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Biofuels – An Alternative Energy: Discussion on Basic Production Methods and Applications of Biofuels

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ABSTRACT

Unlike other renewable energy sources, biomass can be converted directly into liquid fuels, called "biofuels," to help meet transportation fuel needs. The two most common types of biofuels in use today are ethanol and biodiesel, both of which represent the first generation of biofuel technology. Biodiesel is a liquid fuel produced from renewable sources, such as new and used vegetable oils and animal fats and is a cleaner-burning replacement for petroleum-based diesel fuel. Biodiesel is nontoxic and biodegradable and is produced by combining alcohol with vegetable oil, animal fat, or recycled cooking grease. Here, In this paper we discussed about some methods and applications of biofuels.

Keywords: Biofuel, biodegradable, Animal fats , Liquid fuel.

I. INTRODUCTION

Like petroleum-derived diesel, biodiesel is used to fuel compression-ignition (diesel) engines. Biodiesel can be blended with petroleum diesel in any percentage, including B100 (pure biodiesel) and, the most common blend, B20 (a blend containing 20% biodiesel and 80% petroleum diesel). Biogas is a fuel used as domestic purpose which is obtained from cowmanure, fruits and vegetable waste. It is produced by the breakdown of organic waste by bacteria withoutoxygen anaerobic digestion. Basic are the two types of Anaerobic digestion. Mesophilic process – 25-38° C for 14-30 days .Thermophilic process - 50- 60°C for 12-14 days which are Produced from Anaerobic digestion to Anaerobic digesters (AD).

BIOFUEL CONVERSION PROCESSES:

DECONSTRUCTION

Producing advanced biofuels (e.g., cellulosic ethanol and renewable hydrocarbon fuels) typically involves a multistep process. First, the tough rigid structure of the plant cell wall—which includes the biological molecules cellulose, hemicellulose, and lignin bound tightly together—must be broken down. This can be accomplished in one of two ways: high temperature deconstruction or low temperature deconstruction.

High-Temperature Deconstruction

High-temperature deconstruction makes use of extreme heat and pressure to break down solid biomass into liquid or gaseous intermediates. There are three primary routes used in this pathway:

- Pyrolysis
- Gasification
- Hydrothermal liquefaction.

During pyrolysis, biomass is heated rapidly at high temperatures (500°C–700°C) in an oxygen-free environment. The heat breaks down biomass into pyrolysis vapor, gas, and char. Once the char is removed, the vapors are cooled and condensed into a liquid “bio-crude” oil.

Gasification follows a slightly similar process; however, biomass is exposed to a higher temperature range (>700°C) with some oxygen present to produce synthesis gas (or syngas)—a mixture that consists mostly of carbon monoxide and hydrogen.

When working with wet feedstocks like algae, hydrothermal liquefaction is the preferred thermal process. This process uses water under moderate temperatures (200°C–350°C) and elevated pressures to convert biomass into liquid bio-crude oil.

Low-Temperature Deconstruction :
Low-temperature deconstruction typically makes use of biological catalysts called enzymes or chemicals to breakdown feedstocks into intermediates. First, biomass undergoes a pretreatment step that opens up the physical structure of plant and algae cell walls, making sugar polymers like cellulose and hemicellulose more accessible. These polymers are then broken down enzymatically or chemically into simple sugar building blocks during a process known as hydrolysis.

