

Biodiesel Quality Overview

Prepared by:

ABA Technical Quality Committee

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Contributors

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ABA POLICY

The Alberta Biodiesel Association (ABA) recognizes that Quality and Safety of Biodiesel fuel supply are paramount for the biodiesel industry, consumers and the public at large.

The Canadian Federal Government's biodiesel fuel quality standard is currently being developed with inputs from the Canadian Renewable Fuels Association (CRFA), the Canadian Petroleum Products Institute (CPPI) and biodiesel industry stakeholders. This national regulation is expected to provide maximum flexibility and efficiency, ultimately benefiting the end-users.

The ABA policy is to support the nationally and provincially governed set of biodiesel regulations designed to protect the industry, consumers and the environment when it comes into effect.

In the interim ABA's preferred policy option is to support the existing biodiesel quality standards as specified in the ABA Quality Statement.

ABA Quality Statement

The ABA supports and promotes the latest edition of the existing American Society for Testing and Materials (ASTM) D6751 fuel quality standard, Canadian General Standards Board (CGSB) and the BQ-9000 Quality Management System (QMS) Program to ensure that the three imperatives of sustainable development, namely environmental responsibility, economic success and social acceptance of biodiesel, are implemented.

Biodiesel fuel quality ensures adherence to the following;

- 1) Certificate of Analysis (COA)
- 2) Applicable ASTM D6751 and CGSB standards
- 3) The BQ-9000 QMS Program

The BQ-9000 QMS Program monitors the production of biodiesel according to the latest edition of ASTM D6751 standard and includes the sampling, testing, retention, marketing and shipping of both 'pure' (or 'neat') and 'petroleum blends' of biodiesel.

BIODIESEL QUALITY SPECIFICATION

Biodiesel is defined as the mono alkyl esters of long chain fatty acids derived from vegetable oils or animal fats, for use in compression-ignition (diesel) engines. This specification, as presented in Table-1, is for pure or neat (100%) biodiesel B100 prior to use or blending with diesel fuel.

TABLE-1: SPECIFICATION FOR BIODIESEL (B100)

ASTM¹ D6751-07b October 15, 2007

Property	ASTM¹ Method	Limits	Units
Calcium & Magnesium, combined	EN ² 14538	5 Max.	ppm (ug/g)
Flash Point (closed cup)	D 93	93 Min.	Degrees C
Alcohol Control (One of the following must be met)			
Methanol Content	EN ² 14110	0.2 Max.	% volume
Flash Point	D93	130 Min.	Degrees C
Water & Sediment	D 2709	0.05 Max.	% vol.
Kinematic Viscosity, 40 C	D 445	1.9 - 6.0	mm ² /sec.
Sulphated Ash	D 874	0.02 Max.	% mass
Sulphur			
S 15 Grade	D 5453	0.0015 Max.(S15)	% mass (ppm)
S 500 Grade	D 5453	0.05 Max. (500)	% mass (ppm)
Copper Strip Corrosion	D 130	No. 3 Max.	
Cetane	D 613	47 Min.	
Cloud Point	D 2500	Report	Degrees C
Carbon Residue 100% sample	D 4530	0.05 Max.	% mass
Acid Number	D 664	0.50 Max.	mg KOH/g
Free Glycerin	D 6584	0.020 Max.	% mass
Total Glycerin	D 6584	0.240 Max.	% mass
Phosphorus Content	D 4951	0.001 Max.	% mass
Distillation, T90 AET	D 1160	360 Max.	Degrees C
Sodium/Potassium, combined	EN ² 14538	5 Max.	ppm
Oxidation Stability	EN ² 14112	3 Min.	hours

Notes:

1. ASTM - American Society for Testing and Materials
2. EN – European Nations Standard

The following is an update (June 2008) from the ASTM Committee D02 on Petroleum Products and Lubricants;

- a) ASTM D6751 has been changed for B-100 to include the Cold Soak Filtration Test.
- b) D-396 Heating Oil Spec and D-975 Diesel fuel Spec have both been modified to include up to B-5 for heating oil and B-6 to B-20 for transportation fuel.



