

My Car Runs on Vegetable Oil...



Gary Liess

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...Straight Vegetable Oil

Gary and Carolyn are more than satisfied—they're enthusiastic about running their cars on straight vegetable oil.

Run a car on 100 percent vegetable oil? Sounds crazy! I had driven my Mercedes 300CD diesel engine for a quarter of a million miles before I had even heard about biodiesel. Using straight vegetable oil in my car made even more sense to me.

I learned about biodiesel from Joshua and Kaia Tickell's *From the Fryer to the Fuel Tank*. Biodiesel is made by chemically modifying vegetable oil for use as a fuel in diesel engines by using a mix of lye and methanol. After reading the book, I loved the idea of running on biodiesel, but I personally was hesitant to mix nasty chemicals to create it. I knew that Rudolf Diesel originally designed his engine to run on peanut oil, but somehow it didn't sink in that it was possible to run on 100 percent vegetable oil in this day and age.

Then my partner Carolyn Scott attended the Bioneers Conference in San Rafael, California in October 2001. A young man named Jason Goodman was displaying a diesel VW Vanagon that was running on straight veggie oil. I got in touch with Jason and found that he and Chris Gibson were setting diesel vehicles up to run on veggie oil. This was the start of my straight vegetable oil (SVO) education.

Two Choices

You have two choices when running on biofuels. The first is to make or buy biodiesel, make no modifications to your vehicle's engine, and just drive away. The second choice is to buy or make a conversion kit for running straight vegetable oil. There's no need to process the fuel; you just fill up and go. With biodiesel, you modify the vegetable oil; with SVO, you modify your vehicle.

The conversion to running on straight veggie oil is made by installing an extra fuel tank, tapping into the vehicle's liquid coolant system to heat the oil, and then controlling the flow of the oil by valves and switches. The oil must be heated so it is thin enough to flow through your fuel system. The valves and switches allow you to begin and end your trips on petroleum or biodiesel, so your fuel system will not clog when the SVO cools.

Using SVO in Your Engine

Diesel engines will run on straight vegetable oil if the viscosity of the oil is thinned to the same approximate viscosity as petroleum fuel—the engine doesn't care if it's fed petroleum fuel or vegetable oil. Vegetable oil is about ten times thicker than diesel fuel, and as the temperature decreases, the oil gets thicker still. Heating the oil to around 165°F (74°C) thins it enough for the engine to accept it.

There are two heating methods—one uses an electric fuel preheater and the other uses a heat exchanger. I chose the heat exchanger method. When attempting to run on 100 percent veggie oil using the heat exchanger method, the engine must be cold-started on diesel or biodiesel. After cold-starting and driving for a few minutes, the engine will reach its normal operating temperature.

By then, the veggie oil will have been warmed sufficiently by the hot coolant and the heat transfer system. The driver can switch over to the veggie fuel tank and drive on veggie oil. Before engine shutdown, the veggie oil must be replaced in the fuel lines with the diesel or biodiesel so the vehicle will be ready for the next cold-start.

Conversion Kit

I purchased an SVO conversion kit from Justin Carven of Greasecar Vegetable Fuel Systems (greasecar.com). Jason Goodman and Chris Gibson installed it for me. The kit comes with an additional fuel tank for the veggie oil; a six-way solenoid valve, controlled by a dash-mounted rocker switch for changing between the fuel tanks; and a back-flushing, three-way valve with switch to clear the lines of oil. The kit also has a fuel gauge, a heated 10 micron fuel filter for the veggie oil, hoses, and connectors for connecting into the hot coolant from the heater core to heat the fuel lines. The simplicity of the conversion kit is striking.

The heat exchanger is a hose inside a hose (HIH), and a coil wrapped around the vegetable oil filter. Hot engine coolant is diverted with a tee fitting from the cabin heater-core input and is passed through a copper coil surrounding

The Biofuels Research Co-op

I get the vegetable oil I use from a local company in northern California's Sonoma County that bottles assorted products made from organic oils. A number of people in the area have converted vehicles to run on veggie oil here, so we banded together and formed a vegetable oil co-op that we call the Biofuels Research Co-op. We have 36 members and have spent many hours doing research, developing bylaws, establishing committees, and building and operating two fuel sites.

We have contracted with a local company to haul the oil company's waste oil, which is fresh and uncooked. They save disposal fees, and because they "donate" to us, they get a tax write-off on the oil. We were able to get nonprofit status through a local college, whose curriculum is focused on ecology, community, and activism. The group is highly motivated, building a fueling station with steel tanks and metered fuel pumps.

The primary requirement for membership is to have a converted diesel car, truck, or van. Since membership is limited by the amount of oil allocated to us by the oil production company, one of our committees is dedicated to researching new oil sources, so we can support new conversions in our community. We encourage people to contact us and see how they can form their own cooperatives. One of our more active members, William Wrentmore, has established a Web site that many of our members use—www.veggieavenger.com.



