5.2 BIO DIESEL

Biodiesel is an alternative clean-burning renewable fuel similar to conventional diesel. It is produced using animal fats, vegetable oils, and waste cooking oil. Due to its biodegradable nature, it is used as a replacement for fossil diesel fuel. It can also be mixed with petroleum diesel fuel in any proportion.

Important Features of Biodiesel

Below are certain features of the fuel:

1) Biodegradable and Renewable Fuel.

2) Safer to use and has low toxicity compared to fossil diesel fuel.

3) Lower exhaust emission rate than normal diesel fuel.

4) As per ASTM D 6751 quality parameters, the quality of diesel is analyzed.

5) Using biodiesel doesn't require any diesel engine modification.

Biodiesel is a renewable, biodegradable fuel made from vegetable oils, animal fats, or recycled cooking grease. It is commonly used as a substitute for or additive to traditional petroleum diesel fuel in diesel engines. Here's an overview of biodiesel:

1. **Feedstocks:**

   Biodiesel can be produced from a variety of feedstocks, including soybean oil, rapeseed oil (canola), palm oil, waste cooking oil, animal fats, and even algae. These feedstocks are processed through a chemical reaction called transesterification, which converts the oils or fats into biodiesel.

2. **Production:**

   The production process typically involves several steps:

   - Feedstock Preparation: The feedstock is cleaned and processed to remove impurities and moisture.
   - Transesterification: The oil or fat is reacted with an alcohol (such as methanol or ethanol) and a catalyst (usually sodium hydroxide or potassium hydroxide) to produce biodiesel and glycerin as a byproduct.

- Separation: The glycerin is separated from the biodiesel through a process called settling or centrifugation.
- Purification: The biodiesel is further purified to remove any remaining impurities, such as excess alcohol or catalyst.

3. **Properties:**

Biodiesel shares many similar properties with petroleum diesel, including its energy content and combustion characteristics. However, biodiesel has a higher cetane number (a measure of ignition quality) and better lubricity, which can improve engine performance and reduce wear on fuel system components.

4. **Environmental Benefits:**

Biodiesel is considered a cleaner alternative to petroleum diesel because it produces lower levels of harmful emissions, such as sulfur oxides, particulate matter, and carbon monoxide. It also contributes to reducing greenhouse gas emissions, especially if produced from waste materials or sustainably sourced feedstocks.

5. **Compatibility:**

Biodiesel can be used in existing diesel engines with little or no modification. It can be blended with petroleum diesel in various proportions, with common blends including B5 (5% biodiesel, 95% diesel) and B20 (20% biodiesel, 80% diesel). Some vehicles and equipment can even run on pure biodiesel (B100).

6. **Challenges:**

Despite its environmental benefits, biodiesel production and use face challenges, including competition with food production for feedstocks like soybean and palm oil, land use concerns associated with large-scale cultivation of feedstocks, and variability in feedstock availability and prices.

Overall, biodiesel offers a promising avenue for reducing dependence on fossil fuels and mitigating environmental impacts associated with transportation. Its continued development and adoption depend on addressing challenges related to feedstock sustainability, production efficiency, and market competitiveness.

