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GENERATION OF ELECTRICITY USING ORGANIC WASTE

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ABSTRACT

Biogas refers to a gas made from anaerobic digestion of kitchen waste. Methane is a clean energy one of the constituent of biogas which has a great potential to be an alternative fuel. Abundant biomass from various institutions could be a source for methane production where combination of waste treatment and energy production would be an advantage. In Tamil Nadu around 2944 educational institutions are there, from these institutions a large amount of waste is produced but those waste are not utilized. Objective of this study is to utilize the kitchen waste in a bio digester to produce biogas which will be an alternative fuel for their kitchen energy need. This work is carried out to produce biogas in a compact plastic water tank with a fixed types using different kitchen waste. The cow dung is added with food waste in the tank which is used to increase the bacteria; the methane gas production will be higher if the bacteria breed. Thus the methane gas produced is used to generate heat and electricity.

Keywords: Biogas, food waste, cow dung, methane gas, electricity

1. INTRODUCTION

The people in the world produce more than 2,000,000,000 tons per year municipal solid wastes (MSW), in addition to the wastes from agriculture, companies, forestry, etc. This waste is generally land filled (Fig. 1.1). Emissions from landfills and accumulation of solid waste materials in developing countries are problems which grow in parallel with improvement of the welfare in these countries. The first problem comes from the perspective in which local governments have primary responsibility for solid waste materials, and carries out its activities from a primary concern with public health issues, and not **'Environmental Health'.** Our concept is related to biogas extraction from organic wastes. So based on the anaerobic digestion process we could achieve this development.

Fig No 1.1: Landfill Wastes

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2. LITERATURE REVIEW

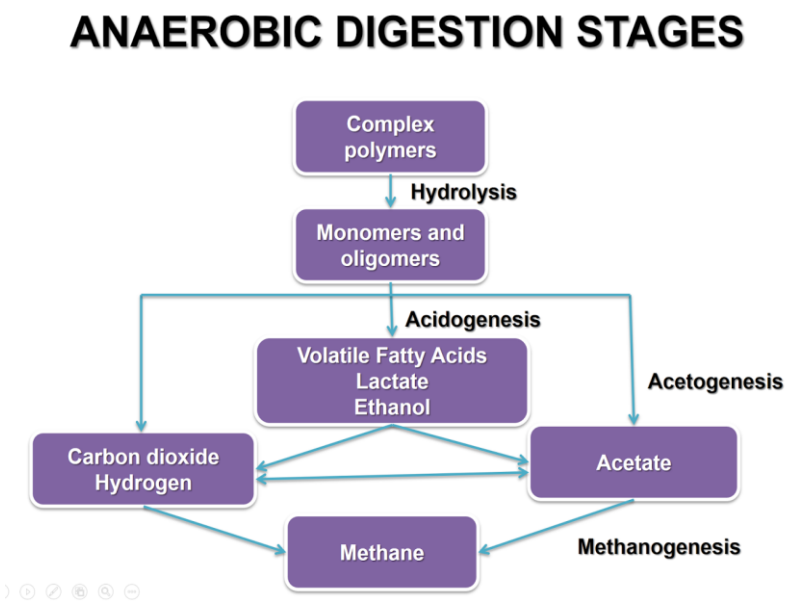
1. "Organic waste treatment for power production and energy supply" – Sudan is endowed with abundant solar ,wind , hydro , and biomass resources . Like many tropical countries Sudan has ample biomass resources that can be efficiently exploited in a manner that is profitable and sustainable. Biogas from biomass appears to have potential as an alterntive energy in Sudan , which is potentially rich in biomass resources.

2. " Development of environmental friendly mini biogas to generate electricity by means of food waste", M.A. Othuman Mydin , N.F. Nik Abllah, N.Ghazali – Biogas can provide a clean , easily controlled source of renewable energy from organic waste materials for a small labour input , replacing firewood or fossil fuels which are becoming more expensive as supply falls behind demand.

3. "Kitchen Waste based Biomass Plant for Power Generation : A case study analysis" , G.R.K.D. Satya Prasad , Sarat Kumar Sahoo , Sambit Pritam , Shyama Sundar Marandi , Amit kumar – The use of renewable energy source are becoming very necessary due to the limited reserves of fossil fuel and global environmental concerns for production of electrical power generation and utilization. Hence the by the use of these systems consisting of biomass to generate methane gas and electrical energy in these remote areas can be more economical.

3. ANAEROBIC DIGESTION:

Anaerobic digestion (AD) is a microbial decomposition of organic matter into methane, carbon dioxide, inorganic nutrients and compost in absence of oxygen. This process is also known as bio-Methanogenesis. Generally three main reactions occur during the entire process of the anaerobic digestion to methane: hydrolysis, acid forming and methanogenesis.