A) **UPGRADING**

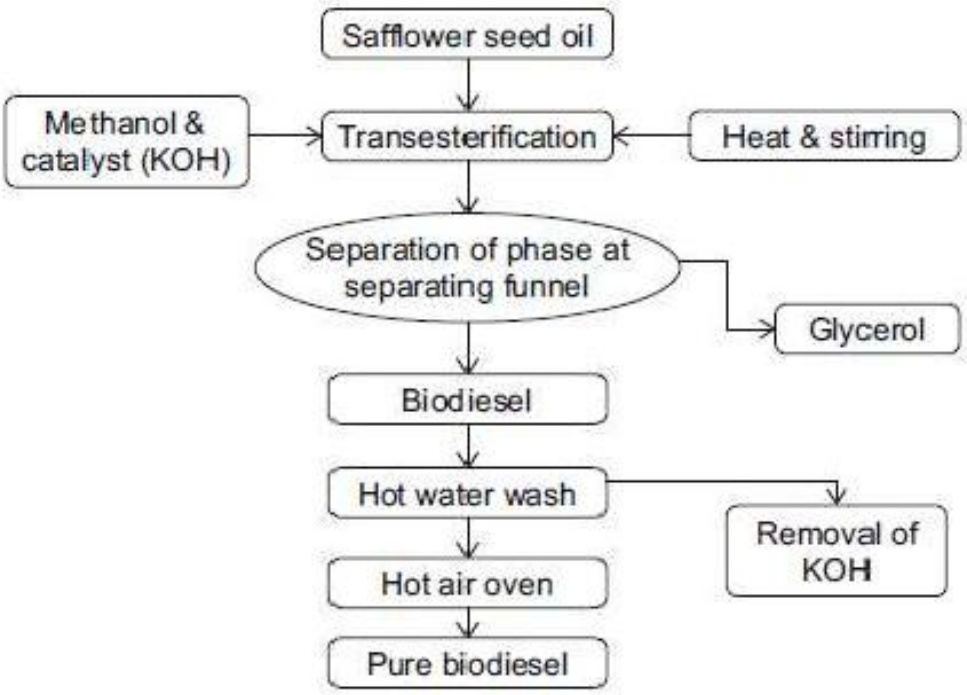
Following deconstruction, intermediates such as crude bio-oils, syngas, sugars, and other chemical building blocks must be upgraded to produce a finished product. This step can involve either biological or chemical processing.

Microorganisms, such as bacteria, yeast, and cyanobacteria, can ferment sugar or gaseous intermediates into fuel blendstocks and chemicals. Alternatively, sugars and other intermediate streams, such as bio-oil and syngas, may be processed using a catalyst to remove any unwanted or reactive compounds in order to improve storage and handling properties.

The finished products from upgrading may be fuels or bioproducts ready to sell into the commercial market or stabilized intermediates suitable for finishing in a petroleum refinery or chemical manufacturing plant.

THE PREPARATION OF BIODIESEL IS AS SHOWN IN THE FIGURE 1 & 2:

Biogas Plant: A biogas plant is a facility that provides oxygen-free conditions where anaerobic digestion can occur. Simply put, it's an artificial system where you can turn waste into sustainable energy and fertilizers, with positive effects on the environment.



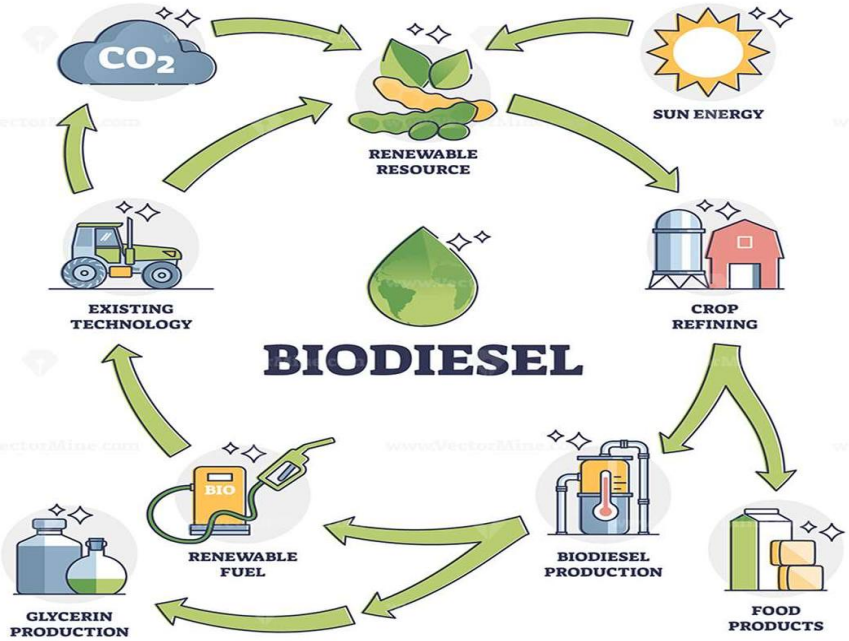


Fig :1 & 2

A biogas plant has three major components that make the biogas production process possible:

