

Biodiesel Blends

In 2003, U.S. net petroleum imports exceeded 11 million barrels of oil per day. Almost 24% of that imported crude oil is refined into diesel fuel and heating oil for use in U.S. trucks, boats, and heavy equipment.¹ We can displace a significant amount of petroleum by adding low levels of biodiesel to the diesel we use every day for transportation, industry, and recreation. According to the Energy Information Administration, the United States consumed approximately 36,000 million gallons of biodiesel in 2004.

Biodiesel is a renewable diesel replacement fuel that is manufactured from domestically produced oils such as soybean oil, recycled cooking oils, or animal fats. To manufacture biodiesel, these fats and oils are chemically reacted with a short chain alcohol (such as methanol) and a catalyst to produce biodiesel and a glycerin co-product. Biodiesel can be used alone (B100) or blended with petroleum diesel in any proportion.

The most popular biodiesel blends are B20 (20% biodiesel), which can be used for Energy Policy Act of 1992 (EPAct) compliance, and B5 or B2. Any diesel engine can operate on these blends with few or no modifications. When used in low-level blends of 5% biodiesel (B5) or below, biodiesel is transparent to the user. When biodiesel is used as B20, the user may experience a 1%-2% decrease in power, torque, and fuel economy; however these changes are usually not noticeable.

Can Biodiesel Improve Engine Performance?

Biodiesel's superior lubricating properties can reduce wear in diesel engines. Bench scale tests have shown that 1% biodiesel can improve the lubricity of diesel fuel by as much as 65%.

The lubricity of biodiesel will become increasingly important because EPA regulations will require the use of ultra-low sulfur diesel fuels in all U.S. highway diesel engines by 2006. Unfortunately, ultra-low sulfur diesel fuels can have poor lubricating properties. Low levels of biodiesel used as a lubricity additive can help solve this problem.

Biodiesel also has a higher cetane number than most diesel fuel. Cetane measures the tendency of diesel to autoignite in an engine, and is comparable to the octane number for gasoline. Higher cetane fuels have shorter ignition delay periods than lower cetane fuels. Fuels with a cetane number

Clean Cities and Biodiesel Blends

Blending relatively low levels of alternative fuels with conventional fuels reduces petroleum use and is therefore an important strategy in the Clean Cities portfolio. Clean Cities tactics to promote fuel blends include:

- Training coordinators on the benefits of biodiesel blends and teaching them how to determine which blends make sense locally or regionally.
- Encouraging coalitions to develop outreach plans to educate heavy-duty fleets about biodiesel blend benefits.
- Working with state and local governments to explore opportunities to expand mandates and other programs for increasing biodiesel blend use.

lower than the engine's minimum requirements can cause rough engine operation and may be more difficult to start, especially in cold weather or at high altitudes. Low cetane fuels may increase engine deposits resulting in more smoke, increased exhaust emissions, and greater engine wear.

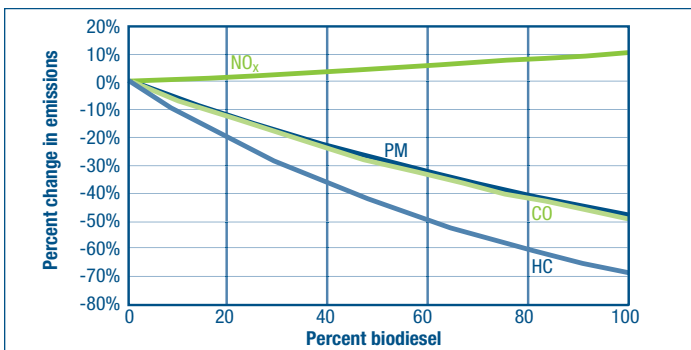
With proper fuel tank maintenance and fuel blending, biodiesel blends of B20 or lower can be used in any diesel engine—including those with advanced fuel injection systems—without reducing reliability or durability. User feedback suggests that maintenance requirements for diesel engines operating on biodiesel blends of B20 or less are identical to those operating on standard diesel.

Do Biodiesel Blends Reduce Emissions?

