Biodiesel

Biodiesel is a domestically produced, renewable fuel that can be manufactured from vegetable oils, animal fats, or recycled restaurant greases. Biodiesel is safe, biodegradable, and reduces serious air pollutants such as particulates, carbon monoxide, hydrocarbons, and air toxics. Blends of 20% biodiesel with 80% petroleum diesel (B20) can be used in unmodified diesel engines, or biodiesel can be used in its pure form (B100), but may require certain engine modifications to avoid maintenance and performance problems. Users should consult their engine warranty statement.

For more information go to the National Biodiesel Board's web site.

What is Biodiesel?

Biodiesel (fatty acid alkyl esters) is a cleaner-burning diesel replacement fuel made from natural, renewable sources such as new and used vegetable oils and animal fats. Just like petroleum diesel, biodiesel operates in compression-ignition engines. Blends of up to 20% biodiesel (mixed with petroleum diesel fuels) can be used in nearly all diesel equipment and are compatible with most storage and distribution equipment. These low level blends (20% and less) don't require any engine modifications and can provide the same payload capacity and as diesel. Users should consult their engine warranty statement.

Higher blends, even pure biodiesel (100% biodiesel, or B100) can be used in many engines built since 1994 with little or no modification. Transportation and storage, however, require special management. Material compatibility and warrantee issues haven't been resolved with higher blends.

Using biodiesel in a conventional diesel engine substantially reduces emissions of unburned hydrocarbons, carbon monoxide, sulfates, polycyclic aromatic hydrocarbons, nitrated polycyclic aromatic hydrocarbons, and particulate matter. These reductions increase as the amount of biodiesel blended into diesel fuel increases. The best emissions reductions are seen with B100.

The use of biodiesel decreases the solid carbon fraction of particulate matter (since the oxygen in biodiesel enables more complete combustion to CO2) and reduces the sulfate fraction (biodiesel contains less than 24 ppm sulfur), while the soluble, or hydrocarbon, fraction stays the same or increases. Therefore, biodiesel works well with new technologies such as diesel oxidation catalysts (which reduce the soluble fraction of diesel particulate but not the solid carbon fraction).

Emissions of nitrogen oxides increase with the concentration of biodiesel in the fuel. Some biodiesel produces more nitrogen oxides than others, and some additives have shown promise in modifying the increases. More R&D is needed to resolve this issue.

Biodiesel has physical properties very similar to conventional diesel.

Biodiesel's Physical Characteristics:
Specific gravity 0.87 to 0.89
Kinematic viscosity @ 40°C 3.7 to 5.8
Cetane number 46 to 70
Higher heating value (btu/lb) 16,928 to 17,996
Sulfur, wt% 0.0 to 0.0024
Cloud point °C -11 to 16
Pour point °C -15 to 13
Iodine number 60 to 135
Lower heating value (btu/lb) 15,700 to 16,735

How is Biodiesel made?
Biodiesel fuel can be made from new or used vegetable oils and animal fats, which are non-toxic, biodegradable, renewable resources. Fats and oils are chemically reacted with an alcohol (methanol is the usual choice) to produce chemical compounds known as fatty acid methyl esters. Biodiesel is the name given to these esters when they're intended for use as fuel. Glycerol (used in pharmaceuticals and cosmetics, among other markets) is produced as a co-product.

Biodiesel can be produced by a variety of esterification technologies. The oils and fats are filtered and preprocessed to remove water and contaminants. If free fatty acids are present, they can be removed or transformed into biodiesel using special pretreatment technologies. The pretreated oils and fats are then mixed with an alcohol (usually methanol) and a catalyst (usually sodium or potassium hydroxide). The oil molecules (triglycerides) are broken apart and reformed into esters and glycerol, which are then separated from each other and purified.

Approximately 55% of the biodiesel industry can use any fat or oil feedstock, including recycled cooking grease. The other half of the industry is limited to vegetable oils, the least expensive of which is soy oil. The soy industry has been the driving force behind biodiesel commercialization because of excess production capacity, product surpluses, and declining prices. Similar issues apply to the recycled grease and animal fats industry, even though these feedstocks are less expensive than soy oils.

Based on the combined resources of both industries, there is enough of the feedstocks to supply 1.9 billion gallons of biodiesel (under policies designed to encourage biodiesel use).

Biodiesel Fuel Market
The use of biodiesel has grown dramatically during the last few years. The Energy Policy Act was amended in 1998 to include biodiesel fuel use as a way for federal, state, and public utility fleets to meet requirements for using alternative fuels. That amendment started the sharp increase in the number of biodiesel users, which now include the U.S. Postal Service and the U.S. Departments of Defense, Energy and Agriculture. Countless school districts, transit authorities, national parks, public utility companies, and garbage and recycling companies also use the fuel. According to the American Biofuels Association, with government incentives comparable to those provided for ethanol, biodiesel sales could reach about 2 billion gallons per year, or about 8% of highway diesel consumption. At this level of market penetration, biodiesel would probably be used in bus fleets and heavy duty trucks (primarily in blends with fossil diesel at the 20% level), marine vessels such as ferries,

construction and agricultural vehicles, home heating oil systems, and electric generation facilities.

Feedstock costs account for a large percent of the direct biodiesel production costs, including capital cost and return. It takes about 7.3 pounds of soybean oil, which costs about 20 cents per pound, to produce a gallon of biodiesel. Feedstock costs alone, therefore, are at least $1.50 per gallon of soy biodiesel. Fats and greases cost less and produce less expensive biodiesel, sometimes as low as $1.00 per gallon. The quality of the fuel is similar to soy biodiesel fuel.

Biodiesel Benefits

Biodiesel is a substitute or extender for traditional petroleum diesel and you don't need special pumps or high pressure equipment for fueling. In addition, it can be used in conventional diesel engines, so you don't need to buy special vehicles or engines to run biodiesel.

Scientists believe carbon dioxide is one of the main greenhouse gases contributing to global warming. Neat biodiesel (100 percent biodiesel) reduces carbon dioxide emissions by more than 75 percent over petroleum diesel. Using a blend of 20 percent biodiesel reduces carbon dioxide emissions by 15 percent. Biodiesel also produces fewer particulate, carbon monoxide, and sulfur dioxide emissions, all targeted as public health risks by the Environmental Protection Agency.

Since biodiesel can be used in conventional diesel engines, the alternative fuel can directly replace petroleum products; reducing the country's dependence on imported oil.

Biodiesel offers safety benefits over petroleum diesel because it is much less combustible, with a flashpoint greater than 150°C, compared to 77°C for petroleum diesel. It is safe to handle, store, and transport.

Source: Alternative Fuels Data Center