GETTING STARTED MAKING BIODIESEL

by Graydon Blair from

UTAH BIODIESEL SUPPLY

Welcome to the wonderful world of Biodiesel. It is a fun and rewarding hobby in which you can make your own fuel to run in diesel engines.

Biodiesel is most commonly made by chemically altering an organic oil through the use of a catalyst and an alcohol, typically Methanol. The chemical reaction that occurs through this process breaks down the oil molecules and replaces the glycerin portion of the molecule with an alcohol molecule. The glycerin falls to the bottom and is drained off resulting in Biodiesel.

The Biodiesel is then typically washed, to remove any extra impurities and is then used as a fuel in a diesel engine without making any modifications to the engine.

Biodiesel is known chemically as a 'fatty acid methyl ester'. Which is just a fancy way of saying it's a product made from Methanol and an organic oil with fatty acid chains in it. It is easily made and has many benefits, including environmentally friendlier tailpipe emissions and improved engine performance.

Below is a guide to some of the things you'll need to know to get started.

PRECAUTIONS

When making Biodiesel, it's important to be safe. Because you are dealing with toxic chemicals, the potential to seriously hurt, injure, and even kill yourself and others exists!

!!! BE SAFE WHEN MAKING BIODIESEL !!!

You'll be dealing with some fairly caustic chemicals, an alcohol called Methanol, fair amounts of heat, and the transferring of flammable fluids from one container to container so it's a good idea to have a fire extinguisher around that is capable of putting out an oil based fire.

Biodiesel should **always** be made in a well-ventilated area away from children and pets with the proper safety equipment utilized.

Before making large batches of Biodiesel, check with your local municipality and fire marshall to ensure that any chemicals, alcohol, or other substances you will use are being stored and used within the proper laws and ordinances for your area. Some area's refer back to state and federal fire codes. It's always a good idea to check before you get started.

Using home made Biodiesel in a diesel engine vehicle may void your manufacturer's warranty. Although the steps outlined to make it are fairly bullet proof and have been tested in several thousands of vehicles all over the world, there's no guarantee your engine manufacturer will honor your warranty.

Biodiesel is considered a fuel so if you plan to use it in a vehicle for on-road use, it may be subject to taxes. Check with your state and federal taxing agencies if in question.

Biodiesel itself, when properly made, is actually quite safe. It's less toxic than table salt and degrades faster than sugar. It has a higher flash point (point at which it ignites) than regular petrodiesel and if spilled isn't considered toxic.

HOW IT'S MADE

Both Maria "Mark" Alovert and Steve Spence have already written excellent articles on this subject in the May and July 2005 Issues of ESSN respectively, and demonstrated that biodiesel is actually very simple to make. It's made by chemically altering the molecular structure of any organic oil through the use of a chemical catalyst and an alcohol.

To do this, oil is simply heated to a designated temperature (to help with the chemical reaction) and then a mixture of catalyst and an alcohol are added to the oil. The oil, catalyst, and

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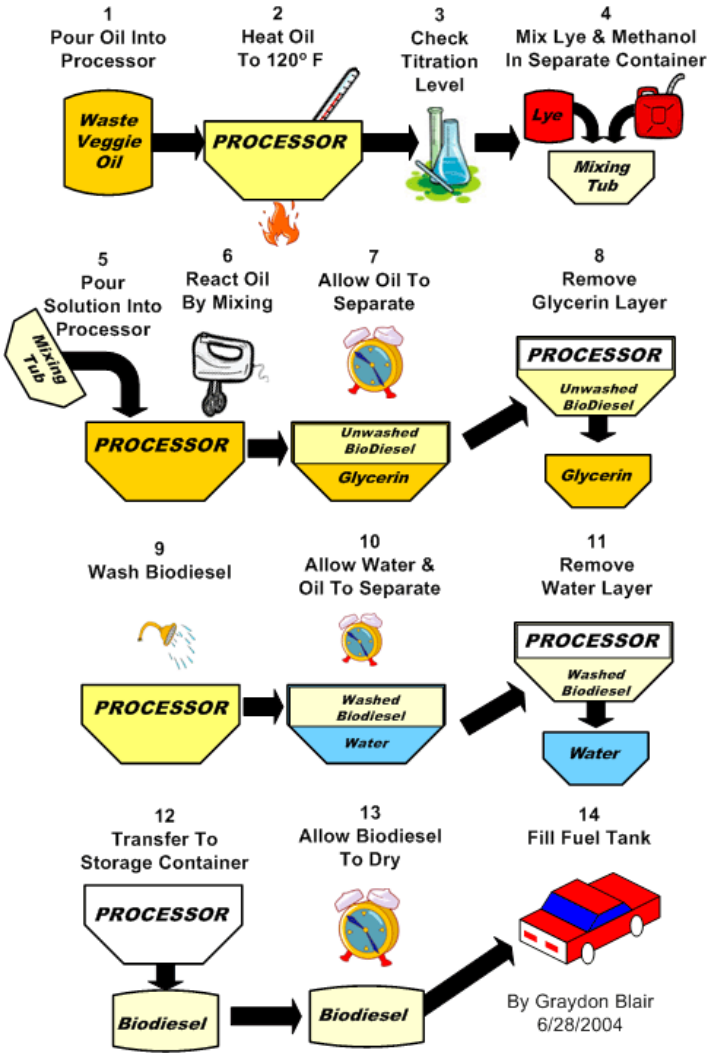
alcohol mixture are then mixed for a period of time and then allowed to settle. If successful, the chemical reaction between the oil, alcohol, and the catalyst will have broken down the oil into several layers. The top layer will be biodiesel, chemically called an Ester, the next layer may contain soap, and the bottom layer will be glycerin.

