

MAKING BIO-DIESEL FOR GREENHOUSE FURNACE FUEL FROM VEGETABLE OIL: HEATING
GREENHOUSES WITH WASTE OIL INSTEAD OF PURCHASED FUEL

Richard Wiswall, Cate Farm, Plainfield

Richard Wiswall uses biodiesel made from waste vegetable oil to heat six greenhouses at Cate Farm as well as power a tractor and one of his cars. When he decided to switch to an alternative fuel, Richard had the choice of converting vegetable oil to biodiesel that could run in his existing equipment or modifying the existing equipment to use straight vegetable oil. The number of locations where he required the fuel made changing the oil itself simpler and more cost-effective than changing and maintaining multiple pieces of equipment.

Biodiesel is a simple product to make. There are several different options for the ingredients and procedure (see the references at the end of this section). Richard uses a base of oil (triglyceride) combined with methanol in a reaction catalyzed by lye (Sodium hydroxide) and heat to yield glycerin (a byproduct) and methyl esters (the biodiesel).

Richard uses a 55-gallon metal drum for mixing his biodiesel batches. In the drum, he has drilled two holes to draw off its contents: one opening at the bottom (for glycerin) and one midway up the barrel with a small pump (for methyl esters). Richard uses an electric hot water element and thermostat to heat the ingredients inside the barrel (a burner underneath would also work) while a paint mixer attached to a washing machine motor mixes them.

Making biodiesel begins with collecting oil from fryolators at area restaurants. Non-hydrogenated oil is best (although largely unavailable as waste cook oil). Oils changed weekly at the restaurant, are preferred to often-reused oils. Animal tallow is the lowest quality source. Richard has established reliable weekly or bi-weekly pick up schedules with restaurants throughout the year. It is important not to arrive on an erratic schedule

or otherwise interrupt the restaurant's routine, so that they will not return to their more familiar waste haulers.

Once the restaurant oil arrives at Cate Farm, it sits in the sun in plastic jugs while the particulate matter settles out. Once particulates have settled, Richard pours 40 gallons of the oil over a screen into the 55-gallon drum. He then clamps on the top, heats the oil to 120 degrees and mixes slightly. He draws off a sample to take a titration for determining how much lye to add (see [From the Fryer to the Fuel Tank](#) for titration instructions). The more free fatty acids in the waste oil, the more lye is required as a catalyst.

Richard mixes lye with 8 gallons of methanol in a container separate from the oil drum. He is very very cautious with the methanol, wears protective clothing and measures it in the open or in a well-ventilated shed. The lye dissolves in the methanol for approximately one hour to produce Sodium methoxide.

Finally, Richard adds the lye/methanol to the heated oil and mixes it for one hour, then allows the mixture to sit overnight. The next day he can draw biodiesel from the top $\frac{3}{4}$ and glycerin from the bottom $\frac{1}{4}$. The biodiesel might sit to settle once more or, if he wants to use it in his vehicles instead of the furnaces, he will wash it to remove further impurities. The glycerin goes to compost, but could be burned or made into soap as other options.

A rough estimate for Cate Farm's biodiesel costs (not including labor) is about \$0.50 per gallon. The methanol is the most expensive ingredient and it costs \$2.00 per gallon. Currently Richard makes about 20 gallons per hour. Costs and labor time will come down as he increases his production.

Recommended Biodiesel Resources:

[From the Fryer to the Fuel Tank](#) By Joshua Tickell (to start a biodiesel project)

Biodiesel Homebrew Guide By Maria 'Mark' Alovert (a more recent, more detailed reference)

<http://www.biodieselnow.com>

<http://biodiesel.info.pop.cc>

<http://www.journeytoforever.org>

<http://groups.yahoo.com/group/altfuelfurnace> (see Jesse Parris' presentation)

<http://www.vermontbiofuels.org>

<http://www.vtbiodieselproject.org>

June 10th and 11th-12th there will be biodiesel workshops at Cate Farm (e-mail info@vermontbiofuels.org). June 8th there will be a biodiesel workshop at Vermont Law School (see <http://www.vtbiodieselproject.org>)