed over the last three decades for the collection and prevention of the biogas generation [5].

2. ANAEROBIC DIGESTION:

The process of anaerobic digestion involves several steps like hydrolysis, acidogenesis, acetogenesis and methogenesis reaction. These four main stages of this degradation can be distinguished [6-7]

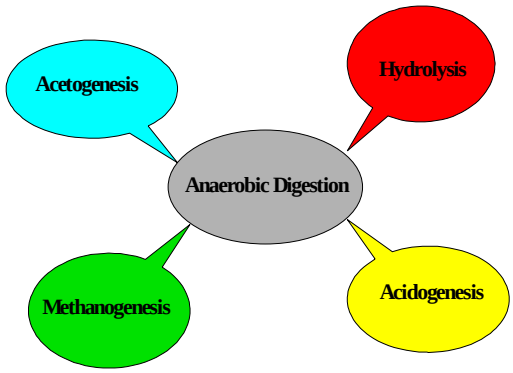

Fig. Stages of anaerobic digestion

Methane being the lightest gas, when its concentration increases, the gram molecular weight of the biogas decreases [8].The production of biogas from slurry takes with the generation of bubble in the slurry. The birth of a bubble can happen when there is excess pressure inside the bubble. According to the Laplace equation, excess pressure

$$p = 2S/r$$

Where S = surface tension

r = bubble radius

When the bubble is formed at depth h, from the surface of slurry, then the external pressure is,

$$Pex = Phead + \rho gh$$

P head is the pressure inside the headspace of the reactor (or atmospheric pressure). gh is the static pressure of liquid at bubble height h from the surface.

Formation of the bubble inside the slurry can exist only when the pressure inside the bubble balances the external pressure (Pex) and the surface tension.

$$Pin = Pex + 2S/r$$

This shows extremely high pressure is required at the time of the birth of a gas bubble because when r is too small, 2S/r becomes significantly large.

3. BIOGAS PLANT & ITS COMPONENTS:

Biogas plant mainly contains following components:

1. **Digester**
2. **Collector (Dome)**
3. **Inlet Chambers**
4. **Pipes (Inlet-Outlet)**
5. **Slurry tank**

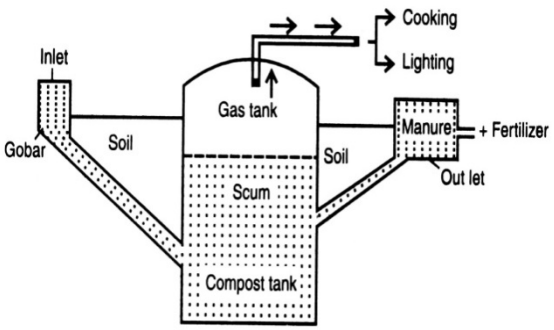

Fig. A schematic representation of Biogas plant

4. MATERIALS AND METHODS:

The waste material used for feeding of bio digester was collected from home and nearby industrial area phase II Noida. The digester used is of metal prototype 30Lts of capacity with proper lid. The proper insulation has been made for prevention of any loses and maintains the temperature of digester in between 30^0C to 35^OC. A graduated transparent flask for measuring volume of gas production, manometer is used to measure the pressure inside the digester, Beckmann's thermometer, digital pH meter hosepipe, soap as sealing agent and biogas burner fabricated locally for checking gas flammability.

The biogas plant is then tested using slurry derived from domestic and Industrial with varying retention time.In the experiment we used soap to ensure no leakage at the inlet and outlet. In this study, the maximum storage domestic and industrial waste forfour weeks. We calculate the efficiency of biogas which is derived from the above waste, by adding water with varying temperatures25^0C until it reach to 45^0C, and found better than the reported small bio gas plants.

5. ANALYSES OF DOMESTIC AND INDUSTRIAL WASTES :

1. Physicochemical analyses
2. Biochemical analysis
3. Microbial analysis
4. Statistical Analysis

6. GAS CHROMATOGRAPHY :

Gas Chromatography (GC) is an optimal analytical instrument for the analysis of components such as CH4, CO_2, H_2S and siloxanes which are present in the gas [9]. The most important factors affecting the precision of biogas volume measurement and sensitivity are errors due to varying temperatures, vapor content, solubility and pressure [10]. The gas measurement technique and process itself can result in the inhibition of anaerobic digestion. This is because the high amounts of dissolved CO_2 can affect the pH of the medium and, consequently, can alter the microbial activity [11].

7. CONCLUSION

The study has shown that domestic specially kitchens and industrial waste which abound everywhere including the immediate environment is easy availablefeedstock for biogas production. This waste can be utilized for energy generation instead of discharge openly and save environment up to some extent.

REFERENCES

[1] Hrad, M., Piringer, M., Huber-Humer, M; Determining methane emissions from biogas plants – Operational and meteorological aspects. Bioresour.j.biortech ;191, (2015)

[2] Vivek Kumar Singh; Comparative Study of Portable Floating Type Bio-Gas Plants with Various Organic Waste Feed Stacks;IJAAEEE ,3 (2014)

[3]T. Nijaguna, "Biogas Technology," New Age International, 46-48, (2002)

[4] I. Angelidakiet. al, "Anaerobic biodegradation, activity and inhibition (ABAI), "Technical University of Denmark.

[5] A. Rozzi, E. Remigi, "Methods of assessing microbial activity and inhibition under anaerobic conditions: a literature review," Reviews in Environmental Science and Bio/Technology, 3, 93–115, (2004).

[6] A. Franco, A. Mosquera-Corral, J.L. Campos, E. Roca, "Learning to operate anaerobic bioreactors," University of Santiago de Compostela, (2007).

[7] MałgorzataCimochowicz-Rybicka, "Effect of anaerobic sludge composition on a biogas production,"Cracow University of Technology.

[8] D. Ludington, "Calculating the heating value of biogas," Dairy Farm Energy, (2005).

[9] A. Andersen, J.Seeley, J. Aurand, "The Use of Gas Chromatography for Biogas Analysis," The American Physical Society, (2010).

[10] M. Walker, Y. Zhang, S. Heaven, C. Banks, "Potential errors in the quantitative evaluation of biogas production in anaerobic digestion processes," Bioresource Technology, 100, 6339-6346, (2009).
[11] F.L. Mould, R. Morgan, , K.E. Kliem, E. Krystallidou, "A review and simplification of the in vitro incubationmedium," Animal Feed Science and Technology, 155–172,155-172, (2005)