BIOGAS PRODUCTION FROM KITCHEN WASTE

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Abstract

Biomass includes cow dung, kitchen waste, wood etc. Among these biomasses this paper will be focusing on the kitchen waste which will result in around 60% of methane gas, 30% will include carbon dioxide, 8% nitrogen and rest 1 to 2 % of hydrogen sulphide. This situation arises due to shocking increment in the rates of oil. In order to overcome this issue most of the countries are working for the development of technology using renewable resources. These resources include solar, wind and biomass. This paper will state the best possible option to perform anaerobic digestion process in order to generate excess amount of biogas at homes. It will also discuss procedure for the removal of toxic gases which exist in biogas and can be harmful for humans as well as it degrade biogas quality. In our research, the generation of biogas and methane is done from the sugary and starch-rich material and is determined at small scale using the elementary digesters.

Keywords: Biomass, kitchen waste and renewable resources.

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INTRODUCTION

Kitchen waste is bio-material having the high energy value and calorific value to microorganisms, that's why efficiency of biogas generation can be expanded by several ways of magnitude. The dumping of food waste is the main cause of pollution can be finished in low cost and environment friendly way [1] [2]. Considering cost effective is not the target the dumping of waste must be done in proper way for maintaining hygiene. The disposal of food in areas and making the places unhygienic and it needs the solution. Installation of biogas plants give the proper way of utilizing and proper storage of waste [3].The process of anaerobic digestion is a key path that allows to efficiently handle a use biofuel (which is comprised of mostly methane and one fourth of carbon dioxide) in order to produce energy [4].

Fossil fuel provides the bulk of the world's primary source of energy. Since they are non-renewable natural resources with little to conserve the earth's supply, supplies of fossil fuel (especially oil and gas) may soon get completely depleted. The establishment of biogas plants in these communities would greatly ameliorate these problems and help preserve the environment. Biogas is distinct from other renewable energy source such as solar energy, wind energy, thermal and hydro sources of energy because of its characteristics of using controlling and collecting organic waste and at the same time producing fertilizer and water for use in agricultural irrigation. Anaerobic digestion process produces a higher biogas yield when running on a mixture of animal manure and vegetable/crop waste rather than animal manure alone, and biogas production is considered the most suitable bio energy technology in china [5]. The slurry and residues from the biogas process can also be used as an organic fertilizer to replace the use of chemical fertilizer on the farm [6,7]. The composition of biogas is typically methane (50-70%), carbon-dioxide (30-40%) and the rest is made up of traces of elements of hydrogen sulphide. Biogas can be used in gas engine to convert the energy in the gas into electricity and heat. Biogas is characterized based on its chemical composition and the physical

characteristics which result from it. It is primarily a mixture of methane (CH4) and inert carbonic gas (CO2). However the name 'biogas' gathers a large variety of gases resulting from specific treatment processes, starting from various organic waste-industries, animals or domestic organic waste etc. Different sources of production lead to different specific compositions. The presence of H2S or CO2 and water make biogas very corrosive and require the use of adapted materials. The composition of a gas issue from a digester depends on the substrate, of its organic matter load, and the feeding rate of the digester. According to its composition, biogas presents characteristics for comparison with natural gas propane. Biogas is a gas appreciably lighter than air, it produces twice as less calories by combustion with equal volume of natural gas. The importance of biogas as alternative source of energy cannot be over emphasised. It is a sustainable, more environmentally friendly and cheaper source of energy.

MATERIALS AND METHODS

MATERIALS REQUIRED

1. Empty water can 20 L capacity-1(Digester)
2. M-seal
3. Gas collecting tube
4. Pvc pipes of ¾ in -3
5. T- shape valve
6. Level pipe(4 m)

DESIGN PROCEDURE

- A plastic can of 20 L capacity coated with black paint is used as a digester.
- A PVC pipe of 50 cm length was joined with one of the hole made on the top of the digester, which acts as an inlet
- system.
- A slurry outlet pipe of 15 cm length was connected at one of the side of a digester.
- A level pipe was attached on the top of the digester containing provision, and other end is connected to gas collecting tube.

Fig.3. Experimental Setup

PREPARATION OF INOCULUM

The inoculum was made on 4th March 2016. Fresh cow dung was used to inoculate. 5 kg of cow dung was weighed and was taken in a tub. 8 litres of tap water were added and homogenized nicely to make fine slurry. The slurry was dumped in to digester and the digester was kept aside for a week. The temperature was kept at a range of 40-45^{O}c.

EXPERIMENTAL PROCEDURE

Kitchen waste from the hostel was brought on 11th March 2016. The waste was brought in a plastic container. The food waste was physically assessed and was found to consist of the following mixture : cooked rice , vegetables like tomoto, carrot, onion ,bananapeels. The food waste was mixed with water used for rice washing to make fine slurry. Fresh sample was taken for physic chemical analysis. The slurry was poured in to the digester and it is kept air tight. Care was taken to prevent any leaks.

FLAMMABILITY TEST:

The Biogas produced experimentally is measured carefully. After the measurement of gas produced it undergoes the Flammability test. If we kept the lightening match stick near the ball valve in which gas is coming out, it burns vigorously with high flame . This indicates that the produced gas contains high amount of methane

Fig .5: Vigorous burning of flame

BIOGAS YIELD

After the digester was operated for several weeks after the initial filling, the pH value had reached the stable value that remained constant during the period of sampling. The temperature is constant between 38-45^{O}c during the day and 35-40^{O}c during the night. Therefore, those two parameters were considered as the constants with respect to the model development[8].

TOTAL SOLIDS (TS %) - It is the amount of solid present in the sample after the water present in it is evaporised. The sample, approximately 10 gm is taken and poured in a crucible and dried to a constant weight at about 105 0C in Hot air oven.

TS % = (Final weight/Initial weight) * 100

VOLATILE SOLIDS (VS %) – Dried residue from Total Solid analysis weighed and heated in crucible for 2hrs at 500 0C in furnace. After cooling crucible residue weighed.

VS % = [100-(V3-V1/V2-V1)] * 100

V1= Weight of crucible.

V2= Weight of dry residue & crucible. V3= Weight of ash & crucible (after cooling).

Biogas produced Experimentally

The biogas produced experimentally is given by the difference between the final weight of the gas collecting tube and the Initial weight of the gas collecting tube. The Biogas produced experimentally is about 0.462 m^3.Therefore the biogas produced from kitchen waste is given by the difference between the total biogas produced to the gas produced from cow dung. Thus, the biogas yield is 0.101 m3/kg volatile solids from kitchen Waste slurry.

CONCLUSION

The study evaluates biogas production from food (rice,vegetable peelings, banana peelings) waste through an anaerobic digestion of 20L capacity designed and built in the lab. In the duration of 30 days, biogas production started from the 10th day. The total amount of gas production recorded up to 30 days[9-11]. Food waste getting converted into biogas not only becomes an alternative source of energy but also burning the biogas helps in reducing the methane production from organic waste which is one of the green house gases. From our study it is evident that food waste can become a good feedstock for the biogas production. Food waste contains more biodegradable solids (9.3%), with higher volatile solids (94.9%) than cow dung. Increase in moisture content of the digestive was 4.75%. 12% decrease in VS was observed after 30 days. Since food waste contains 83.7% VS, it thus has a great potential of biogas production and can be used easily and potentially as a raw material for biogas production. The volatile solids finally reduced to 80%. Thus Biogas produced from the kitchen waste is higher than the biogas produced from the cow dung [12].

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