



Biodiesel

Colorado Governor Bill Owens Signs Senate Bill 06-016 (Biodiesel Bill) on 3/31/06

Senate Bill 06-016 states that by 1/1/07 all state-owned diesel vehicles and equipment shall be fueled with a fuel blend of 20% biodiesel and 80% petroleum diesel, subject to availability and so long as the price is no greater than ten cents more per gallon than the price of petroleum based diesel fuel.

What is biodiesel?

Biodiesel is the name of a clean-burning alternative fuel, produced from domestic, renewable resources. One hundred percent biodiesel, or “neat” diesel as it is called, contains no petroleum but can be blended at any level with petroleum-based diesel to create a biodiesel blend. 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. The production processes for biodiesel and petroleum diesel are almost identical in their efficiency of converting a raw energy source into a fuel product. The difference between these two fuels is in the ability of biodiesel to utilize a renewable energy source made from any of several feedstocks.

One of the EPA’s primary charges is to reduce public health risks associated with environmental pollution. Biodiesel can play a role in reducing emissions of many air pollutants, especially those targeted by EPA in urban areas. These include emissions of particulate matter (PM), carbon monoxide (CO), hydrocarbons (HC), sulfur oxides (Sox), nitrogen oxides (NOx) and air toxics (see emissions info below).

Biodiesel works in any diesel engine with few or no modifications to the engine or the fuel system. Biodiesel has a solvent effect that may release deposits accumulated on tank walls and pipes from previous diesel fuel usage. The release of deposits may end up in fuel filters initially, so fuel filters should be checked more frequently at first. The issue is less prevalent with B20 blends, (i.e., 20% neat diesel), blends, and there is no evidence that lower-blend levels, such as B2, have caused filters to plug.



How is biodiesel made?

Biodiesel is made through a chemical process called transesterification whereby the glycerin is separated from either fat or vegetable oil. The process leaves behind two products -- methyl esters (the chemical name for biodiesel) and glycerin (a valuable byproduct usually sold for use in soaps and other products). In the U.S., the industry organization that defines the consensus on fuels is the American Society for Testing and Materials (ASTM). ASTM fuel standards are the minimum accepted values for properties of a fuel to provide adequate customer satisfaction and/or protection. The neat diesel standard, ASTM PS 121-99, was approved and issued by ASTM in June of 1999 (for copies see the ASTM web site at www.astm.org).

Fuel-grade biodiesel must be produced to strict industry specifications (ASTM D6751) in order to insure proper performance. Biodiesel is the only alternative fuel to have fully completed the health effects testing requirements of the 1990 Clean Air Act Amendments. Biodiesel that meets ASTM D6751 and is legally registered with the Environmental Protection Agency is a legal motor fuel for sale and distribution.

For entities seeking to adopt a definition of biodiesel for purposes such as federal or state statute, state or national divisions of weights and measures, or for any other purpose, the official definition consistent with other federal and state laws and Original Equipment Manufacturer (OEM) guidelines is as follows:

“Biodiesel is defined as mono-alkyl esters of long chain fatty acids derived from vegetable oils or animal fats which conform to ASTM D6751 specifications for use in diesel engines. Biodiesel refers to the pure fuel before blending with diesel fuel. 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). Tallows and waste greases have definite potential as feed stocks for the U.S. production of biodiesel. Oilseed crops mainly used for production include soybeans, sunflowers, canola, rapeseed and mustard seed.”

Biodiesel yields 3.24 units of fuel product energy for every unit of fossil energy consumed in its life cycle. The production of B20 yields 0.98 units of fuel product energy for every unit of fossil energy consumed. By contrast, petroleum diesel's life cycle yields only 0.83 units of fuel product energy per unit of fossil energy consumed. Such measures confirm the renewable nature of biodiesel.

Biodiesel has the highest btu content of any alternative fuel, though it is slightly less than that of diesel. This might have a small impact on vehicle range. Historically, biodiesel has cost about 1 cent per gallon more than diesel for every percent in the blend. Federal and state policies have recently been enacted that reduce the cost of biodiesel to the consumer.



Why should I use biodiesel?

Biodiesel is better for the environment because it is made from renewable resources and has lower emissions compared to petroleum diesel (see emissions info below). It is less toxic than table salt and biodegrades as fast as sugar. A U.S. DOE study showed that the production and use of biodiesel, compared to petroleum diesel, resulted in a 78.5% reduction in carbon dioxide emissions. Biodiesel has a positive energy balance as every unit of energy needed to produce a gallon of biodiesel produces 3.24 units of energy gain.

All research indicates biodiesel is advantageous to diesel engines' maintenance costs. Good quality biodiesel adds lubricity (particularly for the fuel pump and fuel injectors and actual engine wear can be significantly less), keeps the fuel system clean and makes for a cooler running engine. Extra filter expense has to be expected when first using biodiesel as it will clean the fuel system out causing residuals to flow into the filters. Biodiesel is comparable in milage performance to petroleum diesel. Since it is made in the USA from renewable resources such as soybeans, its use decreases our dependence on foreign oil and contributes to our own economy.

Where do I get biodiesel?

Biodiesel is available nationwide. It can be purchased directly from biodiesel producers and marketers, petroleum distributors, or at a handful of public pumps throughout the nation.

