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# BIODIESEL -Alternative Fuels & Energy System

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**ABSTRACT:** Increasing industrialization, growing energy demand, limited reserves of fossil fuels and increasing environmental pollution have jointly necessitated exploring some alternate conventional liquid fuels. Vegetable oils have been considered as appropriate alternate for conventional fuels due to prevalent fuel properties. Due to its easy availability in India, Jatropha Oil is a key player in deriving alternate fuels. Biodiesel is defined as the mono alkyl esters of long chain fatty acids derived from vegetable oils or animal fats, for use in compression-ignition (diesel) engines. Even though "diesel" is part of its name, there is no petroleum or other fossil fuels in biodiesel. Biodiesel is 100% vegetable oil based. Esterification increases the volatility and decreases the viscosity of the oil. Experiments have been conducted on an AV1 Kirloskar naturally aspirated DI single cylinder water-cooled diesel engine to compare the properties of Diesel fuel, Esterified Jatropha Oil as fuel and Non-esterified Jatropha Oil as fuel.. Biodiesel conform to ASTM D6751 specifications for use in diesel engines.

**KEYWORDS:** Bio-Diesel, Esterification, Jatropha Oil, Eco-friendly fuel.

## I. INTRODUCTION

General Definition of Biodiesel: - Biodiesel is a domestic, renewable fuel for diesel engines derived from natural oils like soybean oil or animal fats. Biodiesel is the name of a clean burning alternative fuel, produced from domestic, renewable resources. It can be used in compression-ignition (diesel) engines with little or no modifications. Biodiesel is simple to use, biodegradable, nontoxic, and essentially free of sulfur and aromatics 1% to 2% biodiesel as a lubricity additive, which could be especially important for ultra low sulfur diesel fuels. Equipment that can use B20 includes compression-ignition (CI) engines, fuel oil and heating oil boilers, and turbines. Higher blend levels, such as B50 or B100, require special handling and fuel management and may require equipment modifications such as the use of heaters or changing seals and gaskets that come in contact with the fuel to those compatible with high blends of biodiesel. Biodiesel blends are denoted as, "BXX" with "XX" representing the percentage of biodiesel contained in the blend (i.e.: B20 is 20% biodiesel, 80% petroleum diesel).

## II. CHEMICAL PROCESS

Biodiesel is made through a chemical process called transesterification whereby the glycerin is separated from the fat or vegetable oil. The process leaves behind two products -- methyl esters (the chemical name for biodiesel) and glycerin (a valuable byproduct usually sold to be used in soaps and other products).

## III. TRANSESTERIFICATION CHEMISTRY

R' R" R''' = oil acids; R = (CH<sub>2</sub>)<sub>x</sub>CH<sub>3</sub> Plants produce oils from sunlight and air, and can do so year after year on cropland, these oils are renewable. Animal fats are produced when the animal consumes plant oils and other fats, and they too are renewable. Used cooking oils are mostly made from vegetable oils, but may also contain animal fats. Used cooking oils are both recycled and renewable. Biodiesel can be produced commercially from a variety of oils and fats: Animal fats: edible tallow, inedible tallow, and all the other variations of tallow, lard, choice white grease, yellow grease, poultry fats and fish oils. Vegetable oils: soy, corn, canola, sunflower, rapeseed, cottonseed Recycled greases: used cooking oils and restaurant frying oils.

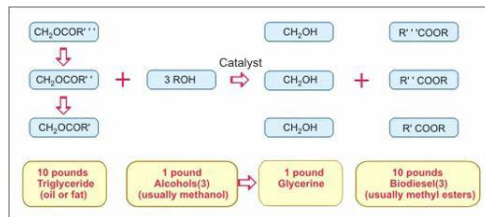


FIG 1: TRANSESTERIFICATION PROCESS

#### IV. BENEFITS OF BIODIESEL

##### 1:- Biodiesel Displaces Imported Petroleum

The fossil fuel energy required to produce biodiesel from soybean oil is only a fraction (31%) of the energy contained in one gallon of the fuel. You get 3.2 units of fuel energy from biodiesel for every unit of fossil energy used to produce the fuel.

