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DIY Home Biodiesel Production: Make Your Own Fuel

Home biodiesel production will help you speed past the gas station on the road to fuel independence. This expert advice provides the necessary know-how for making biodiesel with used cooking oil in a DIY biodiesel plant.

By Lyle Estill

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If you're steering your household toward a more self-sufficient lifestyle, maybe you'd like to add do-it-yourself fuel to your list of goals. Biodiesel can be brewed from waste vegetable oil or animal fats, which you can collect free from restaurants, or you can grow soybeans or canola to press your own oil. Process the oil with a couple of chemicals to produce homemade fuel that can run any device powered by petroleum diesel — including pickups, cars and home heating systems. Do it right, and DIY biodiesel can cost as little as \$1 per gallon to manufacture. The scale is up to you: Brew enough to make your homestead fuel-independent, or join forces with neighbors to produce fuel for your collective households.

At minimum, the equipment you'll need for home biodiesel production is a stainless steel reactor tank, a wash station to remove the coproducts, and containers for storing the resulting fuel. You can rig up an electric water heater as a biodiesel reactor for less than \$1,000, or spend about the same amount on a kit. If you'd rather opt for a ready-made, automated system, expect to pay \$10,000 or more.

Safely making high-quality fuel in your backyard will take planning and work, but the freedom and moneysavings of driving down the road on fuel you've made yourself are hard to beat.

The Chemistry of Making Biodiesel

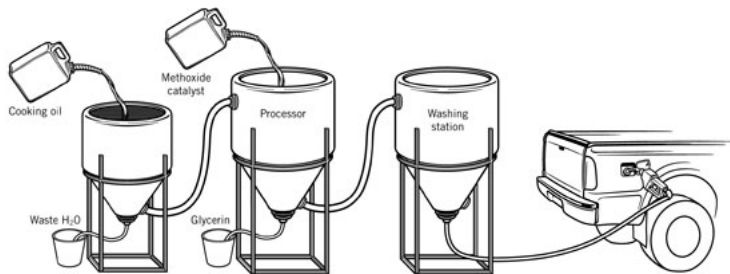
Biodiesel production is dependent on two chemical reactions. The first is commonly called the methoxide reaction. It happens when you mix methanol with a catalyst, which can be either potassium hydroxide or sodium hydroxide.

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Homemade fuel made from used cooking oil can power any diesel vehicle.
 Photo by Matthew Flansburg





The methoxide reaction is “exothermic,” meaning it gives off heat. Don’t use plastic vessels when creating methoxide. They don’t hold up well to heat and have a tendency to explode or dissolve because plastic can store a static electrical charge. Always opt for stainless steel equipment when making biodiesel.

Sodium hydroxide is commercially produced lye; both sodium hydroxide and potassium hydroxide are available online from suppliers of soap-making equipment. Procure methanol at your local chemical distributor or race car shop (race car drivers often blend methanol into their fuel supplies). In North Carolina, where I live, you can carry 100 gallons of methanol on your pickup truck without special permits or licensing.

After you’ve achieved a successful methoxide reaction, the second required process is the biodiesel reaction. This occurs when you mix methoxide with oil and agitate the molecules. The product of the biodiesel reaction will be a mix of about 80 percent biodiesel and a 20 percent cocktail of coproducts. You can either drain the coproducts off the bottom of your tank, or decant the biodiesel from the top of the tank.

Planning a Home Biodiesel Plant

Step one: Find a reliable source of feedstock. Try sourcing used cooking oil from restaurants, makeup manufacturers or nutraceutical companies. If you're planning to sell your biodiesel, begin by analyzing the available feedstock supply, and make plans to size your operation accordingly. The commercial biodiesel landscape is littered with the carcasses of producers who built to meet fuel demand only to find they couldn't secure enough feedstock to make their biofuel plants work.

Most brewers who make biofuels for themselves (that is, not to sell) secure a source of used cooking oil from area restaurants as feedstock for their operations. While you can grow "virgin" feedstock (such as soybeans and sunflower seeds), waste vegetable oil works fine and is less expensive. You can easily make your own fuel for \$1 per gallon by collecting free or cheap cooking oil after it's served its useful life in a restaurant's deep fryer. A gallon of oil will yield about a gallon of biodiesel.

Step two: Build your plant, sized to your feedstock supply. A small homebrewing operation can fit in the corner of a garage, within the footprint of a single parking space. Allow enough space for a water heater, a tank for storing your incoming feedstock, and a tank for washing your fuel. For starters, aim to line up enough feedstock to meet your family's fuel requirements.

If you're collecting used cooking oil from restaurants, expect that 20 percent of the material you gather will be water and bits of fried food. Water is not your friend when making biodiesel, so you'll need to remove it by heating the oil and allowing the contaminants to settle to the bottom before you pour the oil off the top. You'll have to devise a plan for disposing of the greasy wastewater. Pigs love it, and it improves their coats, so ask around to find a local farmer who will take it off your hands.

