Scientific Journal of Impact Factor (SJIF): 5.71
e-ISSN (O): 2348-4470
p-ISSN (P): 2348-6406

International Journal of Advance Engineering and Research Development

Volume 5, Issue 04, April -2018

# BIOGAS PRODUCTION FROM ANIMAL AND VEGETABLE WASTE BY ANAEROBIC DIGESTION

K.Soundhirarajan[1], C.Indhumathi[2]

[1]*Department of civil Engineering, Gnanamani College of Technology*
[2]*Department of Environmental Engineering, Gnanamani College of Engineering*

**Abstract**— *The increased use of fossil fuels for energy consumption has causes both locally and globally. This study investigates the anaerobic digestion in the production of biogas a renewable energy from Animals and vegetable waste as an alternative for fossil fuel for energy consumption. Current promising increase of agricultural investments leads to implementation of new technologies but also leads us to the public awareness towards modern agricultural production. There are million tons of animal and vegetable wastes produced every year and its disposal is a major problem. A biogas plant with anaerobic digester animal quantities of methane which is a highly promising technology for converting and may be directly used as energy source. Kitchen waste and animal waste is the best alternative for biogas production in a community level biogas plant. It is produced when bacteria degrade organic matter in absence of air. Biogas contains 55-65% of methane, 30-40% of carbon dioxide. The calorific value of biogas is appreciably high. The gas can effectively be utilized for generation of power through a biogas based power generation system after dewatering and cleaning of the gas. In addition, the slurry produced in the process provides valuable organic manure for farming and sustainability of soil fertility. The increased use of fossil fuels for energy consumption has causes both locally and globally. This study investigates the anaerobic digestion in the production of biogas a renewable energy from Animals and vegetable waste as an alternative for fossil fuel for energy consumption. The effect of factors namely temperature, pH, total solid and volatile solid, carbon and nitrogrn percentage are also been investigated. In which biogas is typically referred to a mixture of different gases produced by the breakdown of organic matter in the absence of oxygen.*

***Keywords*** *—Biogas; Anaerobic digestion; Energy consumption; soil fertility*

## I. INTRODUCTION

Biogas is primarily methane ($CH_4$) and carbon dioxide ($CO_2$) and may have small amounts of hydrogen sulfide ($H_2S$), moisture and siloxanes. The gases methane, hydrogen, and carbon monoxide (CO) can be combusted or oxidized with oxygen. This energy release allows biogas to be used as a fuel; it can be used for any heating purpose, such as cooking. It can also be used in a gas engine to convert the energy in the gas into electricity and heat.

Biogas can be compressed, the same way natural gas is compressed to CNG, and used to power motor vehicles. In the UK, for example, biogas is estimated to have the potential to replace around 17% of vehicle fuel. It qualifies for renewable energy subsidies in some parts of the world. Biogas can be cleaned and upgraded to natural gas standards, when it becomes bio-methane. Biogas is considered to be a renewable resource because its production-and-use cycle is continuous, and it generates no net carbon dioxide Organic material.

Grows, is converted and used and then regroups in a continuous repeating cycle. From a carbon perspective, as much carbon dioxide is absorbed from the atmosphere in the growth of the primary bio-resource as is released when the material is ultimately converted to energy. Biogas is produced as landfill gas (LFG), which is produced by the breakdown of Biodegradable waste inside a landfill due to chemical reactions and microbes, or as digested gas, produced inside an anaerobic digester. A biogas plant is the name often given to an anaerobic digester that treats farm wastes or energy crops. It can be produced using anaerobic digesters (air-tight tanks with different configurations). These plants can be fed with energy crops such as maize silage or biodegradable wastes including sewage sludge and food waste. During the process, the microorganisms transform biomass waste into biogas (mainly methane and carbon dioxide) and digestive. The biogas is a renewable energy that can be used for heating, electricity, and many other operations that use a reciprocating internal combustion engine. Other internal combustion engines such as gas turbines are suitable for the conversion of biogas into both electricity and heat. The digestive is the remaining inorganic matter that was not transformed into biogas. It can be used as an agricultural fertilizer. There are two key processes: mesophilic and thermophilic digestion which is dependent on temperature.

## II. Biogas Characteristics

### 2.1 Anaerobic Digestion

The digestion process occurring *without (absence) oxygen* is called **anaerobic digestion** which generates mixtures of gases. The gas produced which is mainly methane produces 5200-5800 KJ/m3 which when burned at normal room temperature and presents a viable environmentally friendly energy source to replace fossil fuels (non-renewable).

### 2.2 The fermentation slurry

All feed materials consist of

- organic solids,
- inorganic solids,
- Water.