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3.1. Process Stages:

The four key stages of anaerobic digestion involves hydrolysis, acidogenesis, acetogenesis, methanogenesis.

$$C_6H_{12}O_6 \rightarrow 3CO_2 + 3CH_4$$

Hydrolysis:

The process of breaking these chains and dissolving the smaller molecules into solution is called hydrolysis.

$$H_2O \rightleftharpoons H^+ + OH$$

Acidogenesis:

The biological process of acidogenesis results in further breakdown of the remaining components by acidogenic (fermentative) bacteria. The process of acidogenesis is similar to the way milk sours.

Acetogenesis:

The third stage of anaerobic digestion is acetogenesis. Here, simple molecules created through the acidogenesis phase are further digested by acetogens to produce largely acetic acid, as well as carbon dioxide and hydrogen.

Methanogenesis:

The terminal stage of anaerobic digestion is the biological process of methanogenesis. Here, methanogens use the intermediate products of the preceding stages and convert them into methane, carbon dioxide, and water. The remaining, indigestible material the microbes cannot use and any dead bacterial remains constitute the digestate.

4. PROBLEM INDENTIFICATION

Fig No 1.2: Dumping Organic Waste

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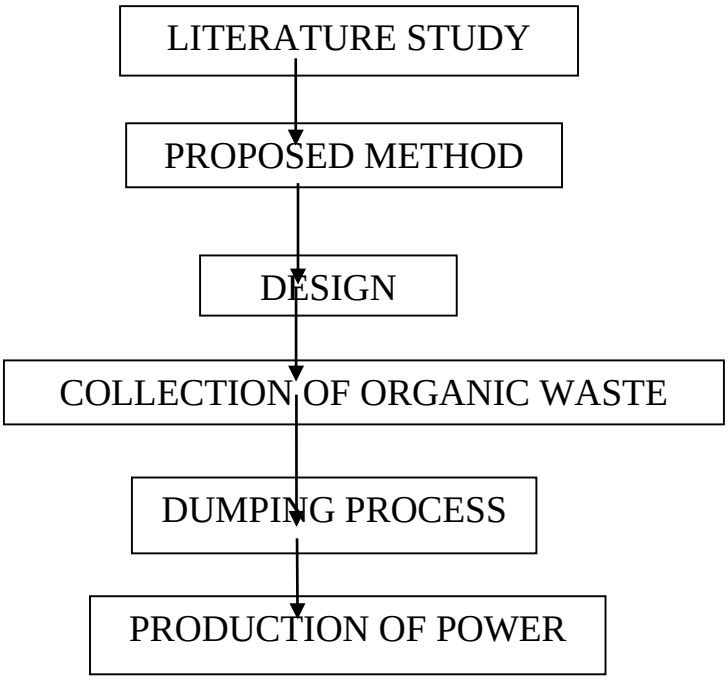
More than 50 percent of the waste occurs during "upstream" or the production, yield handling and storage phase and the remaining happens during processing, distribution and consumption stages or the "downstream" phase. The FAO report was also able to discern a clear pattern in food waste at the global level . The major causes of dumping organic wastes are

- Altered Biodiversity
- Wildfires
- Waterway contamination
- Blocked Drains
- Negative Aesthetics

We are implementing the technology of power generation from organic wastes.

5. WORKING METHODOLOGY



6.COMPONENTS USED

The followings are the components to be used in our project which is going to satisfy the requirements of **" GENERATION OF ELECTRICITY USING ORGANIC WASTE",**

- ORGANIC WASTE
- PRESSURE GAUGE
- PVC PIPE
- STORAGE TANK
- GATE VALVE
- FRAME STRUCTURE

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COMPONENTS DESCRIPTION

ORGANIC WASTE

Canteen and catering waste can be defined as all waste food, which includes used cooking oil that is produced in restaurants, catering facilities and kitchens which prepare food for human consumption. Within the canteen/catering sector a large amount of the waste generated can be reduced, reused and recycled.

Fig 1.3 Food waste / brown waste

PRESSURE GAUGE

A pressure gauge is a mechanical instrument designed to measure the internal pressure and/or vacuum of a vessel or system. Trerice Pressure Gauges are offered in a variety of styles, sizes, and wetted part materials to meet the demands of standard and special applications.

Fig 1.4 Pressure gauge

PVC PIPE

Pipes are essential components in any water supply and distribution network. Water supply is the process of supply of water from public water supply system to the end users. The water from the source of public water supply system to individual buildings is supplied through pipes.

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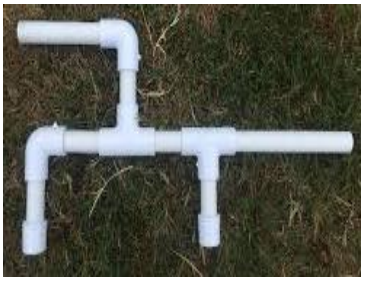

Fig 1.5 PVC pipe

This phenomenon will render the PVC pipes less useful when the hardness or salinity of the water flowing in the pipes is high.