Once the layering has occured, the glycerin and soap are drained off. The biodiesel is then washed with either a mist-wash, a bubble-wash, or both. The washing is done to remove any additional soap, alcohol, or other impurities in the biodiesel.

After it's been washed, it is then dried to remove any water. Commonly it is then filtered through fuel filters and is then ready to be used.

THE PROCESS



TIMING

Biodiesel typically takes a couple of days to a week from start to finish to make a batch. Most people making biodiesel make anywhere between 20 to 100 gallons at a time in a batch process.

Here's a breakdown of typical timing intervals from start to finish:

- **START**
- **Collecting Oil** - 1-2 hours
- **Filtering Oil** - 1-2 hours (depends on amount of oil)
- **Titration Of Oil** - 10-15 minutes
- **Transferring Oil To Processor** - 10-20 minutes
- **Heating Oil** - 1-4 hours (depends on amount of oil, voltage & wattage of element)
- **Making Methoxide** - 5-20 minutes (depends on amount of methanol and catalyst used)
- **Mixing Methoxide Into Oil** - 20-30 minutes
- **Mixing Oil & Methoxide** - 2-3 hours
- **Settling Oil** - 8-10 hours (usually overnight)
- **Draining Glycerin** - 5-10 minutes
- **Transferring Biodiesel To Wash Tank** - 10-20 minutes
- **First Mist Wash** - 2-3 hours
- **Second Mist Wash** - 2-3 hours
- **First Bubble Wash** - 6-8 hours (usually overnight)
- **Second Bubble Wash** - 6-8 hours (usually overnight)
- **Transferring Biodiesel To Drying Containers** - 10-20 minutes (depends on amount)
- **Drying Biodiesel** - 2 hours to 1 week (depends heavily on weather and amount made)
- **Transferring To Storage Containers** - 10-20 minutes (depends on amount)
- **FINISH**

BIODIESEL RECIPES

The method described above is just the basic information of how Biodiesel can be made. Below are some links to detailed methods for making Biodiesel.

- Collaborative Biodiesel Tutorial A great tutorial page on making biodiesel complete with plans for building biodiesel processing equipment.
- Kitchen-Biodiesel based off of Tilly's World Famous Dr. Pepper Method.
- Basic Biodiesel Production Information from Journey to Forever. Good primer to go through before attempting to make biodiesel for your first time.
- Mike Pelly's Recipe from the Journey to Forever website. Seems to be a gold-standard for making Biodiesel among the community.
- World Famous Dr. Pepper Method - Part 1 Part I of a recipe for making a small batch of Biodiesel in a Dr. Pepper bottle. Followed by many the first time they make biodiesel.
- World Famous Dr. Pepper Method - Part 2 Part II for finishing up the batch made in the Dr. Pepper bottle.
- Dangerous Laboratories Great instructions for making a batch of Biodiesel for the first time. Complete with pictures and detailed instructions.

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EQUIPMENT

Biodiesel can be made in anything from a small 2 liter pop bottle to an elaborate processor complete with separate tanks for processing, washing, methoxide mixing, settling, and filtering.

Obtaining equipment is relatively easy. Complete processing equipment can be custom made using plans off of the web or by buying pre-made kits ready to assemble.

Most people get started by making small batches with minimal equipment and then gradually move up to making large batches using large processors built specifically for making biodiesel.

Many homebrewers either buy a variety of premade processors designed for processing biodiesel or custom make their own processors either from kits or from plans on the web.

Professionally built processors can cost as little as $500 to several thousands of dollars. Kits can be purchased for making your own from several online retailers for as little as $200 on up to elaborate systems complete with methanol recovery condensors.

Most commonly, homebrewers build their own processors using plans from the web. Building a processor can be done in an afternoon in a garage. In fact, most folks have their processors built and ready to process biodiesel within a few hours of starting. Parts are relatively cheap to obtain and help is readily available through forums, workshops, and local cooperatives. Click Here for plans on making a simple water-heater based biodiesel processor.