- a reception area
- a digester (or fermentation tank)
- a gas holder

The reception area is where the raw materials arrive and are prepared for **anaerobic digestion**. Each type of biomass has a different fermentation process, so the overall length of the biogas production process varies depending on the raw materials used, and it isn't uncommon to use **pre-treatments** in industrial biogas plants to accelerate fermentation and increase the production of biogas.

Some of the most popular biomass choices are crop residues, municipal and industrial sewage, agricultural material, livestock manures, seaweed, food-processing, and paper wastes, but the list of raw materials used is significantly longer.

The digester is an air-tight, waterproof container with a mean of entry for the biomass. Here, you introduce the raw materials to be transformed into energy. Then, agitators shift the biomass periodically to free the gases and prevent the formation of layers. The digester also includes a pipe that enables the digestate to be removed after the fermentation is over.

The gas holder is an airproof container, preferably made in steel, that collects the gas generated during fermentation. It's provided with a gas outlet that permits the biogas to come out of the system and produce energy and heat.

Depending on the quantity of waste you want to eliminate from the environment or the volume of biogas you need to produce, a plant might have more than one digester and gas holders.

Applications Of Biogas:

It has a low cost as compared to floating drum type, as it uses only cement and no steel. It has no corrosion trouble. In this type heat insulation is better as construction is beneath the ground. Temperature will beconstant. Cattle and human excreta and long fibrous stalks can be fed. It requires no maintenance. It has even some disadvantages also. This type of plant needs the services of skilled masons, who are rather scarce in rural areas. Gas production per cum of the digester volume is also

less. Scum formation is a problem as no stirring arrangement. It has variable gas pressure. It has been even shown in Fig 3 as a supplementary information.

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Supplementary figure:

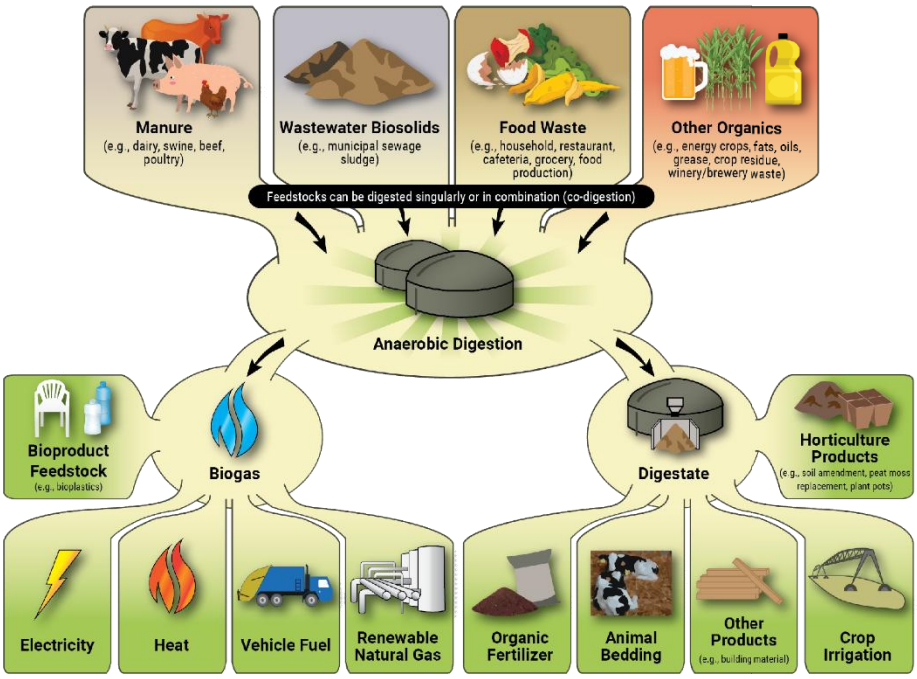

Fig 3: Applications of Bio gas.