



Energy Efficiency and
Conservation Authority
Te Tari Tiaki Pūngao

Working with biodiesel blends

A guide for the motor trade, repair and transport industries



Background

Biofuels have been produced and used for over 20 years in many European countries, the United States, South America, parts of Asia and Australia. They are relatively new to many New Zealand drivers.

EECA has produced this guide on biodiesel and biodiesel blends for those who sell, service or manage diesel-powered vehicles. It is designed to help them understand biodiesel blends, how to avoid problems, and what to tell drivers or clients.

What is biodiesel?

Biofuels (such as biodiesel and bioethanol) are fuels made from renewable resources, which can be substituted for ordinary diesel or petrol.

Biodiesel is commonly made from vegetable oils or animal fats, such as used cooking oil, rapeseed oil, soybean and tallow. A chemical process is used to convert the oils and fats into biodiesel. The process creates a fuel with properties quite similar to ordinary diesel.

Few vehicles are designed to run on biodiesel only, so biodiesel is usually blended with ordinary diesel. For example, B5 is 5% biodiesel blended with 95% diesel and B20 is 20% biodiesel blended with 80% diesel. Pure biodiesel is known as B100.

Using biofuels (or biofuel blends) instead of ordinary diesel or petrol reduces the net greenhouse gas emissions in the atmosphere which contribute to climate change.

Working with biodiesel

Biodiesel is very similar to diesel, but it has a number of differences that are worth noting. Biodiesel users often find that there are several practical advantages that biodiesel blends offer, on top of the environmental benefits.

What's different about biodiesel?

Property	Comment
Good lubrication properties	Biodiesel can improve the lubricity of diesel fuel, reducing engine wear.
Cleaner burning	Biodiesel burns with fewer particulate emissions.
Less hazardous	Pure (100%) biodiesel is not a hazardous substance so has no HSNO classification. However, biodiesel blends should be stored and handled in the same way as ordinary diesel.
More biodegradable	Biodiesel is more biodegradable than ordinary diesel, which means it is a better choice for sensitive environments, e.g. marine, particularly as B100.
Low temperature gelling	Issues with gelling in cold weather can occur with diesel as well as biodiesel. For biodiesel, the temperature at which biodiesel will start to gel depends on the feedstock and blend. Tallow-based biodiesel will generally gel more readily at lower temperatures than biodiesel made from used cooking oil or rapeseed.
Higher viscosity	Biodiesel has a slightly higher viscosity than ordinary diesel. Higher viscosity fuels can increase fuel injection equipment pressures and put more strain on associated components. Fuel injection into the engine's combustion chamber may also be affected. Biodiesel blends purchased from service stations, and for sale commercially, must meet the government's specification for ordinary diesel, which stipulates the same allowable viscosity for biodiesel blends as ordinary diesel.
Lower energy content	The energy content of a litre of biodiesel is around 92% of that of ordinary diesel. In a 5% blend this energy reduction is around 0.4%, too small to be noticed. There can be variations in energy content of up to 3% between different batches of ordinary diesel.
Higher cetane number	Cetane is a measure of combustion quality, similar to octane for petrol. Biodiesel typically has a higher cetane number than ordinary diesel, which may improve the performance of the vehicle. The minimum cetane number or index is the same for biodiesel blends as for ordinary diesel (51), which means a biodiesel blend will perform at least the same as ordinary diesel.

Biodiesel do's and don'ts

Store biodiesel blends correctly

Biodiesel biodegrades faster than ordinary diesel. This is an environmental benefit if there is a spill, but it also means that biodiesel blends may begin to biodegrade if stored incorrectly.

The guidelines for storage of biodiesel blends are much the same as for ordinary diesel – they should be stored in closed containers somewhere dry, cool and dark for no longer than three months. It is important that good housekeeping is followed and that water is not allowed to accumulate in the fuel system.

If the fuel is not likely to be used for an extended period of time, it is recommended that the tank is filled. This will help reduce breathing in the tank and minimise any absorption of water.

Follow ordinary diesel safety rules

Although biodiesel is considered to be non-toxic to humans, biodiesel blends are considered as toxic as ordinary diesel. When handling biodiesel blends take normal safety precautions – avoid skin contact, splashes in the eyes and inhaling the fumes.

