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EXTRACTION OF BIOGAS FROM KITCHEN WASTE: PRODUCTION AND ANALYSIS

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ABSTRACT

Anaerobic digestion process produces a gaseous product, called 'biogas', which is composed mostly of methane and some carbon dioxide. Anaerobic digestion only releases carbon to the gas phase; the other nutrients (nitrogen, phosphorus, and micro-nutrients) remain in the effluent, which makes it a high-quality organic fertilizer and amendment. Biogas does not have any geographical limitations nor require advanced technology for the production of energy. Anaerobic treatment is clearly suitable for India's tropical climate. The reduced cost brought about by lower power consumption are generally enough among all the waste treatment methods even if any returns of gas utilization are neglected. The biogas is convenient source of energy. Kitchen waste from Hotels, Houses, Hostels, Canteens, Temples etc. are to be collected. Where it is a daily large amount of kitchen waste is obtained and Hence for better and effective utilization for better purpose. Biogas is valuable energy source which has high calorific value. It is also used for various purposes. Biogas production is a microbial process in which organic kitchen waste is decomposes into valuable product like Gas and Slurry. Hence bio gas is the most eco-friendly substitute for energy. Biogas is primarily mixture of Methane (CH4), Carbon dioxide (CO2), and other gases like Ammonia (NH3), Hydrogen Sulphide (H2S), Nitrogen (N), Hydrogen (H), and Oxygen (O2).This biogas production also performs the function of waste disposal system and it also prevents the potential source of environment and spreading pathogens and disease causing bacteria. The biogas production is also helpful for the environment cleanliness. It residues is also helpful for fertilizer in farm.

Keywords: biogas, anaerobic digestion, calorific value, environment, kitchen waste

I. INTRODUCTION

There are many suggestions that the biogas was used for heating bath water in Assyria as long ago as the 10th century B.C. and that anaerobic digestion of solid waste may well have been applied in ancient China. However, well documented attempts to harness the anaerobic digestion of biomass by humans date from the mid- nineteenth century, when digesters were in constructed in New Zealand

and India, with a sewage sludge digester built in Exeter, UK to fuel street lamps in the 1890s. Biogas is a very essentially technology for the bio-digestion of any organic material under anaerobic conditions. This process does not require large expenditures of energy, as we know it is biological process driven by a mixed culture of bacteria in the absence of oxygen. But Beyond making a carbon-neutral, renewable source alternative to natural gas, biogas production provides a sustainable method for disposing of organic wastes. This is an ideal alternative advantage because it could be a less and better expensive option for lower income communities. An ideal renewable energy source is one which is locally available, affordable and can be easily used and managed by local communities. The problems arises when non-sustainable use of fossil fuels are promoted and traditional biomass fuels have led to increase the worldwide awareness on research on the accessibility of new and alternative to renewable energy resources like biogas. The development in the field of renewable energy sources i.e. particular to biogas technology and can be helpful to reduce the dependence on other non-renewable sources and minimize the social impacts on the environmental degradation problems which is related with fossil fuel.

component	Concentration (by volume)
Methane (CH_4)	55- 60%
Carbon dioxide (CO_2)	35- 40%
Water (H_2O)	2- 7%
Hydrogen Sulphide (H_2S)	20- 20.000 ppm (2%)
Ammonia (NH_3)	0- 0.05%
Nitrogen (N)	0- 2%
Oxygen (O_2)	0- 2%
Hydrogen (H)	0- 1%

Table -1: composition of biogas

II. Literature Review

Shalini singh et al.[1] (2000) studied the increased biogas production using microbial stimulants. They studied the effect of microbial stimulant aquasan and teresan on biogas yield from cattle dung and combined residue of cattle dung and kitchen waste respectively. The result shows that dual addition of aquasan to cattle dung on day 1 and day 15 increased the gas production by 55% over unamended cattle dung and addition of teresan to cattle dung : kitchen waste (1:1) mixed residue 15% increased gas production.

