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ADVANCE UTILIZATION AND MANAGEMENT OF BIOGAS

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A B S T R A C T

The process of biogas generation is an alternative technology that has larger potential energy output compared to green diesel, biodiesel, bio ethanol, and hydrogen production processes. These treatment processes generate biogas which can be used as a renewable energy source. Anaerobic digestion treatments have often been used for the biological stabilization of solid wastes. Recently, anaerobic digestion of solid wastes has attracted more interest because of current environmental problems, most especially those concerned with global warming

***Keywords**: bio gas, fuel producton, CNG.*

1. INTRODUCTION

Biogas refers to a mixture of different gases produced by the breakdown of organic matter in the absence of oxygen. Biogas can be produced from raw materials such as agricultural waste, manure, municipal waste, plant material, sewage, green waste, or food waste. Biogas is a renewable energy source.

The gases such as 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 food cooking, water heating, etc. It can also be used in a gas engine to generate mechanical energy. Biogas can be compressed after the removal of carbon dioxide and hydrogen sulfide, in the same way as natural gas is compressed to CNG, and used to power motor vehicles.

It qualifies for renewable energy subsidies in some parts of the world. Biogas can be cleaned and upgraded up 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. As the organic material grows, it is converted and used. It then regrows in a continually 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 a natural fuel that is obtained through **anaerobic digestion**, i.e. bacterial fermentation that takes place in the absence of oxygen of organic residues from plant or animal residues.

About 50-70% of the biogas produced is made up of **methane** and the remainder is **carbon dioxide** and other minor components. If adequately processed, it can power the internal combustion engine of a cogeneration plant and produce **renewable electricity and thermal energy**.

2. OBJECTIVE

- Green and clean fuel production
- Economical and enhanced Ecological system
- Waste management
- Formation of Bio-gas
- Easy to store and transport

3. EXPERIMENTAL SETUP AND METHODOLOGY

The principle of a biogas plant is the anaerobic fermentation of the biomass (organic matter) in presence of water. The working of a biogas plant is, that the biomass is mixed with water and then is decomposed by the anaerobic bacteria into the products like gasses (methane, hydrogen, carbon dioxide) and the other side products (manure, fertilizers).

Anaerobic digestion is a collection of processes by which microorganisms break bio-degradable materials in the absence of oxygen. The process is used for industrial or domestic purposes to manage waste and to produce fuels. Much of the fermentation used industrially to produce food and drink products, as well as home fermentation, uses anaerobic digestion.

There are 2 main types of anaerobic digesters:

- Covered effluent ponds for liquid waste, where biogas accumulates under an impermeable cover and is piped for processing.
- Engineered digesters for semi-liquid wastes, like fermentation tanks, where the waste is mixed and the digestion process can be controlled by heating or cooling, or by adding the bacterial mix to enhance the degradation process.

During digestion, 30-60% of the digestible solids are converted into biogas.

Feedstock for the industrial production of biogas includes:

- Livestock effluents and meat processing waste
- The organic components of landfills
- Any other source of biomass (e.g. wastewater treatment sludge or food and beverage industry wastes).

3.1 Biogas contains:

On average, biogas contains:

- 55-80% methane (CH_4)
- 20-40% carbon dioxide (CO_2).
- Trace gases, including toxic hydrogen sulfide and nitrous oxide.

Methane gas is particularly important as its high energy content can be used to produce energy. Methane has 21 times the power of carbon dioxide to contribute to climate change. Rather than letting methane from natural putrefaction escape into the atmosphere, it makes sense to capture it and burn it. Combustion transforms methane into heat and carbon dioxide. In doing so, you can harvest the energy content of the gas and reduce the impact on climate change.

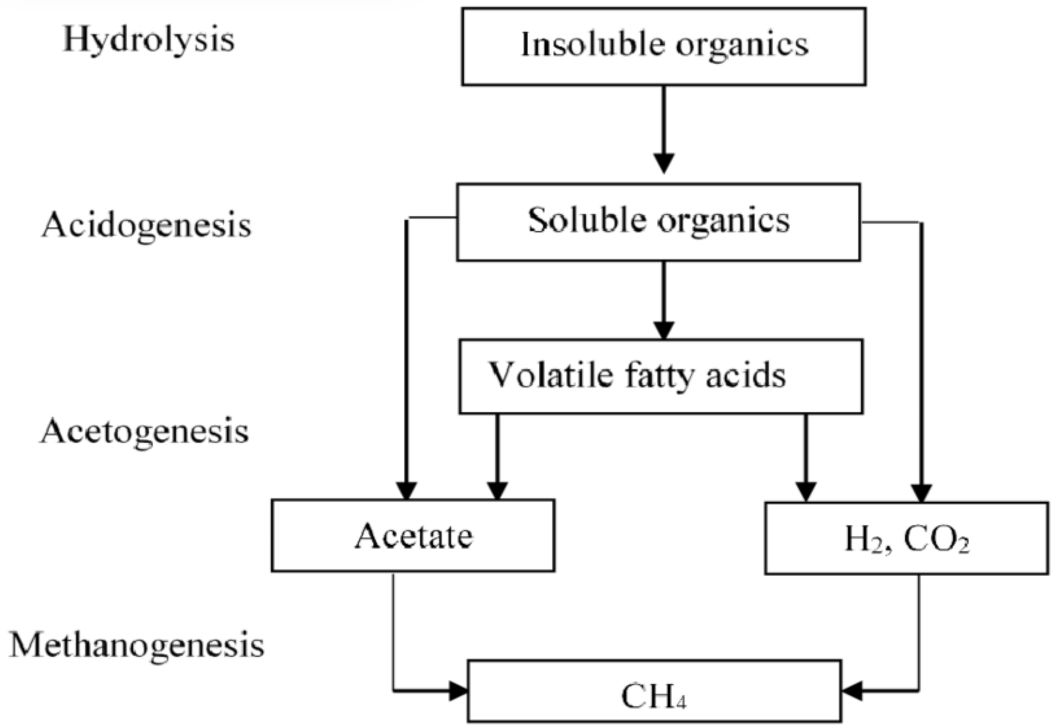
Major sources of biogas include **municipal wastewater treatment plants, industrial waste treatment facilities, landfills, and agricultural sources such as manure and energy crops**.

