

# *Biodiesel Basics*

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## WHAT IS BIODIESEL?

Chemically speaking, biodiesel is the shortcut name for fatty acid methyl ester. It is chemically quite different from petroleum diesel. However, it does a beautiful job of mimicking the properties of petroleum diesel. It is a wonderful fuel for diesel engines and in many respects, is superior to petroleum diesel. It is a cleaner burning alternative to petroleum-based diesel and is made from renewable resources like soybean oil. It works in any diesel engine with few or no engine modifications. It also works in some, but not all oil space heaters.

## ADVANTAGES

Biodiesel is nontoxic, biodegradable and free of sulfur. It gives you about the same fuel economy, horsepower, and torque as petroleum diesel, but it is cleaner burning, and offers much better lubricity. Many states, like California, have dramatically reduced the amount of sulfur in petroleum diesel. Unfortunately, this also removes the lubricity and, as a result, these low sulfur petroleum diesel fuels tend to wear out injector pumps. On the other hand, biodiesel is extremely slippery and, as a result, engines last longer. Biodiesel reduces emissions of carbon monoxide, particulate matter, and sulfates. It is good for your engine, good for our nation, good for the environment, and good for your wallet.

## PETROLEUM/BIODIESEL BLENDS

Petroleum diesel and biodiesel can be combined in any ratio. One tank of fuel might be 100% biodiesel (B-100) and the next could be pure petroleum diesel. Or the two kinds of diesel can be mixed in any ratio. You can fill up your vehicle any way you want with no engine adjustments whatsoever.

## ENGINE MODIFICATIONS

A modern diesel engine requires no modifications at all. Older vehicles might have some rubber parts in the fuel system. Biodiesel tends to slowly eat away rubber parts such as old fuel lines in the same way as alcohol blended fuels do. Generally speaking, rubber has not been used in fuel systems for more than 10 years. So this isn't much of a problem, and if your parts are that old they need to be replaced anyway.

## BIODIESEL CLEANS FUEL SYSTEMS

Biodiesel is quite detergent and will clean out all of the old crud in your fuel tank and fuel system. Therefore, it is quite important to change the fuel filter before you use any biodiesel. Biodiesel is capable of dissolving junk in your fuel filter and sending it to your engine. You may also need to change the fuel filter several more times as the crud is removed from your fuel tank. Once the system is clean, it will stay clean.

## STRAIGHT VEGETABLE OIL

Is running biodiesel the same as burning straight vegetable oil? Absolutely not! To burn straight vegetable oil, you need to make substantial modifications to each vehicle. You need two tanks, one for petroleum diesel and one for vegetable oil. You also need separate fuel pumps and separate fuel lines and filters. The vegetable oil system all needs to be heated, and you also need a method of switching from one fuel to the other. With this kind of a setup, you then start the engine on petroleum diesel and drive that way until the engine is hot and the vegetable oil is hot. Then you switch over to vegetable oil. Before you can shut the engine down, you need to switch it back to petroleum diesel and run it until all of the vegetable oil is out of the engine system. This is bad enough if you only have one vehicle. For multiple vehicles, a tractor, a diesel generator, a diesel heater, it just doesn't make any sense. It is so much easier to make biodiesel and put it in everything.

## BIODIESEL IS EASY TO MAKE

With a well designed biodiesel processor like our Fuelmeister II™ anyone can learn to make premium quality biodiesel that you can safely use in any diesel engine and in some diesel stoves. In 24 hours, you can make up to three 40 gallon batches of biodiesel (dual tank system) with only about one half hour per batch of actual hands on time.

## BIODIESEL IS INEXPENSIVE TO MAKE

In the United States, we are making biodiesel for about 70 cents per gallon.

## WHAT IS BIODIESEL MADE FROM?

Our system uses 40 gallons of new or used vegetable oil, a very small amount of sodium hydroxide (lye,) and 8 gallons of methanol (wood alcohol.) All of these ingredients are very easy to obtain. Your total cost is usually about \$28 (\$20 for methanol, \$8 for lye) and you will get 40 to 42 gallons of premium biodiesel. Therefore, your cost is about 70 cents a gallon for the finished product.

## HOW IS BIODIESEL MADE?

We pump 40 gallons of vegetable oil into the processing tank and then recirculate it for a few minutes to be sure we have a homogeneous solution. Next, we sample the vegetable oil and run a simple PH test to determine the level of acidity. The more the vegetable oil has been used in a

fryer, the more acidic it will become. Some lye is needed for the chemical process and some is needed to neutralize the acidity. Once we know the PH level, we know how much total lye to use. The methanol/lye combination now becomes methoxide. Now we set the automatic timer on the processing tank for one hour.

During the hour the chemical combination of vegetable oil (triglycerides) and methoxide are constantly mixed. During the mixing process, the triglycerides are chemically altered and become methyl esters. Voila, we have biodiesel. Now over the next few hours (the warmer the tank, the faster the process goes) the new biodiesel will float to the top of the tank and the byproduct, glycerol, will settle to the bottom. Because the processor tank is cone shaped and semi-transparent, we can easily see the dividing line between the two. We drain the glycerol off the bottom of the tank and what remains is biodiesel.

Our next step is to hook up a garden hose to a built-in water washing system and let it run. We are actually washing our biodiesel with water. The water will gently drop down through the biodiesel and pick up any excess methanol and/or soap. We will drain off the milky water from the bottom as we continue to add water from the top. When the water runs clear, we have clean, ready to use biodiesel.

#### IS WASHING REALLY NECESSARY?

The pioneers of biodiesel production, like Joshua Tickell (author of *From the Fryer to the Fuel Tank*,) did not wash their product and many home brewers still do not. Crude biodiesel seems to work well in old tractors and old Mercedes automobiles, but we would not put it in our Ford Powerstroke, GM Duramax, Volkswagen TDI, Caterpillar, or Cummins engines. These engines are just too expensive and so we want to make the best possible product.

#### QUALITY CONTROL

Quality control is vital. Modern diesel engines are far too expensive to take any risks in our fuel production. In our Fuelmeister II™ training we encourage everyone to make several one litre batches of biodiesel in half gallon canning jars. It's far better to mess up a one litre batch than a 40 gallon batch. We think that you must acquire the skills and confidence to be 100% positive that you have produced a quality product. Your finished biodiesel can and should be tested for quality before it is used. We emphasize quality and we teach quality.