The biogas is formed by digestion of the organic substances. The inorganic materials (minerals and metals) are unused ballast, which is unaffected by the digestion process. Adding water or urine gives the substrate fluid properties. This is important for the operation of a biogas plant. It is easier for the methane bacteria to come into contact with feed material which is still fresh when the slurry is liquid. This accelerates the digestion process. Regular stirring thus speeds up the gas production. Slurry with a solids content of 5-10% is particularly well suited to the operation of continuous biogas plants.

### 2.3 DEWATERING AND DRYING

The waste collected from the sources of kitchen and animal waste such as sheep, cattle, cow, chicken are heated in oven and the moisture is been removed and crushed in a mixer grinder and slurry is been prepared.

### 2.4 DISPOSAL

The slurry is usually disposed directly in land as a manure to the soil, In some cases raw or digested as well as supernatant from digester can be lagoon as a temporary measure but such practice may create problems like odour nuisance, ground water pollution and other hazards to public health. Wet or digested slurry can be used as sanitary landfill or for mechanized composting with city refuse. From public health point of view, heat dried slurry is the safest, though deficient in humus, if it convenient for handling and distribution.

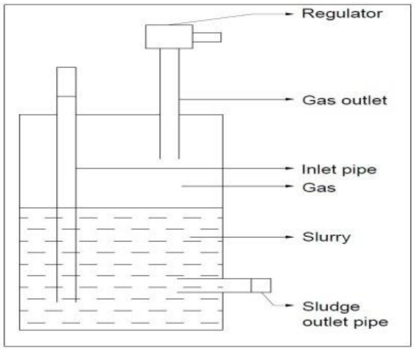
## III. EXPERIMENTAL STUDY

### 3.1 COLLECTION OF SAMPLE

The four different animal waste (cattle, sheep, cow, chicken) used was collected from different sources of waste generation. The waste used in this project is been collected from srivilliputhur. The vegetable waste consists of rice, salad, fish, meat, vegetables and non used vegetables.

### 3.2 MATERIALS AND METHODS

This project was done with 20lit bottles, digester. Here different concentration & combination of wastes are used. Different parameters of input and effluent like total solid, volatile solid, volatile fatty acid, pH, Temperature, Nitrogen and Carbon percentage, C:N ratio will be measured. After that a 20 lit. plastic container is used to check the gas production. In this batch type digester is used. The methods used in this construction are bio digester, feeding of bio digester and mode of biogas collection.

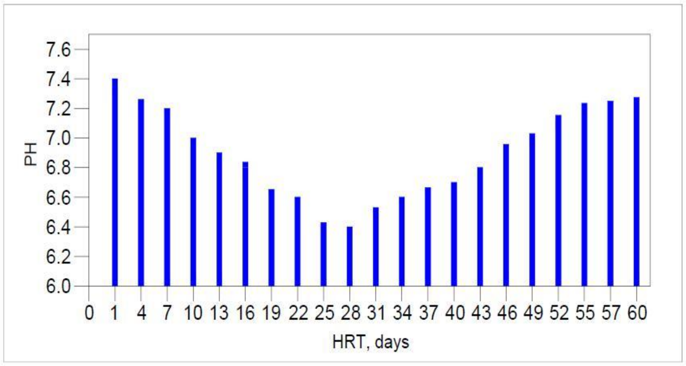



**a. Experimental setup** **b. Schematic diagram of bio digester**

### 3.3DETERMINATION OF PH

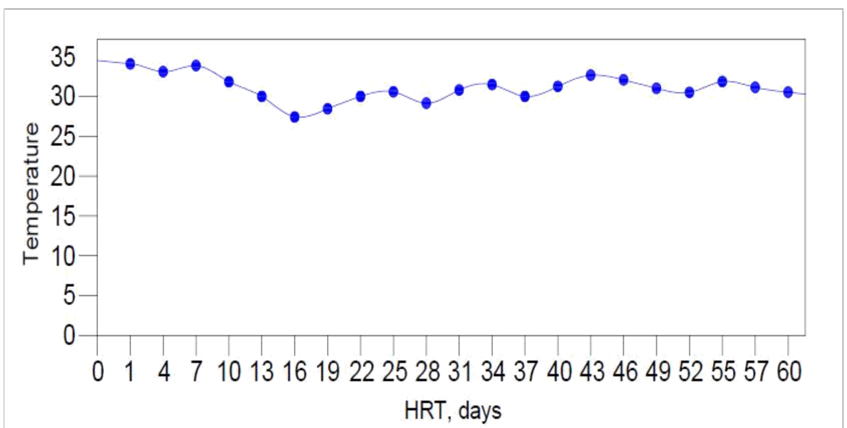
PH is tested to determine alkalinity or acidity of the sludge. Two products of aerobic digestion that tend to lower the digester pH are carbon dioxide and hydrogen ions. A pH drop can occur when ammonia is oxidized to nitrate if the alkalinity of the wastewater is insufficient to buffer the solution. In situations where the buffering capacity of the sludge is insufficient, it may be necessary to chemically adjust the pH (Metcalf & Eddy, 1991). If pH adjustment is necessary, the proper chemical dosage can be determined by performing a bench-scale jar test and proportioning the chemical dosage from the jar test to the digester volume.




