

TO: People interested in making Biodiesel
FROM: Thomas B. Reed, the Biomass Energy Foundation
SUBJECT: Making Bio-diesel in the kitchen

BIODIESEL FROM VEGETABLE OILS AND ANIMAL FATS

Biodiesel is a new, alternative, renewable, clean diesel fuel made from triglycerides (oils, fats, waste cooking oils,). Making biodiesel on a large scale is a task for chemical engineers. It is a relatively simple process, but requires purification and washing to make a commercial fuel, especially if you use waste vegetable oil.

However, if you would like to try the reaction in your kitchen, here's the recipe for a simple demonstration using common household chemicals. **REMEMBER TO HANDLE ALL CHEMICALS WITH CARE!** While these are common "household" chemicals, the methanol will burn with an almost invisible flame, so extinguish all fires; the lye can burn your fingers or blind you. Read the warnings on the can!

The reaction (transesterification) substitutes methanol (wood alcohol, Dri-Gas,) for the Glycerine in triglycerides (fats, oils) to make the methyl esters called biodiesel. It uses lye as a catalyst. A junior chemist might write it:

Triglyceride (fats or oils) + Methanol =====> Biodiesel + Glycerine (Lye catalyst)

The lye converts a small amount of the oil to soap and neutralizes any excess fatty acids in used cooking oil. After the reaction is over, the Glycerine and soap settle to the bottom of the vessel and the biodiesel floats on top.

Measure 500 ml (1 cup) of vegetable oil (cooking oils such as Mazola, New Maid etc.) into a blender (or mixing bowl). (Most modern measuring cups show both ml and cups.) Heat the oil to 120 F (not critical) using a cooking thermometer while carrying out the next step.

In a separate cup measure 85 ml of methanol. (The easiest source of methanol is Dri-Gas, obtainable from any automotive store. Be sure to get the cheap one - contains methanol -, not the one containing iso-propyl alcohol.) To this add 1/4 level tsp. of lye (sodium hydroxide). (Red Devil lye is carried by most grocery and hardware stores.) Stir well with a wooden spoon, crushing as needed until all the flakes disappear. (The mixture will be slightly cloudy and is called "sodium methoxide".)

Add the methanol-lye mixture to the warm oil while vigorously stirring, using a mixer, paint stirrer (electric drill with propeller) or blender. Stir for 30 minutes. The mixture at first thickens, then becomes thinner than the original oil.

Allow the mixture to settle for a day in a tall thin vessel. The biodiesel floats to the top and can be poured off into a container for display. The glycerine and soap go to the bottom and can be discarded, (but can make a high glycerine soap). You have now made biodiesel on a small scale and can appreciate the use of renewable fuels from farms.

This clear biodiesel contains a very small amount of soap. If you want to use it in your diesel vehicle it would be of no consequence. However, if you want to make large quantities or for sale, fuel specifications require removal of the soap by washing or other effective means.

BIODIESEL FROM WASTE VEGETABLE OILS

Waste vegetable oils used for cooking are an attractive source of biodiesel, but are more difficult to convert because they contain 2-10% free fatty acids (the cause of the rancid taste) and can make a big mess. First it is necessary to remove any water present in the waste oil. Heat in the oven at 220°F for an hour or until no bubbles can be seen.

It is then necessary to titrate the oil to determine how much free fatty acids they contain. To Measure Free Fatty Acid content of your oil: mix 1 ml oil with 10 ml isopropyl alcohol (available as the other dry-gas) + 2 drops phenolphthalien solution (available in a hobby shop or toy store selling chemistry set supplies). Dropwise add 0.1% lye solution (1 g lye in 1 liter water) with vigorous stirring until the solution stays pink for 10 seconds. (20 drops = 1 ml) Record the milliliters of 0.1% lye solution used. For each liter of waste vegetable oil you will need one gram of granular solid lye for each ml of 0.1% lye solution used to titrate the free fatty acids, plus the 3.5 grams required as a catalyst as described above for new oil. Completely dissolve the proper amount of Lye in the methanol. This combined mixture makes the sodium methoxide.

Add the alcohol-lye to the oil, stir VIGOROUSLY, and separate, as in instructions above for new oil .

For further information on all aspects of biodiesel, buy the book "From the Fryer to the Fuel Tank", \$25. from J. and K. Tickell, available from BookMasters, Box 388, Ashland, OH, 44805, 800 266 5564 or 419 281 1802, Fax 419 281 6883; or e mail

Emailorder@bookmaster.com

Or from the Biomass Energy Foundation (us) at www.woodgas.com.

An EXCELLENT BOOK.