Don't use raw oils as fuels

Technically, it is possible to use vegetable oils and animal fats in raw form to power a diesel engine, however, this sort of 'home brew' is likely to damage engines and is not recommended. Using raw oils can lead to engine deposits, filter 'plugging', poor fuel atomisation and hence poor combustion, dilution of and reaction with the lubricating oil, and undue strain on injection components. The cleanliness of raw oils sold for use in engines may also be suspect, causing injector fouling and plugging.

Additives

The Engine Fuel Specifications Regulations ensure that the quality of biodiesel blends for retail sale, including cold temperature properties, must meet the same specifications as ordinary diesel.

Fuel additives mixed with fuel after it is sold may put any fuel out of specification and should only be used if approved by the vehicle manufacturer.

Diesel bug

Do not introduce biodiesel blends into a tank of ordinary diesel where the presence of water or microbial growth (diesel bug) is suspected without flushing out the tank first. Biodiesel blends can take up water more easily and water allows microbial growth to occur and spread. If diesel bug is suspected seek specialist advice.

Caution in cold areas

In winter, if the biodiesel blend has not been purchased locally, drivers should not park in very cold areas (e.g. in the mountains) for extended periods such as overnight, because gelling of the fuel may occur. The gel will block the fuel filter and prevent the engine starting. This is similar to ordinary diesel; locally-purchased fuel is formulated to suit a region's typical temperatures. Simply driving through cold areas with a biodiesel blend in the tank is not a problem.

Vehicle compatibility

EECA recommends that vehicle owners check with their vehicle or engine manufacturer, and specialists with expertise in the field, about the level of biodiesel blend that is suitable for their vehicle or vessel.

B5

B5 (5% biodiesel blend) contains only a small amount of biodiesel, and virtually all diesel vehicles can use B5 without any engine or fuel system modifications. B5 is approved for use by the vast majority of vehicle manufacturers, including the Engine Manufacturers Association (EMA) and the Fuel Injection Equipment (FIE) manufacturers.

Under New Zealand fuel specifications, blends of up to B5 may be sold at service stations or other retail outlets without labelling.

B7

B7 (7% biodiesel blend) is a relatively common biodiesel blend in use in Europe. B7 can be sold at service stations or other retail outlets in New Zealand, but must be labelled.

B20 and other higher blends

Most large commercial vehicles, such as trucks, buses and vessels, can use higher blends, such as B20. Many vehicle owners in New Zealand have been running vehicles safely and smoothly on biodiesel blends of B20 or higher for some time, after seeking expert advice.

However, most engine manufacturers are cautious about approving the use of higher blends of biodiesel, and owners of newer vehicles may find that the use of higher blends will breach warranty conditions.

It is strongly recommended when using higher blends such as B20 or other blends that are not intended for retail sale, that the oxidation stability of the biodiesel component is guaranteed. Fuel suppliers will be able to provide the results of tests on the biodiesel used for the blend they have supplied.

Suitability for new technologies

Diesel engine technology continues to evolve. Among recent developments are particulate traps – exhaust systems designed to reduce fine particles emitted from engines. Other developments include advanced emissions-related technologies such as Selective Catalyst Reduction systems (SCR). The latest generation of fuel injection systems are very sensitive to fuel type.

These new technologies are being used in countries that also sell biodiesel blends. Always check with your vehicle or engine manufacture regarding the use of higher biodiesel blends with new technologies. The Motor Industry Association provides advice on the use of biodiesel blends above 5% here: www.mia.org.nz/documents#fuels

Other uses for biodiesel blends

Biodiesel blends can be used in almost any diesel engine, including those found in trucks, earth moving equipment, tractors, generators and boats.

The main thing to remember when using biodiesel in equipment or vehicles that are used infrequently is to store the biodiesel properly (see Biodiesel do's and don'ts).



Photo courtesy of Fulton Hogan

Switching to biodiesel

In most cases, changing to a biodiesel blend is very simple. Vehicles can switch to and from biodiesel blends and ordinary diesel at any time, and have a mix of both in the tank at the same time.

