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BIOGAS PRODUCTION AND ITS USES IN AGRICULTURE

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ABSTRACT

This article deals with the production of biogas by using organic wastes such as animal manure ,food wastes, sewage water and other agricultural wastes . Biogas is a mixture of gases, primarily consisting of methane, carbon dioxide and hydrogen sulphide, produced from raw materials such as agricultural waste, manure, municipal waste, plant material, sewage, green waste and food waste. It is a renewable energy source. This article involves both the industrial and domestic production of biogas and its benefits ,uses and applications of biogas.

KEYWORDS: ***Biogas , BARC, Sakthi – Surabi biogas plant and biogas production.***

INTRODUCTION

Biogas is a mixture of gases, primarily consisting of methane, carbon dioxide and hydrogen sulphide, produced from raw materials such as agricultural waste, manure, municipal waste, plant material, sewage, green waste and food waste. It is a renewable energy source. Biogas is produced by anaerobic digestion with anaerobic organisms or methanogen inside an anaerobic digester, biodigester or a bioreactor. Biogas is primarily methane (CH4) and carbon dioxide (CO2) and may have small amounts of hydrogen sulfide (H2S), 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 in fuel cells and 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. According to Mata-Alvarez et al. (2000), digestion of more than one substrate in the same digester can establish positive synergism and the added nutrients can support microbial growth.

what is biogas

It mainly comprises of hydro-carbon which is combustible and can produce heat and energy when burnt. Bio-gas is produced through a bio-chemical process in which certain types of bacteria convert the biological wastes into useful bio-gas. Since the useful gas originates from biological process, it has been termed as bio-gas. Methane gas is the main constituent of biogas. Food waste is a desirable material to co-digest with dairy manure because of its high biodegradability (Zhang *et al.*, 2006).

Biogas Production Process

The process of bio-gas production is anaerobic in nature and takes place in two stages. The two stages have been termed as acid formation stage and methane formation stage. In the acid formation stage, the bio-degradable complex organic compounds present in the waste materials are acted upon by a group of acid forming bacteria present in the dung. Since the organic acids are the main products in this stage, it is known as acid forming stage. In the second stage, groups of methanogenic bacteria act upon the organic acids to produce methane gas. Proper mixing should be provided to overcome the scum formation and suspended solid accumulation (El-Mashad and Zhang, 2007). Moreover, screening of manure requires some extra installations (e.g.pumps and screens).

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Advantages Of Biogas Production

- It is a eco-friendly fuel.
- The required raw materials for biogas production are available abundantly in villages.
- It not only produces biogas, but also gives us nutrient rich slurry that can be used for crop production.
- It prevents the health hazards of smoke in poorly ventilated rural households that use dung cake and fire-wood for cooking.
- It helps to keep the environment clean, as there would be no open heap of dung or other waste materials that attract flies, insects and infections
- Availability of biogas would reduce the use of firewood and hence trees could be saved.

Components of Biogas Plants

Mixing tank - The feed material (dung) is collected in the mixing tank. Sufficient water is added and the material is thoroughly mixed till a homogeneous slurry is formed.

Inlet pipe - The substrate is discharged into the digester through the inlet pipe/tank.

Digester - The slurry is fermented inside the digester and biogas is produced through bacterial action.

Gas holder or gas storage dome - The biogas gets collected in the gas holder, which holds the gas until the time of consumption.

Outlet pipe - The digested slurry is discharged into the outlet tank either through the outlet pipe or the opening provided in the digester.

Gas pipeline - The gas pipeline carries the gas to the point of utilization, such as a stove or lamp.

PRODUCTION

Biogas is produced by microorganisms, such as methanogens and sulfate-reducing bacteria, performing anaerobic respiration. Biogas can refer to gas produced naturally and industrially.

NATURAL

In soil, methane is produced in anaerobic environments by methanogens, but is mostly consumed in aerobic zones by methanotrophs. Methane emissions result when the balance favors methanogens. Wetland soils are the main natural source of methane. Other sources include oceans, forest soils, termites, and wild ruminants.

INDUSTRIAL

The purpose of industrial biogas production is the collection of biomethane, usually for fuel. Industrial biogas is produced either;

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- As landfill gas (LFG), which is produced by the decomposition of biodegradable waste inside a landfill due to chemical reactions and microbes, or
- As digested gas, produced inside an anaerobic digester.

BIOGAS PLANT

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.s

shakthi - Surabhi - Biogas plant for households

Shakthi-Surabhi is a kitchen waste based biogas plant. It works on similar principles of a traditional biogas plant, but has been modified to suit urban requirements also. The unit consists of an inlet waste feed pipe, a digester, gas holder, water jacket, a gas delivery system and an outlet pipe. It is developed by the Vivekananda Kendra, Natural Resources Development Project (VKNARDEP), Kanyakumari, Tamil Nadu.

- Cattle dung is a major input for the conventional plants. And everyday the dung should be mixed as slurry and poured into the gas tank. But for Shakthi-surabhi, cattle dung is required for initial charging. Later on, kitchen and other wastes (leftover cooked food (veg and non-veg), vegetable wastes, material from flour mills, non edible oil seed cakes (neem, jatropha etc)) alone are sufficient for producing the required gas.
- The unit comes in two attractive colours in capacities from 500 to 1,500 litres.
- It is easy to fix or relocate and can be installed either at the backyard (if it is an independent house) or in the terrace or sunshade in flat structures.
- Required feed materials

Performance

About 5 kg of waste is required for a 1 cubic metre plant which is equal to 0.43 kg of LPG. It is estimated that 100 cubic metres of biogas could produce 5 KW of energy to meet a 20-hour power requirement of a house The process is hygienic and is devoid of odour and flies. The unit also helps in controlling climate change effects and arrests green house gases, and the digested outlet slurry of the unit acts as good organic manure

Kitchen Waste Based Biogas Plant

A kitchen waste based biogas plant has been installed at Nursery site for environmental friendly disposal of the waste generated in kitchens of various canteens in BARC premises. It is expected that the plant can process all the waste generated in these canteens.

The biogas plant has following components:

- A mixer/pulper (5 HP motor) for crushing the solid waste
- Premix tanks
- Pre digester tank
- Solar heater for water heating
- Main digestion tank (35 m3)
- Manure pits
- Gas lamps for utilisation of the biogas generated in the plant.

Uses And Application of Biogas

- Biogas gas – grid injection
- Biogas in transport
- Biogas generated heat and electricity
- Biogas as fuels in hill station

Uses In Agriculture

It can be used as an agricultural fertilizer. Biogas can be used as the fuel in the system of producing biogas from agricultural wastes and co-generating heat and electricity in a combined heat and power (CHP) plant. Unlike the other green energy such as wind and solar, the biogas can be quickly accessed on demand.

CONCLUSION

In this above article I have explained briefly about the production , usage, application and other uses of biogas which includes producing it from agricultural wastes and using it for agricultural and economical purposes in day today life.

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