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## Alternative Fuels: Biodiesel

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**B**iodiesel is a renewable fuel produced from agricultural resources such as vegetable oils. In the United States, most biodiesel is made from soybean oil; however canola oil, sunflower oil, recycled cooking oils, and animal fats are also used.

### How It's Made

To make biodiesel, the base oil is put through a process called "esterification." This refining method uses an industrial alcohol (ethanol or methanol) and a catalyst (substance that enables a chemical reaction) to convert the oil into a fatty-acid methyl-ester fuel (biodiesel).

Biodiesel in its pure form is known as "neat biodiesel" or B100, but it can also be blended with conventional diesel, most commonly as B5 (5 percent biodiesel and 95 percent diesel) and B20 (20 percent biodiesel and 80 percent diesel). Biodiesel is registered with the U.S. Environmental Protection Agency (EPA) and is legal for use at any blend level in both highway and non-road diesel vehicles.

Most diesel engines can run on biodiesel without needing any special equipment. If you are interested in using biodiesel in your vehicle or equipment, check with the manufacturer for any recommendations and information regarding engine warranties. In addition, once you have determined the proper blend for your vehicle, make sure to purchase your fuel from a reputable dealer selling commercial grade biodiesel.

### Biodiesel -vs- Vegetable Oil

In 1895, Dr. Rudolf Diesel invented the diesel engine with the intention of running it on a variety of fuels, including vegetable oil. In fact, when he demonstrated his engine at the World Exhibition in Paris in 1900, he fueled the vehicle with peanut oil. However, biodiesel and vegetable oil are very different. Raw vegetable oil or recycled greases (also called waste

cooking oil) that have not been processed into esters are not biodiesel, and are not registered by EPA for legal use in vehicles. In addition, vehicles converted to use these oils would likely need to be certified by the EPA; to date EPA has not certified any conversions. These conversions may also violate the terms of the vehicle warranty. For more information on the certification process, please visit EPA's Web site at: [www.epa.gov/otaq/cert/dearmfr/cisd0602.pdf](http://www.epa.gov/otaq/cert/dearmfr/cisd0602.pdf).

### Performance

Vehicles have similar horsepower and torque as conventional diesel when running on biodiesel. Chemically speaking, biodiesel has a higher cetane number, but slightly lower energy content than diesel. To the average driver, this means better engine performance and lubrication, but a small decrease in fuel economy (2-8 percent). Biodiesel vehicles can also have problems starting at very cold temperatures, but this is more of an issue for higher percentage blends such as B100 and easily solved the same way as with conventionally fueled vehicles -by using engine block or fuel filter heaters or storing the vehicles in a building.

### Availability

In 2004, 25 million gallons of B100 were sold. By 2005, that number had tripled. Today, approximately 600 fleets nationwide use biodiesel blends in their diesel engines, and biodiesel is available in its various blends at approximately 800 locations across the United States. A complete list of stations is available at [www.biodiesel.org](http://www.biodiesel.org).

## Affordability

The price of biodiesel blends varies depending on geographic area, base material (corn, soybeans, etc.), and supplier.

Although biodiesel can cost more than petrodiesel, diesel drivers can transition to biodiesel without purchasing new vehicles. In the case of fleets, managers can transition to biodiesel without acquiring new spare parts inventories or rebuilding refueling stations.

## Maintenance

Generally, the use of biodiesel does not cause many maintenance issues. However, when used for the first time, biodiesel can release deposits accumulated on tank walls and pipes from previous diesel fuel, initially causing fuel filter clogs. As a result, vehicle owners should change the fuel filter after their first tank of biodiesel. Also, biodiesel can degrade rubber fuel system components, such as hoses and pump seals. This is especially true with higher-percentage blends, and older vehicles. Many newer vehicles have biodiesel-compatible components, but it is best to consult your owner's manual or contact your vehicle manufacturers for specific information.

## Benefits

Biodiesel has a number of important benefits. As an alternative to diesel, it can help reduce U.S. dependence on foreign oil. Biodiesel also provides significant greenhouse gas (GHG) emission reductions. B100 reduces lifecycle greenhouse gas emissions by more than 50 percent, while B20 reduces GHG emissions by at least 10 percent.

In addition, biodiesel offers several criteria emissions benefits for the existing vehicle fleet. It reduces emissions of carbon monoxide, particulate matter (PM), and sulfates, as well as hydrocarbon and air toxics emissions.

A 2002 EPA summary analysis of existing data suggests vehicles using biodiesel may emit slightly more nitrogen oxide (NOx) (about 2% for B20 and 10 percent for B100).

Subsequent studies have yielded mixed results, with some showing small increases and others showing small decreases. EPA plans a further investigation to fully assess this issue, including the emissions impact of using biodiesel in vehicles equipped with PM traps and NOx aftertreatment designed to meet strict new emission standards.

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## For More Information

EPA Grow & Go Web Site: [www.epa.gov/smartway/growandgo](http://www.epa.gov/smartway/growandgo)

EPA Alternative Fuels Web Site: [www.epa.gov/otaq/consumer/fuels/altfuels/altfuels.htm](http://www.epa.gov/otaq/consumer/fuels/altfuels/altfuels.htm)

DOE Alternative Fuels Data Center Web Site: [www.eere.energy.gov/afdc](http://www.eere.energy.gov/afdc)

National Biodiesel Board Web Site: [www.biodiesel.org](http://www.biodiesel.org)