TO: People interested in making Biodiesel

FROM: Thomas B. Reed, the Biomass Energy Foundation

SUBJECT: Making Bio-diesel in the kitchen

Biodiesel is a new, alternative, renewable, clean diesel fuel made from Nature's triglycerides - oils, fats, waste cooking oils and many other natural products.[1,2]

However, if you would like to try the reaction in your kitchen, here's the recipe for a simple demonstration you can try, using common household chemicals.[3] (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 (with the terrible names "transesterification" or "alcoholysis"[3]) substitutes methanol (wood alcohol) for the Glycerol 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 + Glycerol (+soap from catalyst)

The lye converts a small amount of the oil to soap so that the methanol will be soluble in the triglyceride. After the reaction is over, the glycerol and soap settle to the bottom of the vessel and the biodiesel floats on top.

In a measuring cup measure 200 ml of methanol.[4] To this add 1 level tsp of lye (sodium hydroxide).[5] In a separate pan, heat 500 ml (1 cup) of any vegetable oil cooking oil (such as Mazola, Canola etc.to about 120F (using a candy thermometer). Put the oil in a blender and add the methanol-lye mixture to the warm oil while vigorously stirring. Stir for 30 minutes. This solution is opaque at first, but as the reaction progresses it becomes thinner than the original oil and translucent.

Allow the mixture to settle for a day in a tall thin vessel. You will see two separate layers. The biodiesel floats to the top as a clear liquid, and can be poured off into a container for display(or into your diesel car or truck). The glycerol and some soap go to the bottom and can be discarded in this experiment. In commercial practice the glycerol and soap can be further processed to other fuels.

You have now made biodiesel on a small scale and can better appreciate the use of renewable fuels from farms.

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BIODIESEL FROM WASTE VEGETABLE OILS

Every fast food restaurant discards large quantities of waste vegetable oils weekly. They are collected and sold as "yellow grease" and can contain fats from cooked meat and free fatty acids from the breakdown of the oil. Yellow grease is an attractive source of biodiesel, but is more difficult to convert to biodiesel because it contains 2-10% free fatty acids (the cause of the rancid taste) which consume some of the lye catalyst.

Many people are converting “yellow grease” to biodiesel or using it directly. (See http://en.wikipedia.org/wiki/Yellow_grease) and http://www.easternct.edu/depts/sustainenergy/calendar/biodiesel/Geise%20-%20Biodiesel%20from%20Recycled%20Vegetable%20Oil.pdf

It requires additional lye to neutralize the free fatty acids and the process so more chemistry than the kitchen provides.

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[1] Corn based ethanol has been a “renewable fuel” since about 1980,available as a 10% blend with gasoline. It competes directly with corn for food and can cause economic upsets if we make too much. Biodiesel is made from soy oil and many other vegetable oils and animal fats. Soy beans are raised primarily for their protein content and the oil is a by product, since many other plants also contain vegetable oils. Used cooking oil (yellow grease) is a waste product, but is fed to cattle or burned for heat.

I have been running my diesel vehicles on biodiesel since I first discovered it in 1990 and it is now the most successful of our “renewable fuels”.

[2] Don’t worry about long complicated chemical names. They are usually descriptive of the molecule and more like a map. You probably heard them in high school chemistry and promptly forgot them. Your doctor measures the “triglyceride” content of your blood on any blood test. Healthy humans are typically about 20% triglyceride (fat) or else all your joints would squeak. 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

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[4] The easiest source of methanol is Dri- Gas, obtainable from any automotive store. Be sure to get the cheap yellow variety - contains methanol - not the red one containing iso-propyl alcohol. Methanol is also used as the preferred fuel at most race tracks and you can buy a 5 gallon can.) The methanol must be new and DRY.

[5] Red Devil lye or the equivalent is carried by most grocery and hardware stores. Read the safety instructions. Stir well into the methanol with a wooden spoon, crushing as needed until all the flakes disappear. The mixture will be slightly cloudy and is called "sodium methoxide".