



## 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/analysis/biodsl/p02001.pdf](http://www.epa.gov/otaq/models/analysis/biodsl/p02001.pdf).

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

\* Estimated from B100 result

\*\* Average reduction across all compounds measured

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

(more)

**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<sub>x</sub> emissions from biodiesel increase or decrease depending on the engine family and testing procedures. NO<sub>x</sub> 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<sub>x</sub> control technologies that cannot be used with conventional diesel. Additionally, some companies have successfully developed additives to reduce No<sub>x</sub> 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 1-nitropyrene reduced by 90 percent, and the rest of the nPAH compounds reduced to only trace levels.