**Variation in pH the experiment, the pH value of varied from 6.4 to 7.5.**

### 3.4 DETERMINATION OF TEMPERATURE

The temperature deviation during the experimentation has been shown in the figure 4.2. The temperature of the system deceit within the mesophilic temperature range i.e. 28–350C. Therefore, for most favorable gas production, the temperature of digester can be increased by 7-100C, since most favorable temperature at mesophilic condition is 30–350C.




**Daily average temperature variation of sample**

### 3.5 DETERMINATION OF CARBON AND NITROGEN (C: N) RATIO

Nitrogen (N) is a important plant nutrient which promotes foliar growth and increases yield. The ratio of the mass of carbon to the mass of nitrogen in a substance. The C: N ratio serves as a tool for understanding the sources of sedimentary organic matter, which can lead to information about the biogas production.

| FEEDSTOCK | CARBON CONTENT % | NITROGEN CONTENT % | C:N |
|---|---|---|---|
| Sheep excreta | 10 | 0.41 | 10:1 |
| Goat excreta | 46.22 | 0.57 | 47:1 |
| Chicken droppings | 35.11 | 2.39 | 36:1 |
| Cow excreta | 14 | 1.21 | 14:1 |
| Rice | 45.22 | 0.97 | 46:1 |
| Vegetables | 44.21 | 0.54 | 45:1 |
| Leaves | 14 | 0.72 | 14:1 |

### 3.6 DETERMINATION OF TOTAL DISSOLVED SOLIDS AND TOTAL SUSPENDED SOLIDS

It is a measure of combined content of inorganic and organic substances contained in a liquid in molecular, ionized or micro-granular suspended form. Generally the operational definition is that the solids must be small enough to survive filtration through a filter with two-micrometer pores. Total dissolved solids are normally discussed only for freshwater systems, as salinity includes some of the ions constituting the definition of TDS. The principal application of TDS is in the study of water quality for streams, rivers and lakes, although TDS is not generally considered a primary pollutant it is used as an indication of aesthetic characteristics of drinking water and as an aggregate indicator of the presence of a broad array of chemical contaminants. Primary sources for TDS in receiving waters are agricultural and residential runoff, clay rich mountain waters, leaching of soil contamination and point source water pollution discharge from industrial or sewage treatment plants.

#### 3.6.1 Total suspended solids (TSS)

It is the dry-weight of particles trapped by a filter. It is a water quality parameter used for example to assess the quality of wastewater after treatment in a wastewater treatment plant. It is listed as a conventional pollutant in the U.S. TSS of water or wastewater sample is determined by pouring a carefully measured volume of water through a pre-weighed filter of a specified pore size, then weighing the filter again after drying to remove all water. Filters for TSS measurements are typically composed of glass fibres. The gain in weight is a dry weight measure of the particulates present in the water sample expressed in units derived or calculated from the volume of water filtered.

| SUBSTRATES | SAMPLE A | SAMPLE B | SAMPLE C | MEAN |
|---|---|---|---|---|
| Total moisture | 85.1 | 88.3 | 90.7 | 88 |
| Total solids % | 13.7 | 10.9 | 9.4 | 11.3 |
| Volatile solids % | 71 | 46.9 | 65.4 | 61.1 |
| Ash content % | 28.9 | 31.7 | 34.3 | 31.6 |
| Ammonium level(mg/ml) | 2.3 | 2.4 | 2.1 | 2.2 |

## IV. CONCLUSION

Today's attractive feature in science and technology research is the anaerobic decomposition of organic matter and evolution of biogas with methane as an economically valued product. To augment biogas production the current decisive review discussed trends and issues coupled with biogas production in contemporary scenario at the same time only some aspects on biogas production point towards broad-shouldered outlook.

Prior to anaerobic digestion biological retreatment of lignocelluloses wastes found to be capable for augmented biogas production. Considerating the dynamics of a variety of additives along with other biochemical parameters would expand the four overriding processes to facilitate to develop biogas production effectiveness. Detached investigational approaches also yielded superior results with enzymes, microbial substitutions and genetically customized microbes. Despite the fact that a range of models and approaches originate to be hopeful, multiphase come up to incorporating the exceeding all prospects would be successful for the point in time. The values of pH, Temperature, Total Solids (TS), Volatile Solids (VS) , C:N ratio were found.

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