

FINDING, QUALIFYING AND MANAGING SOURCES OF WASTE VEGETABLE OIL AS FEEDSTOCK FOR BIODIESEL PRODUCTION

INTRODUCTION

Fresh vegetable oil is usually marketed for human consumption and therefore cost-prohibitive for biodiesel production. Developing a reliable source of waste vegetable oil as feedstock for biodiesel production is a simple process. Every restaurant, bar, grille, pub, caterer and luncheon truck that deep fry foods has to pay 60-80 cents per gallon to dispose of their used cooking oil. That means the manager would likely be very happy to just give you their oil for free. With this incentive the manager will be receptive to simple requests for handling their oil so that it is suitable for processing into biodiesel.

POTENTIAL SOURCES

The very best source by far for waste vegetable oil is a large producer of fried vegetables such as potato chips, corn chips, or any other vegetable-only type of deep-fat cooking. A close second is the local "fish and chips" shop or Irish Pub since fish adds very little water or animal fats to the cooking oil. Third is the local hamburger shop that is willing to segregate out their vegetable oil from other waste including burger drippings and other non-vegetable waste. Amazingly enough, most doughnut shops never generate waste oil because of their high oil consumption rate (yum).

The locations that are most likely to work with you to collect their oil are those that are locally owned or managed. Large fast-food chains often require corporate approval for your arrangement, making it less likely to succeed. The best bet is a local non-chain restaurant. After that, small local chains could be approached.

PREFERRED WASTE OILS

There is a hierarchy of preference for waste vegetable oil. Light oils such as canola (rapeseed), soy or sunflower are the best. Heavier oils such as peanut and corn are slightly less desirable because they can thicken more easily. Palm oil, coconut oil and vegetable shortening are least desirable because they are often solid at room temperature. Oils that stay liquid at lower temperatures are preferred.

Oils that have been used for cooking only vegetables, such as fries and tempura, are ideal. After that, fried fish followed by fried chicken are acceptable foods to cook in. The most problematic are oils used in frying animal fat laden foods such as beef and pork. While you *could* turn this grease into biodiesel, it contains a very high amount of Free Fatty Acids and will tend to gel more at higher temperatures.

LOCATING THE SOURCE

Once a potential waste oil source is located, make contact only with the owner or manager, not the hired help. Employees are not likely to understand your inquiry or have the authority to make decisions. Pick a time of day when it's less likely to be busy, such as 1 hour after the breakfast or lunch rush is over. Introduce yourself to the manager as a member of a "local non-profit co-op" that turns waste oil into clean-burning biodiesel. That will assure them that you are not trying to sell them something. Ask if they must pay to dispose of their used cooking oil (most will say yes). Then offer to take away their liquid waste oil for free. If they agree, make sure they understand that you only want the *liquid* waste. The other solids and pastes must still be disposed of in the normal fashion. Since 80-90% of most waste vegetable oil is usable liquid, they will only need to call their grease disposal company 1/5th - 1/10th of the time!

QUALIFYING THE OIL

First, look at how the restaurant handles and stores their waste oil. It should contain *no* water, and as little food debris as possible. It's best if the oil is transferred to their storage container while still hot to prevent absorption of water. Their storage barrel should ideally be located inside, or at least in a sheltered and locked area if outside to prevent contamination from rain or use as a general trash container. These requests are quite reasonable and are actually easy for them to meet once they are aware of your needs.

Once you have determined that the oil is worth further testing, fill a small frying pan to about 1/2" deep with the candidate oil and try to boil it. If you see bubbles or hear a "crackling" sound, it contains water and will be unsuitable for biodiesel. Otherwise, fill a 1 gallon glass or plastic jug and bring it home for further testing in mini-batches of biodiesel.

MINI-BATCH TESTING

Producing a small quantity of biodiesel using the candidate oil is the very best way to determine its suitability. This test is to determine the Free Fatty Acid content (rancidness) of the test oil, and therefore how much lye is needed to neutralize the acids.

Divide the oil into four containers with 1 liter each. Prepare 4 quantities of 1/5th liter each of pure methyl alcohol (not isopropyl and not denatured alcohol). NOTE: BE SURE TO WEAR GLOVES AND EYE PROTECTION WHEN WORKING WITH LYE AND METHANOL. WASH THOROUGHLY AFTER YOU'RE DONE TO PREVENT GRANULES OR SPLASHES FROM CAUSING SKIN IRRITATION. Measure out 4 quantities of 99%+ pure lye (eg-Red Devil lye, NOT Drano or Liquid Plumber!) as follows: 3.5 grams, 4.5 grams, 5.5 grams, 6.5 grams. Make the sodium methoxide pre-mixes by pouring each amount of lye into each of the 4 containers of alcohol and dissolve

the lye (takes about 10 minutes of vigorous mixing or shaking) until there are no more crystals visible. Take an electric hand-blender (metal blade, not plastic) and mix each batch of oil while pouring in each methoxide pre-mix. Blend thoroughly for 5 minutes and let settle overnight.

The next morning, take a good look at the samples for the distinctiveness of the separation between the light colored biodiesel on top and the dark colored glycerine on the bottom. The best "chemical crack" is with no other layers between the biodiesel and the glycerine, and nothing floating on top of the biodiesel. That is the mini-batch with the right amount of lye for your full batch. The lower the amount of lye required to get a good clean separation, the closer the oil quality is to that of fresh oil.

MANAGING THE SOURCE

Once the source is qualified, set up a way for them to contact you easily to schedule an oil pickup. Providing them a separate barrel (eg- 30 gallons) will help them keep the qualified oil separate from other waste products such as grease, drippings, grille scrapings, etc. Be sure to respect their workplace by being courteous, quiet, discreet and clean. If you can remove their waste oil storage barrel to outside the back of the building for transfer to your vehicle, so much the better.

COLLECTING THE OIL

It's a good idea to wear long-cuff rubber gloves when working with oil collection equipment. Bring a few rags or old towels to clean up later. The easiest way to move oil is to pump it from the source's storage barrel into a barrel already in your vehicle. A simple rig can be made from a 3 foot length of 1" PVC tubing, some 1" washing machine hose, a self-priming 12VDC pump, and a few PVC fittings. A patch of window screen over the pickup end of the PVC tubing will prevent picking up chunks of food and debris. Hold the pickup end of the tube just below the surface of the oil and watch closely as you pump the level down. Stop pumping when you get within about 1 inch from any solids or paste. Clean up after yourself and return any of the restaurant's containers to its proper place. Don't forget to securely cap the oil barrel before moving your vehicle.