

Biodiesel And Fuel Economy

- The energy content, or Lower Heating Value (LHV) is the amount of energy in the fuel (BTU's/gallon or MJ/L)
- The energy content of petroleum diesel fuel can vary by approximately 6% (summer fuel is higher than winter fuel)
- Generally B20 blends decrease energy content by approximately 1%
 - However B20 field trials show little difference in fuel economy
- B1-B5 Blends – has shown no perceptible change in fuel economy in a number of cases

Important Biodiesel Parameters/Quality Issues

- Removal of water
- Removal of glycerine
- Removal of catalyst
- Removal of alcohol
- Absence of free fatty acids
- Clean fuel tanks and lines prior to first biodiesel fuel blend use
- Limit long term storage to 6 months; keep dry and avoid high temperatures

ASTM B100 Biodiesel Specification (D6751)

PROPERTIES	ASTM METHOD	LIMITS	UNITS
FLASH POINT	D93	130 min.	° C
WATER & SEDIMENT	D2709	0.050 max.	% vol.
CARBON RESIDUE	D4530	0.050 max.	% mass
SULFATED ASH	D874	0.020 max.	% mass
KIN. VISCOSITY, 40°C	D445	1.9 – 6.0	mm ² /sec.(cSt)
SULFUR (S15)	D5453	0.0015 max. (15)	% mass (ppm)
SULFUR (S500)	D5453	0.05 max. (500)	% mass (ppm)
CETANE	D613	47 min.	
CLOUD POINT	D2500	Report	°C
COPPER CORROSION	D130	No. 3 max.	
ACID NUMBER	D664	0.80 max.	mg KOH/g
FREE GLYCERIN	D6584	0.020	% mass
TOTAL GLYCERIN	D6584	0.240	% mass
PHOSPHOROUS	D4951	10 max	ppm
DISTILLATION, T90 (90%)	D1160	360 max	°C

Although the D6751 B100 specification allows for both S15 (15ppm) and S500 (500ppm), the majority of biodiesel produced contains almost zero sulphur.

Key parameters are in bold.

Material Compatibility

- Biodiesel and high % biodiesel blends can form high sediment levels when in contact with the following metals:
 - Brass, Bronze, Copper, Lead, Tin, Zinc
- Biodiesel is compatible with:
 - Mild and Stainless Steel, Aluminum, Plastic
- Golden Rule: Keep the fuel clean and dry and work with the biodiesel supplier on storage, blending and handling issues

Material Considerations

- B100 may adversely affect some elastomers such as natural or nitrile rubbers over time
- Most elastomers used after 1993 are compatible with B100 (Viton, etc.)
- In blends such as B20 the material compatibility effect is less, or non-existent
 - Normal monitoring of hoses and gaskets for leaks appear sufficient with B20
- No special precautions are needed for B1–B5 blends

Use, Storage, Handling, Stability

- Four factors that negatively impact fuels in storage are air, water, temperature, and the fuel composition
- Biodiesel (B100) is a solvent—it may harm some painted surfaces
- Wipe up biodiesel spills quickly
- Store biodiesel soaked rags in a safety container to avoid spontaneous combustion
 - Or dry each rag separately
 - DO NOT pile rags in corner and forget them
 - Fuel antioxidants mitigate this risk
- Handling B1–B5 blends is exactly the same as handling petroleum diesel fuel
- Oxidative and thermal stability present no more a concern to biodiesel users than that of petroleum diesel fuel
- Additives are available for both fuels to address stability levels
- Standard storage and handling procedures for petroleum fuels apply to biodiesel or biodiesel blends (clean, dry, dark and cool environment)
- Fuel storage time for biodiesel can be equal or less than petroleum diesel but can be improved with stability additives. The ASTM D6751 specification recommends storing biodiesel no longer than six months.



West Coast Biodiesel

A Division of West Coast Reduction Ltd.

105 North Commercial Drive, Vancouver, BC V5L 4V7
Tel 604-255-9301 Fax 604-255-1803 www.wcrl.com

BIODIESEL BASICS

“The use of vegetable oils for engine fuels may seem insignificant today. But such oils may become in course of time as important as petroleum of the present time.”

DR. RUDOLF DIESEL, 1912

Biodiesel is a clean burning, biodegradable, non toxic alternative fuel produced from renewable resources (animal fats and plant oils), that can be blended with petroleum diesel to create a biodiesel blend (BXX where the XX represents the percentage of biodiesel ie B5 means 5% biodiesel, 95% petroleum diesel).

The technical definition of biodiesel is “a fuel composed of mono-alkyl esters of long chain fatty acids derived from vegetable oils or animal fats, designated as B100, and meeting the requirements of ASTM (American Society for Testing and Materials) D6751 specification”.