Biodiesel production within the U.S. is estimated to be at around 200 million gallons at this time. Production has tripled in the last two consecutive years.

Colorado Accredited Producers:

- BioEnergy of America, Inc. (formerly BioEnergy of Colorado, LLC) - Denver
- BioFuels of Colorado, LLC - Denver
- Rocky Mountain Biodiesel - Longmont

Colorado Biodiesel Distributors:

- Acorn Petroleum - Colorado Springs and Pueblo
- Agland, Incorporated - Lucerne
- Bartkus Oil Company - Boulder
- Blue Sun Biodiesel - Westminster
- Chief Petroleum - Colorado Springs
- Colorado Petroleum - Denver
- Cox Oil Co. - Greeley
- Gray Oil - Fort Lupton
- Hill Petroleum - Arvada
- Mallette Oil - Leadville
- SHOCO Oil Company - Commerce City
- The Catherine Store - Carbondale



Colorado Fueling Sites:

- A-1 Auto Service - Salida
- Acorn Petroleum - Colorado Springs and Pueblo
- Bartkus Oil Company - Boulder
- Chief Petroleum - Colorado Springs
- Colorado Petroleum - Denver
- Cox Oil Co. - Greeley
- Sapp Brothers - Denver
- SHOCO Oil Company - Commerce City
- The Catherine Store - Carbondale
- Hill Petroleum - Arvada
- TJs Express - Fort Lupton

Biodiesel Emissions

Biodiesel is the first and only alternative fuel to have a complete evaluation of emission results and potential health effects submitted to the U.S. Environmental Protection Agency (EPA) under the Clean Air Act Section 211(b). These programs include the most stringent emissions testing protocols ever required by EPA for certification of fuels or fuel additives. The data gathered complete the most thorough inventory of the environmental and human health effects attributes that current technology will allow.

EPA has surveyed the large body of biodiesel emissions studies and averaged the Health Effects testing results with other major studies. The results are seen in the table below. To view EPA’s report titled “A Comprehensive Analysis of Biodiesel Impacts on Exhaust Emissions” visit www.epa.gov/otaq/models/biodsl.htm.

AVERAGE BIODIESEL EMISSIONS COMPARED TO CONVENTIONAL DIESEL, ACCORDING TO EPA		
Emission Type	B100	B20
Regulated		
Total Unburned Hydrocarbons	-67%	-20% -
Carbon Monoxide	-48%	12% -
Particulate Matter	-47%	12%
Nox	+10%	+2% to - 2% -
Non-Regulated		
Sulfates	-	20%*-
PAH (Polycyclic Aromatic Hydrocarbons)**	100%	13% -
nPAH (nitrated PAH's)**	-80%	50%***-
Ozone potential of speciated HC	-90%	10%
	-50%	

* Estimated from B100 result

** Average reduction across all compounds measured

*** 2-nitroflourine results were within test method variability

The ozone (smog) forming potential of biodiesel hydrocarbons is less than diesel fuel. The ozone forming potential of the speciated hydrocarbon emissions is 50 percent less than that measured for diesel fuel.

Sulfur emissions are essentially eliminated with pure biodiesel. The exhaust emissions of sulfur oxides and sulfates (major components of acid rain) from biodiesel are essentially eliminated compared to diesel.

Criteria pollutants are reduced with biodiesel use. Tests show the use of biodiesel in diesel engines results in substantial reductions of unburned hydrocarbons, carbon monoxide, and particulate matter. Emissions of nitrogen oxides stay the same or are slightly increased.

Carbon Monoxide -- The exhaust emissions of carbon monoxide (a poisonous gas) from biodiesel are on average 48 percent lower than carbon monoxide emissions from diesel.

Particulate Matter -- Breathing particulate has been shown to be a human health hazard. The exhaust emissions of particulate matter from biodiesel are about 47 percent lower than overall particulate matter emissions from diesel.

Hydrocarbons -- The exhaust emissions of total hydrocarbons (a contributing factor in the localized formation of smog and ozone) are on average 67 percent lower for biodiesel than diesel fuel.

Nitrogen Oxides --NO_x emissions from biodiesel increase or decrease depending on the engine family and testing procedures. NO_x emissions (a contributing factor in the localized formation of smog and ozone) from pure (100%) biodiesel increase on average by 10 percent. However, biodiesel's lack of sulfur allows the use of NO_x control technologies that cannot be used with conventional diesel. Additionally, some companies have successfully developed additives to reduce No_x emissions in biodiesel blends.

Biodiesel reduces the health risks associated with petroleum diesel.

Biodiesel emissions show decreased levels of polycyclic aromatic hydrocarbons (PAH) and nitrated polycyclic aromatic hydrocarbons (nPAH), which have been identified as potential cancer causing compounds. In Health Effects testing, PAH compounds were reduced by 75 to 85 percent, with the exception of benzo(a)anthracene, which was reduced by roughly 50 percent. Targeted nPAH compounds were also reduced dramatically with biodiesel, with 2-nitrofluorene and 1nitropyrene reduced by 90 percent, and the rest of the nPAH compounds reduced to only trace levels.

Contact Rob Pearson at (303) 866-2163 or rob.pearson@state.co.us for additional information.