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The Canadian General Standards Board (CGSB) is accredited by the Standards Council of Canada to develop National Standards of Canada in a broad range of subject areas and to offer conformity assessment services, including programs for certification of suppliers meeting product and services standards, registration of quality and environmental management systems conforming to ISO standards, and related services.

These services are provided in support of Canada’s economic, regulatory, procurement, health, safety and environmental interests. Refer to Table-2 for a list of recent publications associated with biodiesel.

Table-2: CGSB Reference Document

This section lists CGSB standards pertaining to biodiesel that have recently been published.

Date of publication	Designation — Title / ICS
March 2006	CAN/CGSB-3.520-2005 — <i>Automotive Low-Sulphur Diesel Fuel Containing Low Levels of Biodiesel Esters (B1-B5)</i> / 75.160.20
April 2007	CAN/CGSB-3.520-2005 -- <i>Automotive Low-Sulphur Diesel Fuel Containing Low Levels of Biodiesel Esters (B1-B5) - Amendment No. 2</i> / 75.160.20

Contact CGSB Sales Centre for more information; Phone: 819-956-0425 or 1-800-665-2472; Fax: 819-956-5740; E-mail; ncr.cgsb-ongc@pwqsc.gc.ca



Frequently Asked Biodiesel Quality and Operability Questions:

1.0 What are bio-fuels?

Fuels such as biogas, biodiesel and bio-ethanol (or ethanol) made from plant material and recycled elements of the food chain are classified as bio-fuels. The two most common liquid bio-fuels are biodiesel and ethanol.

2.0 Is biodiesel the same as ethanol?

Biodiesel is *not* the same as ethanol. Biodiesel is a diesel alternative, whereas ethanol is a gasoline additive/substitute (typically derived from corn or sugar cane). Whereas the processes employed to manufacture biodiesel and ethanol are very different, both are considered renewable bio-fuels.

3.0 Where is biodiesel derived from?

Biodiesel is a refined alternative fuel derived from renewable resources such as virgin plant oil (eg: canola, soybean, palm oil, etc.), recycled waste oils (eg: cooking grease), animal fats (eg: renderings), or non-food sources (e.g. jatropha) for use in existing diesel (compression-ignition) engines.

4.0 Are Straight Vegetable Oils (SVO) and Animal Fats also considered biodiesel?

Straight vegetable oils and animal fats are *not* biodiesel. However, biodiesel is produced from vegetable oils and animal fat through a trans-esterification process in the presence of a suitable catalyst. The trans-esterification process involves the reaction of the oil with alcohol (eg: *methanol* or *ethanol*) in the presence of a caustic catalyst (eg: *sodium* or *potassium hydroxide*) to produce biodiesel and a glycerin by-product.



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5.0 What is a biodiesel blend?

A biodiesel blend is a combination of biodiesel and petroleum based diesel fuel (petrodiesel) in a specified ratio, typically designated as B_n (where 'n' is the volume percent of biodiesel). For example, B20 indicates 20% biodiesel and 80% petrodiesel.

6.0 Can pure biodiesel (B100) and biodiesel blends be used?

Both, pure biodiesel (B100), and biodiesel blends (biodiesel plus petrodiesel) ranging from B2 to B20, can be used provided they all meet the latest ASTM D6751 specification standard. Usage of both pure biodiesel and biodiesel blends have demonstrated significant environmental benefits.

7.0 What is the role of BQ-9000 in relation to ASTM D6751?

The BQ-9000 is a voluntary quality management program that provides accreditation/certification to biodiesel producers and marketers. In order to maintain the efficacy of biodiesel as a high quality, high performance fuel and protect consumers, it is imperative that the latest ASTM D6751 standards are met. The BQ-9000 quality management program ensures that biodiesel is produced, maintained and marketed to the accepted ASTM D6751 industry standard, and thereby promotes the commercial success of and public confidence in the use of biodiesel.