Additionally, most homebrewers obtain equipment, such as pumps (either manual or electric) for transferring oil, methanol, and glycerin with as well as several containers for storing oil and biodiesel in.

USING BIODIESEL

Biodiesel can easily be used in any diesel engine vehicle. Once processed, washed, and dried, biodiesel can be simply poured into the fuel tank of any diesel engine. Biodiesel can also be mixed with petrodiesel in any ratio. It easily mixes with petrodiesel and is commonly sold commercially blended with petrodiesel.

When getting started, most homebrewers typically purchase commercially made biodiesel to test in their diesels first, just to get an idea of how it reacts with their engines. From there, they may use commercially made biodiesel as a benchmark against the fuel they make, comparing their homemade biodiesel to the commercially made biodiesel.

Within minutes of biodiesel being added to the fuel tank, and especially when used in high blend ratios (50% to 100%) a noticeable difference in engine noise begins. Most report a reduction in engine noise, a smoothing of the engine, and a noticeable change in the smell of the exhaust. The longer the biodiesel is run in the engine, the better things become.

Research has been done comparing biodiesel to petrodiesel across a wide range of measurements. One of the most significant differences is the drastic reduction in tailpipe emissions biodiesel produces over petrodiesel. Reductions in hydrocarbons, carbon dioxide, and particulate matter have been significant. For many using biodiesel, these emission reductions are reason enough to use this incredible alternative fuel. Besides better emissions, research has indicated an increase in engine longevity, a decrease in engine maintenance, and a better performing engine. Because biodiesel has solvent properties by nature, it acts as a cleaning agent on the fuel system in diesel engines. This means that it cleans things up the more it's used.

Because of these solvent properties, some have noted that fuel lines in older diesel engines may degrade because the biodiesel breaks them down. Particularly susceptible are fuel lines made from natural rubber. Most of the susceptible fuel lines can easily be replaced with inexpensive fuel line that are biodiesel compatible. If in doubt, check with your local dealer. The lines usually degrade over time and develop small seeping leaks instead of large leaks.

Diesel engines made after 1993 and sold in the United States typically won't have this problem as the fuel lines are already biodiesel compatible. This is because of a reduction in sulphur in diesel fuel in 1993 in the United States that necessitated manufacturer's needing to change the fuel lines with non-rubber lines.

Homebrewers use biodiesel in varying blends but most commonly it's used in blends between 20% to 100% with 100% being the preferred method when weather allows. When the weather drops below 50° F, it's recommended to blend biodiesel with petrodiesel or add anti-gel additives to prevent biodiesel from gelling.

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Another thing most biodieselers do when getting started is to change their fuel filters before using biodiesel and then change them again a few thousand miles later. This is to prevent the filters from plugging up due to biodiesel's solvent properties. As it's used, it may knock some of the "gunk" off of the walls of the fuel tank and fuel lines that have built up from the use of petrodiesel. Replacing the fuel filter's is just a precaution to ensure the engines keep on running.

TAXES & REGULATIONS

Biodiesel, if used as an on-road fuel in a vehicle, may be subject to road taxes. The taxation laws are changing all the time so check with your local tax consultant to identify which taxes biodiesel may be subject to. Currently (April 2005), the first 400 gallons of homemade biodiesel is exempt from Federal excise taxes. Anything over 400 gallons is subject to the normal tax rate. You will need to check your State Tax Code for exemptions on State Excise Taxes.

It's also important to check with your local fire marshal on fire codes for the manufacture and storage of biodiesel as well as the chemicals and alcohol used to make it. These laws and regulations are there in most cases to protect you and your neighbors. Most city officials will never have heard of biodiesel, so it may be your job to properly educate them on what it is and what you'll be using it for. Go prepared with as much information as you can and you'll improve your chances of receiving permission to make it.

THE BIODIESEL COMMUNITY

Luckily, there are several other people out there that have made and continue to make their own biodiesel. Most are incredibly helpful and willing to share what they've learned with anyone interested.

The internet has made getting help incredibly quick and easy. As always, not everything you read may be true, but for the most part those publishing web pages and sharing information via the web are willing to go the extra mile to help you out.

There are several others out there that have been making it for several years and are more than happy to share with you what they have learned and help solve any problems you may run into.

CONCLUSION

So, in a nutshell, biodiesel is an incredibly fun and rewarding thing to get into. With a fair amount of caution and safety, you can easily make your own fuel for your diesel powered vehicles and maybe even find a few friends along the way.

To get started, really all you need to do is:

1. Give it a try in your vehicle
2. Make a few small batches
3. Build a processor
4. Make a few large test batches
5. Begin making large batches

So get started. Give it a try. You may just find it to be an incredibly fulfilling adventure!

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