STORAGE TANK

A water tank is a container for storing water. Water tanks are used to provide storage of water for use in many applications, drinking water, irrigation agriculture, fire suppression, agricultural farming, both for plants and livestock, chemical manufacturing, food preparation as well as many other uses. Water tank parameters include the general design of the tank, and choice of construction materials, linings.

Fig 1.6 Water Tank

GATE VALVE

Gate valves are designed for fully open or fully closed service. They are installed in pipelines as isolating valves, and should not be used as control or regulating valves. Operation of a gate valve is performed doing an either clockwise to close (CTC) or clockwise to open (CTO) rotating motion of the stem. When operating the valve stem, the gate moves up- or downwards on the threaded part of the stem.

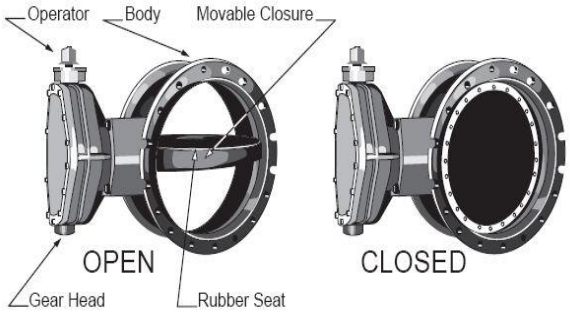

Fig 1.7 Gate valve NO and NC

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FRAME STRUCTURE

Fig 1.8 L-angle for frame structure

This frame structure is a base of our prototype model and it give shape our desire machines. We use material for this frame structure is mild steel because its material properties are suitable for our construction.

6.1.WORKING PRINCIPLE

6.1.1 CONSTRUCTION DIAGRAM

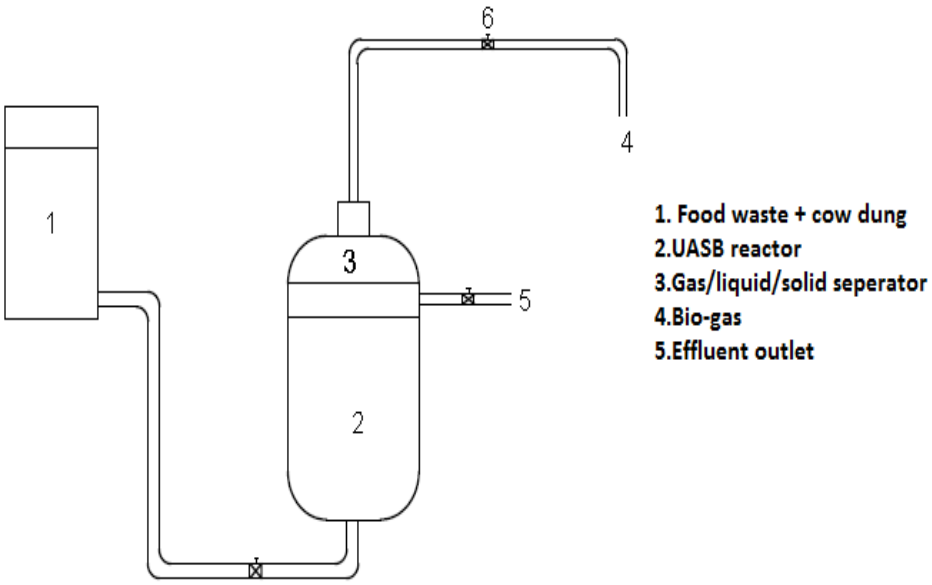

Fig 1.9 construction diagram for power generation from organic waste

6.1.2. WORKING PRINCIPLE

By using food waste and organic waste from home, this mini biogas power plant will digest all the waste to turn it into methane in order to produce electricity. The flow of work done to turn waste to electric energy:

a) About 30 kg of waste was placed into tank every other day.

b) The tank was filled with water and cow dung. All the materials were digested together (solid + liquid).
c) On the next day, the digested waste was pumped into the digester that only consists of water (liquid).
d) After that, the wastes decompose and methane gas was generated.
e) Methane rises to the top and is collected into digested bag.
f) Methane was then used to produce heat or generate electricity.
g) Step a) to f) was repeated daily.

As-produced, biogas also contains water vapour. The fractional volume of water vapour is a function of biogas temperature; correction of measured gas volume for both water vapour content and thermal expansion is easily done via a simple mathematic algorithm which yields the standardized volume of dry biogas.

7.CONCLUSION

First of all, this mini biogas power plant is easy to set-up because it is made in a modular system that could be installed or uninstalled and transferred easily everywhere and anywhere. Finally we produce the electricity through our proto type biogas plant.

7.1.FUTURE SCOPE

Biomass is a renewable energy source, which can be converted into liquid fuels and/or gas fuels with different technologies available today. Some solutions are technically feasible in short term. The production energy from agricultural bio-mass seems a realistic option for the future.

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