EPA research shows that biodiesel reduces most emissions from unmodified diesel engines (see chart). The amount that emissions are reduced depends on the blend level. For example, B100 produced from soybean oil reduces life cycle CO₂ emissions by 78% compared to petroleum diesel. This effect is linear with blend level so a B5 blend reduces life cycle CO₂ emissions by 3.8%. Low-level blends will also cause small reductions in emissions of hydrocarbons, carbon monoxide, particulate matter, and harmful air toxics.

Oxides of nitrogen (NO_x), which contribute to smog formation, may increase slightly when biodiesel is used. Numbers vary, however B20 is believed to increase NO_x by 2%-4%. A number of biodiesel researchers are working on fuel additives to address this problem. For blend levels of 5% or lower, the NO_x increase is negligible.





Basic Emission Correlation. Average emission impacts of biodiesel for heavy-duty highway engines. Source: U.S. EPA².

Who Regulates Biodiesel Quality?

The American Society for Testing and Materials (ASTM) has developed specifications for B100 that will be blended with diesel fuel to make low-level biodiesel blends. ASTM specification D6751-03 is intended to ensure the quality of biodiesel used in the United States, and any biodiesel used for blending should meet this specification. Biodiesel meeting ASTM D6751-03 is also legally registered as a fuel and fuel additive with the U.S. Environmental Protection Agency. For a complete list of ASTM biodiesel requirements, see the 2004 Biodiesel Handling and Use Guidelines at www.nrel.gov/docs/fy05osti/36182.pdf.

In addition, the National Biodiesel Board is instituting a quality assurance program for biodiesel producers and marketers. To learn more about the BQ-9000 program, visit the National Biodiesel Board at www.biodiesel.org.

Are Incentives and Credits Available for Biodiesel?

B5 generally costs about 5 cents more per gallon than No. 2 diesel. In October 2004, however, the President signed a bill that contained a biodiesel tax incentive for biodiesel blenders. Experts expect that this tax incentive will lower the price of biodiesel blends but the full effect of implementing this regulation is not yet known. To learn more about this tax incentive, visit the National Biodiesel Board at www.biodiesel.org.

Additionally, in January 2001, federal, state, and certain fuel provider fleets became eligible for EPA credits for using biodiesel blends of at least 20%. This rule

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does not make B20 an alternative fuel, but gives one credit for every 450 gallons of pure biodiesel used in biodiesel blends. To read about this regulation, visit www.eere.energy.gov/afdc/pdfs/FedRegBioFinal.pdf.

Finally, some states have passed legislation that either reduces fuel excise taxes or provides other incentives for biodiesel use or sale. To find out if your state has passed biodiesel legislation, contact your local tax authority, or visit www.eere.energy.gov/afdc/laws/incen_laws.html.

Is Biodiesel Readily Available?

Biodiesel is available in all 50 states. An increasing number of retailers, petroleum distributors, and biodiesel distributors are offering biodiesel blends. The National Biodiesel Board (NBB) maintains a list of registered fuel marketers and retail fueling sites on its website at www.biodiesel.org.

Where Can I Get More Information?

The U.S. DOE's Alternative Fuels Data Center at www.eere.energy.gov/afdc/ is a vast collection of information on alternative fuels and alternative fuel vehicles.

The U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy website at www.eere.energy.gov/biomass/ contains information on biodiesel and ethanol production and policy.

The National Biodiesel Board is the national trade association representing the biodiesel industry. Its website, www.biodiesel.org, serves as a clearinghouse of biodiesel related information.

The National Renewable Energy Laboratory's Nonpetroleum Based Fuels website, located at www.nrel.gov/vehiclesandfuels/npbf/, provides links to a variety of biofuels documents.

The Environmental Protection Agency's Biodiesel Emissions Analysis Program at www.epa.gov/otaq/models/biodsl.htm contains emissions and performance data for biodiesel.

¹ U.S. Energy Information Administration, "Monthly Energy Review, October 2004," www.eia.doe.gov/emeu/mer/contents.html.

² U.S. Environmental Protection Agency, (2002) "A Comprehensive Analysis of Biodiesel Impacts on Exhaust Emissions, Draft Technical Report," EPA420-P-02-001, www.epa.gov/otaq/models/analysis/biodsl/p02001.pdf.

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