Fuel systems and filters

Biodiesel blends tend to 'clean' fuel systems; loosening dirt and old fuel deposits and carrying them through to the fuel filter. Although blending with ordinary diesel reduces this from occurring, cleansing still happens slowly over time, particularly in older vehicles or where the fuel system may be in poor condition.

Therefore, it is recommended that the fuel filters in older vehicles are replaced after a few tanks of a biodiesel blend, when they will have had a chance to catch any loosened material.

Remember, power loss can be a sign that an engine's fuel filters are blocked, and is not necessarily a result of the change in fuel. Full power will be restored once the fuel filters are replaced.

Check for fuel leaks

Biodiesel blends may affect the materials of certain fuel system components such as seals, hoses, gaskets and wire coatings. The non-metallic materials and components most at risk include fuel injection pump seals.

With low blends such as B5 and B7, it is unlikely that problems will occur, but there is still a small risk of components degrading. Mechanics and customers should keep an eye out for wet patches under the vehicle after it has been parked, moisture at the bottom of the engine, unusual diesel smells when operating the vehicle, or a reduction in the fuel economy, any of which may indicate a fuel leak.

Retail sale of biodiesel blends

New Zealand retailers (i.e. service stations) are permitted to sell biodiesel blends of up to 5% (B5) unlabelled, and up to 7% (B7) if labelled.

Higher blends may be sold as long as there is a commercial contract or agreement in place with the customer. This can allow fleet customers, commercial operators, and drivers as part of a fuel cooperative (or consortium) to access higher blends of biodiesel such as B20, B30, B60 or B100.



Tanker delivering biodiesel (Photo courtesy of Green Fuels NZ).

Trouble-shooting

Biodiesel blends are unlikely to cause problems for vehicle operators, as long as they are appropriate for the vehicle. The information below is to help workshops recognise problems affecting diesel vehicles which in some cases may be more prevalent if biodiesel is used.

Note: When looking for causes of fuel related problems, it is important to ensure that the vehicle's engine management, air intake and fuelling systems are in a good state of repair.

Problem	Symptoms	Possible cause	What to look for	What to do
Scale and plaque	Fuel starvation, smoking and loss of power.	Fuel filter blocking is caused by scale and plaque. If it has been some time since last filter change, the vehicle may simply be due for new filters.	Look for solids on the membrane of the primary fuel filter.	Change the primary fuel filter, and monitor vehicle performance. If symptoms persist inspect the secondary fuel filter. This problem should not recur once the fuel system is clean.
Water in fuel	Fuel pump and injector failure.	Free water in any diesel or biodiesel blend can cause fuel pump and injector failure.	Look for corrosion of fuel pump components and water trapped in the fuelling system, including the pump, primary filter, water trap and fuel tank.	Remove fuel, dry fuel system and tank, clean the water trap (if fitted), change fuel filters and fill with fresh dry fuel. Check the fuel pump and injectors for signs of corrosion.
Waxing (gelling)	Fuel starvation and loss of power.	Biodiesel is prone to waxing (gelling) in very cold conditions, causing the fuel filter to block.	Look for whitish waxy material on the membrane of the primary fuel filter.	Replace primary fuel filter. If necessary, inspect secondary filter.
Diesel bug	Fuel starvation and loss of power.	Fuel filter blockage caused by diesel bug. Water in storage or vehicle tank combined with slow product turnover can encourage diesel bug growth.	Fuel is often hazy and greyish in appearance. Filter membranes are often charcoal grey.	Drain fuel and check for free water in vehicle and storage tanks. Replace fuel and filters, and clean the water trap if fitted.
Damaged fuel pump or injectors	Poor performance of the engine.	Most likely the result of free water. If water is not the cause, it is possible that the biodiesel has aged or that the cause is unrelated to the fuel.	If water does not appear to be the cause of the problem, check for sticking of moving parts, varnish and deposits on critical components and coking on the injectors.	Take a fuel sample. Check/replace both primary and secondary fuel filters. Replace damaged parts.
Failure of DPFs (Regenerative Diesel Particulate Filters)	Poor running, smoking. Vehicle fails emissions test.	Metal soaps can block or deactivate DPFs. If fuel filters are working correctly, this type of damage is unlikely.	Excess emissions.	If the DPF appears to be malfunctioning, consult the vehicle manufacturer. The cause may be unrelated to the biodiesel blend.



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