Lissens et al.[3] (2004) completed a study on a Biogas Operation to increase the total biogas yield from 50% available biogas to 90% using several treatments including a mesophilic laboratory scale continuously stirred tank reactor, and an up flow biofilm reactor, a fiber liquefaction reactor releasing the bacteria Fibrobacter Succinogens and a system that adds water during the process. These methods were sufficient in bringing about large increases to the total yield; however, the study was under a very controlled method, which leaves room for error when used under varying conditions.

Ravi P Agrahari and G N Tiwari[5] (2013) compared different ratios of Kitchen Waste Under Aluminum Made Biogas Plant. Aluminium is also better alternative on the basis of biogas production and also safe for the environment because it can easily be disintegrated by microorganisms but plastic creates a lot of environmental problem due to its non-biodegradable nature. Black painted aluminum made biogas plant will be the best alternative under community level biogas production from kitchen waste.

Cunsheng Zhang et al.[7] (2014) formed A Buffer System By Volatile Fatty Acids and Ammonia, resulting in higher methane yield and system stability. Co-digestion of food waste with other substances such as waste water could enhance the biodegradation of long chain fatty acids.

III. MATERIALS AND METHODS

a) MATERIALS

A biogas production system consists of the following features: a) 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. b) Digester This is the reservoir of organic wastes in which the substrate is acted on by anaerobic microorganisms to produce biogas. c) 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 airtight polythene tube with an inlet–outlet outfit. d) Gas Burner This may be a special lighting lamp or a modified burner for cooking. e) 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.

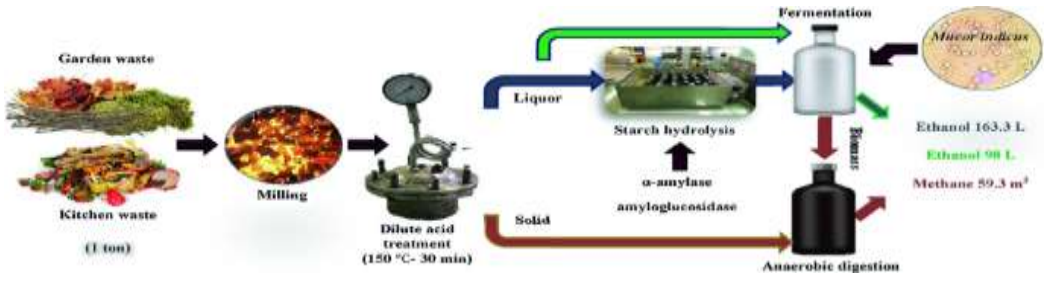

Fig -1: Layout of biogas production from kitchen waste

b) METHODS

Organic substances exist in wide variety from living beings to dead organisms. Organic matters are composed of Carbon (C), combined with elements such as Hydrogen (H), Oxygen (O), Nitrogen (N), and Sulphur (S) to form variety of organic compounds such as carbohydrates, proteins and lipids. In nature MOs (microorganisms), through digestion process breaks the complex carbon into smaller substances. There are two types of digestion process

Fig -2: Anaerobic digester

IV PROJECT DESCRIPTION

a) Project Objectives

1) Optimization of gas production
2) Comparison with conventional plants
3) Effect of different parameters like
   i) Temperature
   ii) PH
   iii) Total & volatile solid concentration
   iv) Alkalinity
   v) C: N Ratio

4) To increase the production by using
   i) Additives
   ii) Nutrients
   iii) Nitrogen source
5) Check optimization of gas production at lab scale andfield scale.

V. CONCLUSION

Biogas is produced from the kitchen waste for better alternatives like animal dung and other waste. Biogas produced at very high rate and efficiently & the biogas digester is simple but effective option

to save cost on power. It is depend upon the temperature of digester and its constructions and size. Biogas has been stated as one of the most leading source of clean renewable energy which can replace the fossil fuels, resulting in reduction of environment problems affected by non-renewable sources. It is very easy and cost effective method. It is an option for replacement of non-renewable energy source. The total biogas generated in the system over the experimental period is the sum of methane and carbon dioxide.

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