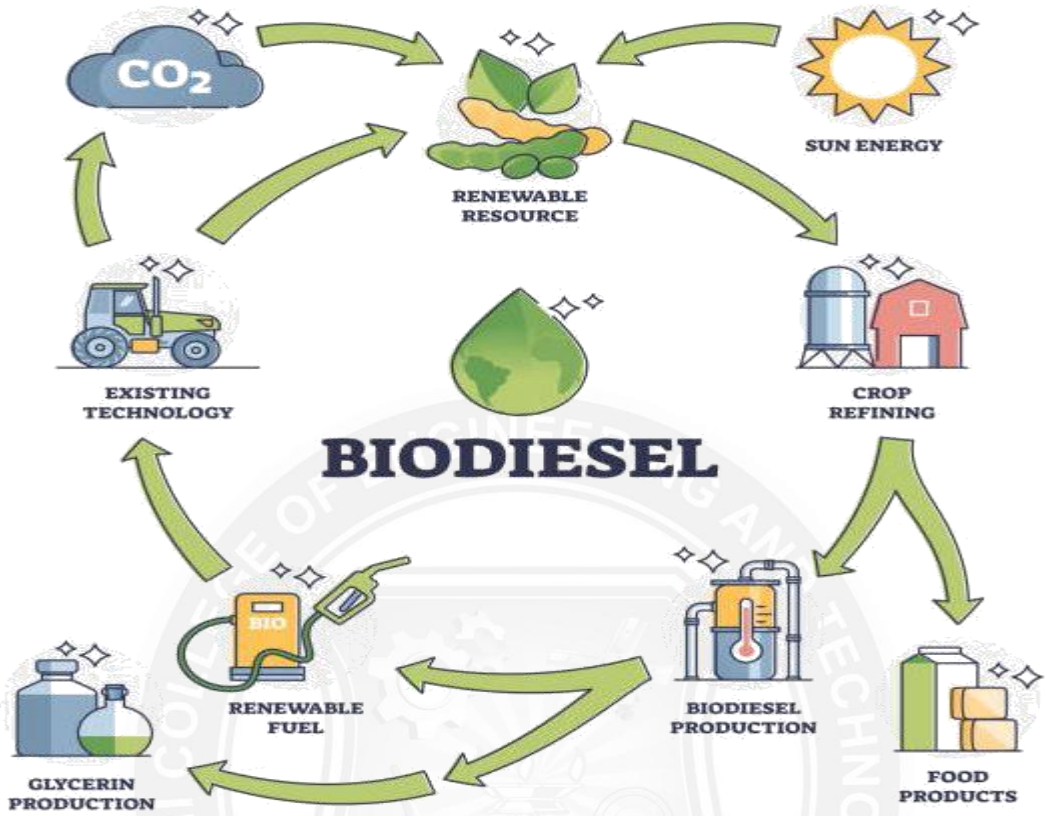

FIG.5.1.1 BIODIESEL

BIODIESEL PRODUCTION

Biodiesel is produced from tallow, vegetable oil or animal fat, and waste oils. There are three stages of this transformation of oil and fats to biodiesel.

a) Transesterification of the oil in which it is base-catalyzed.

b) The direct acid-catalyzed transesterification

c) Finally conversion of oil to fatty acid and then the formation of biodiesel.

The production of biodiesel involves a chemical reaction. This chemical reaction is known as transesterification.

Transesterification is the chemical process, which converts natural fats and oils into Fatty Acid Methyl Esters (FAME) or Biodiesel. Some of the major sources of suitable oil (to make biodiesel) come from crops like palm, soybean or rapeseed. High-quality biodiesel is made from rapeseed, but nowadays most of the biodiesel is produced from waste vegetable oils obtained from chip shops, restaurants, and industrial food producers.

BENEFITS OF BIODIESEL

Biodiesel has the following benefits:

1) Biodiesel and biodiesel blends are used in almost all diesel engines and vehicles.

2) It is a carbon-neutral liquid, which means that the combustion of biodiesel never produces the net output of carbon in the form of carbon dioxide like other mineral diesel.

3) In 2007, British Royal Train ran its train with 100% biodiesel fuel.

4) Used as heating oil – In many commercial & domestic boilers, biodiesel is also used as heating fuel.

RENEWABLE DIESEL AND OTHER BIOFUELS

Renewable diesel and other (non-fuel ethanol) biofuels and biointermediates can be produced from nearly any biomass feedstock, including those used for biodiesel production, through a variety of processes, such as:

- Hydrotreating
- Gasification
- Pyrolysis
- Other biochemical and thermochemical technologies

Renewable diesel is similar to biodiesel but with important differences. Renewable diesel is a hydrocarbon that is chemically equivalent to petroleum diesel and can be:

- Used as a drop-in biofuel
- Transported in petroleum pipelines
- Sold at retail stations with or without blending with petroleum diesel

Renewable diesel production uses a hydrogenation process rather than the esterification process used to produce biodiesel. Because renewable diesel is a drop-in fuel, it meets ASTM D975 specification for petroleum diesel and can be seamlessly blended, transported, and even co-processed with petroleum diesel.

Most renewable diesel is hydrogenation-derived renewable diesel (HDRD) or hydroprocessed esters and fatty acids (HEFA) produced by hydrogenation of triglycerides, a similar process used for desulfurizing petroleum diesel. So, existing petroleum refineries can be converted to renewable diesel production with only modest changes. However, hydrotreating renewable feedstocks requires significantly more hydrogen than desulfurizing diesel, and the source of the hydrogen could affect whether or not the renewable diesel can meet national or state standards for biofuels. Other methods can be used for renewable diesel production, such as gasification and pyrolysis.