Veggie fleet:
Gary's Mercedes 300CD (front), and Carolyn's Mercedes 190D (rear).
They also have a veggie-powered VW Vanagon camper for weekend fun.



The 15 gallon vegetable oil tank hides in the trunk.

extra fuel tank. My partner Carolyn had a Greasecar kit installed too. Her car is a Mercedes 190D and gets 30 to 35 mpg and her range is 1,000 miles (1,600 km) with both tanks full.

What Works Best

Certain types of diesel engines, injection types, and injector pumps are better suited to running on pure veggie oil than others. Engines with indirect injection are reported to be better than those with direct injection. All newer diesel engines have direct injection. Mechanical injection methods are better than computerized injection methods.

There are three types of injector pumps—inline, rotary, and Lucas/CAV injection pumps. In-line pumps have turned out to be very solid and without problems with veggie oil, and can be found in Mercedes cars (with

Under the 300CD's hood: 1) heater hose from heater-core splice; 2) six-port solenoid fuel switch; 3) three-port solenoid fuel switch; 4) vegetable oil heated filter; 5) HIH back to/from vegetable oil tank.

the vegetable oil filter. From the filter coil, the coolant flows back to the vegetable oil tank via a 1 inch radiator hose, which forms a hot coolant jacket around the vegetable oil line—this is the HIH. The HIH consists of the 1/4 inch (6 mm) veggie fuel oil line that is inside the 1 inch (25 mm) heater hose.

Finally, the coolant is passed through copper coils in the vegetable oil tank, which warms the oil so that it can flow in cold weather. The coolant is then returned to the engine via another 1 inch heater hose that is attached with a tee fitting into the system at the water pump return.

The cost of the deluxe conversion kit from greasecar.com is US\$795; an economy kit is US\$495. Other companies offer kits with prices starting at US\$299, but the deluxe greasecar.com system has a metal fuel tank instead of a plastic one, and uses a 1 minute back-flush method that eliminates switching back to diesel or biodiesel five minutes before shut-down. Installation cost is additional, and was US\$525 for my car. For more information on kits, see Access.

With the addition of the kit's 17 gallon (64 l) vegetable oil fuel tank, my car has a range of over 800 miles (1,300 km). The car will run on regular diesel, biodiesel, or straight vegetable oil. The only negative aspect of the conversion is the loss of some trunk space for the





1) the auxiliary veggie fuel gauge, 2) fuel-type switch, and 3) back-flush switch on the dash of the 300CD.

Biofuel Taxes

My partner and I worked on the co-op legal committee to find out what taxes, if any, might be applicable for our use of vegetable oil. Our co-op was alarmed when we heard about the arrest of British drivers who were using vegetable oil. They were fined £500 (US\$750) with the threat of seven years imprisonment.

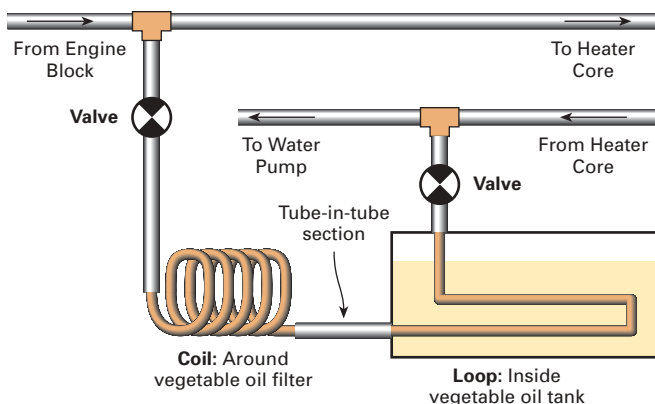
I called several agencies, including the California State Board of Equalization, and found that there are no federal taxes on straight vegetable oil and no taxes on homemade biodiesel if the maker uses or blends less than 400 gallons (1,500 l) per quarter. The state, on the other hand, has informed me that they are formulating rules or laws that will tax any fuel used in diesel engines. They consider food products fuel if they can power a vehicle. The planned road tax will be 18 cents a gallon.

precombustion chambers) and engines such as Cummins, Volvo, and Iveco. Bosch distribution pumps or rotary pumps have shown to be strong enough to cope with veggie oil. But to avoid premature pump failure, you should use fuel with near to diesel-like viscosity. Lucas/CAV pumps are very sensitive to any kind of particles of dirt in the fuel. Use a fine filter and only heated veggie oil.

The type of oil that is used can be important. I am fortunate to have access to high quality (food grade) uncooked oils. Not everybody has this available. Certain oils are better than others. Oils made from plants in the *Brassica* genus (mustard, canola—all containing high-lubricity oils) are among the best. If you live in a colder climate, you want canola, soy, sunflower, or corn oil because they don't solidify as much as others.