8.0 Is an engine modification or different maintenance regime required if biodiesel is used?

Both, B100 or blended biodiesel, may be used in most modern diesel engines with little or no modification depending on the type, age and warranty of the diesel engine. Adhering to the manufacturer's manual for biodiesel compatibility and usage is highly recommended.



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Materials: In older diesel engines (eg: typically pre-1997 models), operating at blends above B5, rubber components such as “O” rings, gaskets and fuel lines may have to be replaced because the alcohol in the biodiesel is a solvent and may cause deterioration and leaks. This problem can be overcome by replacing the rubber components with corresponding neoprene gaskets and fuel lines. Materials generally compatible with biodiesel are commercially rated elastomers such as teflon, viton, nylon, polyethylene and silicone, metals such as aluminium and steel, and most fibreglass components. Materials not compatible with biodiesel are commercial elastomers such as nitrile rubber, polypropylene, polyvinyl, tygon, as well as metals such as brass, copper, bronze, lead, tin and zinc. Therefore, checking the biodiesel material compatibility and the manufacturer’s instructions is highly recommended.

Filter Change: Biodiesel effectively strips diesel plaque build-up in fuel lines and tanks, leaving deposits in the fuel filter. Use of blends above B5 may initially require some fuel filter changes to remove the impact of these deposits on operability.

Lubricity: Biodiesel is easier on engines as it increases lubricity (which helps to reduce friction and wear) because of its ester content as opposed to petrodiesel, which traditionally achieves lubricity by way of sulphur content. Consulting the manufacturer’s manual for biodiesel blend compatibility and usage is highly recommended.

9.0 How can biological contamination in B100 be controlled?

Biological contamination occurs because of water contamination in biodiesel. If water contamination is not eliminated, the aerobic fungus, bacteria, and yeast hydrocarbon utilizing micro-organisms usually grow at the fuel-water interface. These bugs can become active in sediments on tank surfaces and cause corrosion. Although eco-responsible biocides may control biological contamination, prevention of water contamination inhibits the problem proactively.



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10.0 Are tail pipe emissions the same for biodiesel and petrodiesel?

The composition of tail pipe emissions related to biodiesel are not the same as for petrodiesel. Pure biodiesel contains about 10% more oxygen by weight. It is this oxygen which effectively increases combustion efficiency and leads to a reduction in emission of hydrocarbons (HC), toxic compounds, carbon monoxide (CO) and particulate matter (PM). In addition, recent testing has shown that there is virtually no variation in nitrogen oxide (NOx) emission between B20 and petrodiesel, although there is a noticeable reduction in emissions of relative organic gases (ROG) which are considered noxious and carcinogenic. Overall the biodiesel tail pipe emissions are significantly lower than those of petrodiesel.

11.0 Will using biodiesel help to lower Green House Gas (GHG) emissions?

Using biodiesel will substantially help in lowering GHG emissions, relative to petroleum diesel. Based on a reliable GHGenius model, a litre of petrodiesel creates about 4.0 kg of CO₂ equivalent emissions, while biodiesel emissions range between 0.5 to 1.0 kg of CO₂. Even a B20 blend would have about a 15% reduction in GHG emissions.

12.0 Where can I find information on current programs related to biodiesel in the province of Alberta?

Information on current biodiesel related programs can be accessed via Climate Change Central's developed website www.biofleet.net.



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13.0 Where can I find retail suppliers for biodiesel in Canada?

A list of Canadian Retail Fuelling Outlets may be accessed via www.biofleet.net and clicking on 'Greenfuels Map'.

14.0 Where can I find retail suppliers for biodiesel in the USA?

A list of U.S. Retail Fuelling Outlets may be accessed via www.biodiesel.org/buyingbiodiesel/retailfuelingsites and clicking on the desired State.

Other References:

- 1) www.astm.org
- 2) www.biodiesel.org
- 3) www.albertabiodiesel.org