CANADIAN RENEWABLE FUELS ASSOCIATION  ASSOCIATION CANADIENNE DES CARBURANTS RENOUVABLES

31 Adelaide Street East, P.O. Box 398, Toronto, ON M5C 2J8
Tel 416-304-1324 Fax 416-304-1335 www.GreenFuels.org

Benefits

- Renewable fuel for diesel engines
- Can be made from used recovered vegetable oil, any seed oil including “low grade” seed oil, yellow grease, tallow
- Reduces lifecycle greenhouse gas emissions (GHGs), may lower hydrocarbon and particulate emissions
- Biodegradable (spills degrade 4 times faster than petroleum diesel fuel)
- Safety – Health Effects tests confirm it is 10 times less toxic than table salt and biodegrades as fast as sugar
- Reduces harmful diesel exhaust emissions
- Can be used in existing diesel engines (no modification required)
- Has been shown to enhance diesel oxidation catalyst performance
- Adaptable to existing infrastructure
- Blends completely with petroleum diesel
- Increases fuel lubricity and reduces engine wear
- Increased cetane (ignition quality)
- Higher flash point than petroleum diesel (less flammable, safer)
- Expanded market opportunity for Canadian agriculture and tallow markets
- Economic/employment opportunities for rural Canada
- Extends domestic fossil fuel supply
- The Lifecycle Energy Balance for biodiesel is about 3.2:1 (Biodiesel yields 3 units of fuel energy for every 1 unit of fossil energy consumed in its lifecycle)

Markets For Biodiesel

- Biodiesel is used across Canada and extensively in the United States
- Users and potential markets include: on road transportation (long haul trucking, buses, consumer vehicles), off road transportation (mining, marine, rail, construction, agriculture/on-farm, recreation), home heating/commercial heating, feedstocks for other chemical processes and products (fuel additives, paints, inks, plastics, fabrics)

Biodiesel Emissions

- Global Warming – greenhouse gas reduction
- Closed carbon cycle: 60%–95% life cycle decrease
- Very low sulfur, less than 10ppm nitrogen, and no aromatic compounds
- Contains 11% oxygen by weight

- Reduces most regulated emissions (PM – particulate matter, CO, SO_x, etc.)
- Highest energy balance of ANY fuel at 3.2 to 1 (energy output per unit of energy to produce)
- 90% reduction of air toxics; 75–90% reduction in PAH (polyaromatic hydrocarbons) & NPAH
- Lends itself to engine optimization techniques which reduce emissions further
- Significantly reduces risks of cancer and birth defects as compared to petroleum diesel
- Biodiesel is the only alternative fuel to have achieved EPA Tier I & II testing
- Can have a slight increase in NO_x emissions in some engines (depending on feedstock)

Performance

- Integrates into existing infrastructure
- Completely miscible with petroleum diesel fuel
- High cetane number (> 50 versus 42 for petroleum diesel), improving combustion
- Improved lubricity
 - Key benefit – ASTM has recently included lubricity requirement in D975 petroleum diesel fuel specification
 - > 6000g vs 3100g SLBOCLE required for petroleum diesel fuel
 - 1% blend biodiesel improves lubricity by up to 65%
- BTU content (B100 has 5–9% less BTU content than petroleum diesel; 1–2% decrease for B20 blends)
- Higher flashpoint than petroleum diesel (less flammable/safer; > 149°C biodiesel versus 50°C for petroleum diesel)
- Additional filter changes may be required for B20 blends; no additional filter replacements or changes are required for a B2 blend

Warranties

- Biodiesel industry is working cooperatively with FIE, Engine and Vehicle Makers
- Use of B5 will Not Void Original Equipment Manufacturer (OEM) Warranties or B20 in some cases
 - Warranty means parts and workmanship
 - OEM's do not make fuel; OEM's do not warrant fuel
 - B100 must meet ASTM D6751

- Canadian standard for blend specification: CAN/CGSB-3.520 Automotive Low-Sulphur Diesel Fuel Containing Low Levels of Biodiesel Esters (B1–B5) identifies B1–B5 blends are suitable for general public use (CGSB: Canadian General Standards Board)
- Fuel related problems are a fuel supplier responsibility – just as with petroleum diesel
- No biodiesel related problems with B20 in US over last 3–4 years when biodiesel met ASTM B100 specifications and with proper fuel management
- Engine company statements on NBB.org website
- B1–B5 blends that meet CAN/CGSB-3.520) must also conform to the Canadian low sulphur diesel fuel standard CAN/GCSB-3.517

Economic Impact

- Canada uses about 23 billion litres of diesel per year for transportation
- A 1% biodiesel blend (B1) in Canada (for all on road diesel) translates to a market for 230 million litres of biodiesel
- Canola produces approximately 250 litres/acre of oil for biodiesel from a 25 bushel/acre crop
- 80% of yellow grease is vegetable oil
- Biodiesel made from tallow benefits farmers as an added value product
- Additional market for fats and oils
- Economic/employment opportunities for rural Canada

Cold Flow

Number 2 diesel fuel can experience significant cold flow problems in cold weather.

- The diesel industry has solved the problems with Number 2 diesel through a variety of means that are in common practice today.
- These same solutions should be used with biodiesel blends to assure satisfactory cold weather performance.
- B20 has been used successfully in fleets experiencing extremely cold weather without any additional precautions.
- When using blends of B20 or lower, the cold weather performance of the blend is mostly determined by the diesel fuel portion.
- Incorporation of blends less than 20% biodiesel (i.e. B5 or B2) into existing diesel fuel has little or no effect on the cold flow properties of the finished blend.