Vegetable Oil Preheat

Using Engine Coolant Loop



The Biodiesel Option

For those folks who are driving diesel powered vehicles and don't want to install the extra components to run on straight veggie oil, there is still biodiesel. Using the same waste vegetable oil, you can process the oil into biodiesel and make no modifications to your engine. Because biodiesel is such a great improvement over petroleum diesel (see www.ott.doe.gov/biofuels/environment.html), many people are making biodiesel from waste oil. They are saving money on fuel and helping the environment.

To find out how to make biodiesel, see the URLs in the Access section at the end of this article, and see the how-to article in *HP93*. Because I must use biodiesel for cold-starting, I have decided to join together with local biodiesel lovers and form a co-op group to make biodiesel. The group mixes the nasty methanol and lye together with pumps, which almost eliminates the dangers of handling these potentially hazardous products. The cost of the finished biodiesel is around US\$0.60 a gallon.

Pollution

Emissions are greatly reduced with biodiesel and straight vegetable oil, and are far less damaging to the environment than petroleum diesel. There hasn't been as much testing on 100 percent vegetable oil compared to biodiesel, but neither product contains sulfur, so there are no sulfur dioxide emissions. Soot or particulates are reduced by 40 to 60 percent compared to petroleum diesel, while carbon monoxide and hydrocarbon emissions are reduced by between 40 and 60 percent.

Renewable fuels such as biodiesel and veggie oil don't contribute to global warming, since they are carbon neutral. They don't put any more CO₂ into the atmosphere than the crops grown to make more fuel will use. Only nitrogen

oxides may be increased, and adjustments to the injection timing and engine operating temperature can result in lower levels than that produced by petroleum diesel. Compared to petroleum diesel, biodiesel and vegetable oil are 80 to 90 percent less hazardous, and SVO is nontoxic, nonhazardous, and biodegradable.

Vehicles running on biodiesel produce the least amount of greenhouse gases compared to those running on any other fuel, including compressed natural gas, hybrid, and all-electric vehicles (charged by the grid), according to a report authored by the Alternative Fuel Vehicle Program, sponsored by Ford Motor Company and Harvard University. It's not hard to see why biodiesel use has grown thirtyfold in two years.

Biodiesel is recognized by both the U.S. Environmental Protection Agency and Department of Energy as an alternative fuel. It qualifies for mandated programs under the Clean Air Act Amendments and the Environmental Protection Act of 1992. In California, biodiesel has been approved for use in remediation of petroleum oil spills.

Advances in Energy Independence

In the year since I installed my conversion kit, there have been some advances in systems. The Elsbett system from Germany uses only the original fuel tank and doesn't require extra switches, hoses, and fuel tank. This company supplies new glow plugs and fuel injectors, which along with an in-line heater allows the vehicle to be cold-started on veggie oil. Several of our co-op members are using this system along with an electric 12/24 volt, VEG-Therm SVO heater from Neoteric, and are having great results.

The veggie fuel movement is becoming known and is rapidly growing. Some people feel that the straight oil conversion kits are still in the experimental state. As with anything new, developments and improvements are happening quickly. But that benefits all of us who are striving for energy independence and trying to improve our lives responsibly.

Access

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From the Fryer to the Fuel Tank: The Complete Guide to Using Vegetable Oil as an Alternative Fuel, by Joshua Tickell, US\$29.95 from BookMasters, PO Box 388, Ashland, OH 44805 • 800-266-5564 or 419-281-1802 • tickell@veggievan.org • www.veggievan.org

Greasecar Vegetable Fuel Systems, Justin Carven, PO Box 60508, Florence, MA 01062 • 413-586-2432 • info@greasecar.com • www.greasecar.com • Conversion kit supplier

www.journeytoforever.org/biodiesel_svo.html • Lots of good biodiesel and straight vegetable oil info

www.biodiesel.infopop.net/2/OpenTopic/a/cfrm • Biodiesel and straight veggie oil discussion

Photos by William Wrentmore • william@veggieavenger.com • www.veggieavenger.com

Elsbett Technologie GmbH, Weißenburger Str. 15, D-91177 Thalmässing, Germany • 49-0-9173-779-40 • Fax: 49-0 -9173-779-42 • info@elsbett.com • www.elsbett.com • Conversion kit

Neoteric Biofuels Inc., PO Box 26068 Westbank, BC, Canada V4T1E6 • 866-768-3169 or 250-768-3169 • Fax: 250-768-3118 • info@biofuels.ca • www.biofuels.ca • SVO heaters and SVO conversion kits

GreaseBaron.com, W3883 Highline Rd., Bonduel, WI 54107 • www.greasebaron.com • Grease accessories, collection devices, filters, pumps, preheaters

Greasel Conversions, HC 73 Box 157D, Drury, MO 65638 • 866-473-2735 • charlie@greasel.com or pillard@greasel.com • www.greasel.com • SVO kits



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