##### 2:- Biodiesel Reduces Emissions

When biodiesel displaces petroleum, it reduces global warming gas emissions such as carbon dioxide (CO<sub>2</sub>). When plants like soybeans grow they take CO<sub>2</sub> from the air to make the stems, roots, leaves, and seeds (soybeans). After the oil is extracted from the soybeans, it is converted into biodiesel and produces CO<sub>2</sub> and other emissions, which return to the atmosphere when burned. This cycle does not add to the net CO<sub>2</sub> concentration in the air because the next soybean crop will reuse the CO<sub>2</sub> in order to grow. Biodiesel reduces tailpipe particulate matter (PM), hydrocarbon (HC), and carbon monoxide (CO) emissions from most modern four-stroke CI engines. These benefits occur because the fuel (B100) contains 11% oxygen by weight. The presence of fuel oxygen allows the fuel to burn more completely, so fewer unburned fuel emissions result. This same phenomenon reduces air toxics, because the air toxics are associated with the unburned or partially burned HC and PM emissions. In older two-stroke engines, B20 can reduce CO, HC, and PM if the engines do not consume excessive amounts of lube oil. In addition, one of the first benefits that people notice when using biodiesel or biodiesel blends is the smell. Using biodiesel can make diesel exhaust smell better; more like cooking odors.

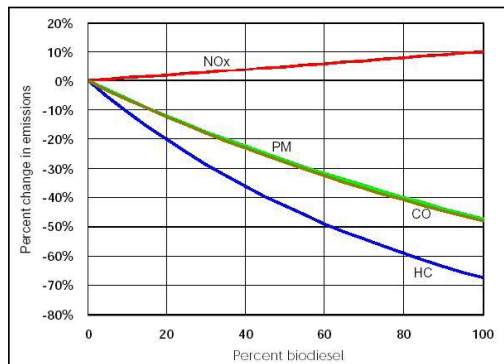


Fig 2: Percentage reduction of gases using various blends

##### 3:- Biodiesel and Human Health

Recently, the Department of Labor’s Mining Safety Health Administration (MSHA) tested and approved the use of biodiesel in underground mining equipment where workers are exposed to high levels of diesel exhaust. Switching to biodiesel blends is believed to reduce the risk of illness and life-threatening diseases in miners.

##### 4:- Biodiesel Improves Lubricity

By 2006, all U.S. highway diesel will contain less than 15 ppm sulfur—ultra low sulfur diesel fuel (ULSD). In the on-road market, low-level blends of biodiesel such as 1% or 2% can improve lubricity of diesel fuels and this may be particularly important for ULSD as these fuels can have poor lubricating properties.

### 5:- Biodiesel is Easy to Use

And last, but maybe not least, the biggest benefit to using biodiesel is that it is easy. No new equipment and no equipment modifications are necessary. B20 can be stored in diesel fuel tanks and pumped with diesel equipment.

### V. BIODIESEL IN COMPRESSION IGNITION ENGINES

You don't have to convert the engine to run it on biodiesel, but you do need to make some adjustments and check a few things. Retard the injection timing by 2-3 degrees -- this overcomes the effect of biodiesel's higher cetane number. It also causes the fuel to burn cooler, thus reducing NO<sub>x</sub> emissions. The engine loses a little of the extra power you get with biodiesel, but it runs quieter and the fuel burns cooler, reducing Petroleum diesel leaves a lot of dirt in the tank and the fuel system. Biodiesel is a good solvent -- it tends to free the dirt and clean it out. Be sure to check the fuel filters regularly at first. Start off with a new fuel filter. If a car has been left standing for a long time with petroleum diesel fuel in the tank the inside of the tank may have rusted (water content is quite a common problem with petrol-diesel fuel). Biodiesel will free up the rust, and it could clog the particle filter inside the tank. At worst the car simply stops. Since biodiesel is produced mainly as a whole cut fuel, where the goal is to take all of the vegetable oil or animal fat and turn it into biodiesel, some of the properties of finished biodiesel depend heavily on the feedstock. These properties can include cetane, cold flow, bulk modulus (compressibility), and stability. In addition, testing has shown that differing biodiesel properties can also lead to different levels of NO<sub>x</sub> emissions from compression ignition (diesel) engines, although this does not appear to be the case with other regulated emissions (HC, CO, PM) or unregulated emissions (PAH, NPAH) or with open flame combustion in boilers or home heating applications.

### VI. CONCLUSION

Biodiesel blends of 20% or less should not change the engine performance in a noticeable way. Some users of biodiesel blends notice significant reductions in soot, and CO and HC emissions are reduced. Higher blend levels can reduce fuel economy, torque, and power but will also produce lower PM, HC, and CO emissions. Less noise and a better exhaust smell have also been noticed with biodiesel fuels. High cost of production: will eventually solve itself when large-scale production and use starts. Many automobile brands are currently marketed ready for use engines of biodiesel. Laws- Biodiesel is a recognized alternative fuel under the Energy Policy Act of 1992 (EPAct) as amended in 1996

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