Ensuring Safe Biofuel Production

Home biodiesel production is not without risks. Making your own fuel will require great attention to detail and safety because you'll be using chemicals that are flammable and caustic. This article outlines the basics of how to make biodiesel, but you'll need to research carefully before you begin production. (See "Resources")

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Rules and Regulations for Biodiesel Plants

Be sure to check with your local zoning department, too, to see whether you may face restrictions related to fuel production. Note that farms are exempt from zoning approval in many areas. You should also get in touch with your area fire marshal or the local building inspection folks about fire-code compliance.

When designing your DIY biodiesel plant, be sure to devise a strategy for getting rid of coproducts before you begin production, because you don't want to end up with totes of methanol-laced glycerin piled up behind the barn. The cocktail produced by the biodiesel reaction tends to be filled with methanol, glycerin, free fatty acids and soaps. Because methanol is a microbial starter for digesters, some wastewater treatment plants will welcome it, as will some commercial-scale composters. Or, a friendly community biodiesel producer may accept it from you.

Designing a DIY Biodiesel Plant

Backyard biodiesel plants tend to be as diverse as the people who create them. Water heater tanks recycled into biodiesel reactors are common: Imagine an electric water heater, with a pipe plumbed to its outlet at the bottom, attached to a mixing pump that sends liquids to the top of the tank and back around again. Many small brewers cobble together their own vessels and pipes from scrap. Others order off-the-shelf parts or kits (see "Resources").

Perhaps you'd prefer a biodiesel setup on the go. You and a group of neighbors can cooperate on a mobile biodiesel processor that can travel to the feedstock source. Mobile processors tend to be significantly more expensive than fixed units set up in a garage, but they can offer regulatory flexibility. In my experience, local building authorities tend to ignore mobile processors, because they prefer to inspect units that are stationary. Mobile processors also offer the possibility of sharing a capital resource with other fuel consumers.

You can build a small-scale biodiesel plant on the back of a pickup truck for a couple thousand dollars. Outfitted with an 80-gallon reactor, such a plant could make enough fuel to meet a handful of families' biodiesel needs — assuming there's enough used cooking oil to feed and operate it. With free feedstock, \$1-per-gallon biodiesel could pay back the cost of the system quickly by providing enough fuel to keep everyone rolling. Find detailed instructions on making biodiesel in my book and in the other titles under "Resources."

Resources

Books on Home Biodiesel Production

- Backyard Biodiesel: How to Brew Your Own Fuel (<https://www.motherearthnews.com/store/product/backyard-biodiesel>) by Lyle Estill and Bob Armantrout
- Run Your Diesel Vehicle on Biofuels: A Do-It-Yourself Manual (https://www.amazon.com/gp/product/0071600434/ref=as_li_tl?ie=UTF8&camp=1789&creative=9325&creativeASIN=0071600434&linkCode=as2&tag=motearnew-20&linkId=33cac9c9675a388914b552126fd4279a) by Jon Starbuck and Gavin Harper
- Biodiesel Basics and Beyond (http://www.amazon.com/gp/product/0973323337/ref=as_li_qf_sp_asin_il_tl?ie=UTF8&camp=1789&creative=9325&creativeASIN=0973323337&linkCode=as2&tag=motearnew-20&linkId=CJ3RCTXPTGJRP2D) by William Kemp

Suppliers of Biofuel Plant Equipment

- Utah Biodiesel Supply (<http://www.utahbio.com>)
 - B100 Supply (<http://www.b100supply.com>)
 - Springboard Biodiesel (<http://www.Springboardbiodiesel.com>)
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Lyle Estill is the founder of Piedmont Biofuels, a community-scale biodiesel plant in Pittsboro, N.C. He hasn't filled up at a local gas station since January 2002.

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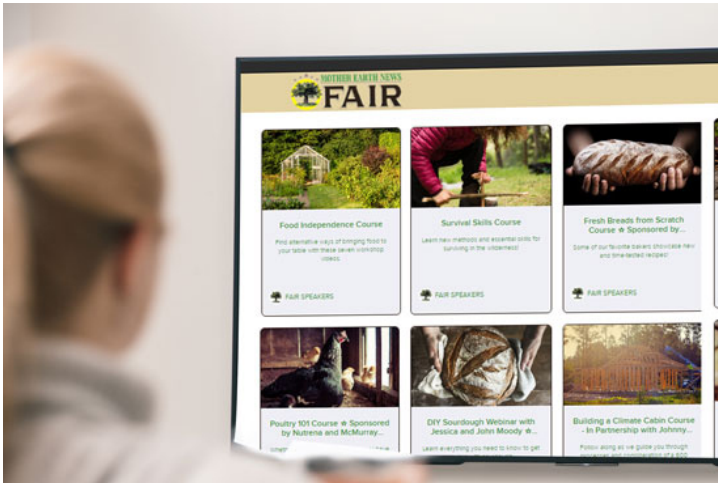
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