3.2 Types of Biogas Digesters and Plants

- 2.1 Fixed Dome Biogas Plants.
- 2.2 Floating Drum Plants.
- 2.3 Low-Cost Polyethylene Tube Digester.
- 2.4 Balloon Plants.
- 2.5 Horizontal Plants.
- 2.6 Earth-pit Plants.
- 2.7 Ferro-cement Plants.

Process stage:

The whole biogas process can be divided into three steps: **hydrolysis, acidification, and methane formation**. Many microorganisms take part in this complex transformation with the main role given to 3 types of methane-producing bacteria.



Hydrolysis:

Hydrolysis is a chemical reaction of the interaction of chemicals with water, leading to the decomposition of both the substance and water. Reactions of hydrolysis are possible with salts, carbohydrates, proteins, fats, etc. Hydrolysis of organic substances in catabolism reactions occurs, as a rule, with the participation of enzymes. Proteins are split into amino acids, fats into glycerol and fatty acids, and polysaccharides into monosaccharides. The following is an example of the hydrolysis reaction of carbohydrates.

Acid genesis:

Acid genesis is the fermentation stage where the products of hydrolysis (soluble organic monomers of sugars and amino acids) are degraded by acidogenic bacteria to produce alcohols, aldehydes, and volatile fatty acids (VFAs) and acetate together with H_2 and CO_2

Acetogenesis:

Acetogenesis refers to the synthesis of acetate, which includes the formation of acetate by the reduction of CO2 and the formation of acetate from organic acids. Hydrogen-utilizing acerogenins, previously also termed homoeologous, are strictly anaerobic bacteria that can use the acetyl-CoA pathway as (i) their predominant mechanism for the reductive synthesis of acetyl-CoA from CO2, (ii) terminal electron-accepting, energy-conserving process, and (iii) mechanism for the synthesis of cell carbon from CO2 (Drake, 1994). These bacteria compete with methanogens for substrates like hydrogen, format, and methanol.

Methanogenesis:

Methanogenesis is anaerobic respiration that generates methane as the final product of metabolism. In aerobic respiration, organic matter such as glucose is oxidized to CO_2, and O_2 is reduced to H_2O. In contrast, during hydrogenotrophic methanogenesis, H_2 is oxidized to H^+, and CO_2 is reduced to CH_4.

ADVANTAGE:

1. Renewable Source of Energy
2. Utilization of waste
3. Produces a circular economy
4. A good alternative for electricity and cooking in rural areas and developing countries

DISADVANTAGE:

1. Few technological advancements
2. Weather dependence
3. Foul odor emitted from biogas power plant

Application of Biogas:

Schematic of an anaerobic digester ass parts of a sanitation system. It produces digested slurry that can be used as a fertilizer, and biogas that can be used for energy using anaerobic digestion technologies can help to reduce the emission of greenhouse gases in several key ways:

- Biogas as a Cooking Fuel and Some Common Indian Burner Designs
- Burner Designs Commonly used in China
- Use of Biogas as a Lighting Fuel
- Utilizations of Biogas for Pumping Water and Miscellaneous other Applications
- Biogas as a Fuel for Running IC Engines
- Biogas as a Vehicle Fuel
- Applications of Biogas for Power Generation
- Fuel Cell Linked Biogas Systems

Table 1.1 Composition of biogas

Name of the gas	Composition in biogas (%)
Methane (CH_4)	50-70
Carbon dioxide (CO_2)	30-40
Hydrogen (H_2)	5-10
Nitrogen (N_2)	1-2
Water vapor (H_2O)	0.3

Hydrogen sulfide (H_2S)	Traces

Table 1.2 Properties of biogas

Properties	**Range**
Net calorific value (MJ/m^3)	20
Air required for combustion (m^3/m^3)	5.7
Ignition temperature (^0C)	700
Density (kg/m^3)	0.94

KEY FAVOURABLE FACTORS OF THE PROJECT:

- Replacement of fossil fuel and their migration of GHG emission and environmental pollution.
- Market is created for presently unused or wasted commercially viable agri-product.
- By product from the biogas plants can be used as liquid fertilizer.
- Promotion of public-private partnership.
- Creation of rural jobs.

4. CONCLUSION

Due to day by day increasing population, directly affects the environment due to the continuous use of energy sources by the people. So, the main motive of this project entitled PRODUCTION OF GAS FROM FRUITS AND vegetable WASTES" is to protect the environment and produce gas with optimum cost.

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