New Method Cuts Cost Of Making Biodiesel

Dave Hubbard has modified the standard biodiesel production process to make the job easier and cheaper.

Making biodiesel from used cooking oil for himself and four other farmers is more than a hobby for Dave Hubbard. He and his friends have come to depend on it, especially as diesel prices climbed over the past several years. Best of all, he modified the standard biodiesel production process to make the job easier and cheaper.

Hubbard recognized that if he could pull the methanol out of the glycerin that's washed from the biodiesel, he could recycle it and cut his costs. To do so, he runs the glycerin through a modified still where it's heated under vacuum to 170 degrees F to release the methanol as vapors.

"I run the vacuum hose carrying the vapors through a pail of water, which condenses them back to a liquid that I can collect and reuse with the next batch of biodiesel," he explains.

Hubbard uses a tank large enough to handle a five-gallon pail. The tank is an old compressed air tank with the weld joint cut away. The top has a rim that slips into the bottom half of the tank for a tight fit. A pail of glycerin is set in the bottom half of the tank along with a heating element. Hubbard slips the top in, runs a strip of tape around the joint to make it airtight, and attaches the vacuum line to the air valve.

"It usually takes about three hours, but the time will vary depending on how much methanol was used in processing," he says. "When no more methanol is condensing, I know it's done."

Not only does the process allow him to reclaim methanol and lower his processing costs, his cattle love the pure glycerin.

"They eat it like candy," says Hubbard.

He also found a way to simplify one of the steps in making the biodiesel itself. Knowing when all the glycerin and impurities have settled out of washed biodiesel is vital. He notes that the oil can look clear near the top of the tank, even though all the soaps haven't settled out farther down.

"I adapted a flashlight so I can get light all the way down through the oil," says Hubbard. "I removed the light bulb and soldered two 3-ft. wires between the socket and the bulb."

The bulb extension allows Hubbard to lower the light all the way to the bottom of a barrel of oil to check for impurities. "If it still glows down 3 to 4 ft., I know it's clear."

For many biodiesel producers, obtaining used vegetable/cooking oil is getting more difficult. To find an adequate and secure supply, Hubbard and his friends approached a nearby college. Because the oil would benefit local farmers, the college agreed to give them all their oil instead of selling it to commercial operators.

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BMW Cycle Powered By Biodiesel

With home-brewed biodiesel powering his truck, tractors and other farm equipment, Dave Hubbard decided to use it in a motorcycle, too. He bought a 1986 BMW R80RT and replaced the gas engine with a three cylinder, Daihatsu D950 industrial diesel from Briggs and Stratton.

"I chose the BMW for its inline engine. The drive shaft goes straight out the back of the engine to the transmission and the differential on the rear wheel," says Hubbard. "On most bikes, the engine sits sideways across the frame. The three cylinder would have been too wide if placed sideways."

The industrial engine had multiple holes for mounting in different positions, making the conversion easier. Hubbard cut the original frame in two and then attached the front and back halves of the frame to the front and back of the engine.

To mount the transmission to the new motor, Hubbard had to fabricate a bell housing. He cut the top off a 40-lb. propane cylinder and welded steel plates to either end. Using paper templates, he ground down the steel plates and drilled holes to match the transmission and the motor mounts.

To cool the motor, Hubbard mounted three small radiators in gaps in the faring where the original motor had stuck out. The radiators originally were mounted under seats in a school bus. He connected them to the water pump salvaged from the original BMW motor. A small electric fan on one side of the motor kicks in as needed.

"It runs great," says Hubbard. "It will go 70 mph wide open and has a lot of torque. I just shift up through the gears fast, open it up and leave it there."

Hubbard explains that with the governor system on the diesel, he can set it to work like cruise control. The motorcycle will cruise up hills and down with the motor speeding up and backing off as needed. Best of all, it is economical to run.

"Making the biodiesel myself, it only costs 65 cents per gallon, and I can get about 70 miles to the gallon." says Hubbard.

Hubbard replaced the gas engine on his 1986 BMW with a 3-cyl., Daihatsu industrial diesel from Briggs & Stratton. The driveshaft goes straight out the back of the engine to the transmission and the differential on the rear wheel.

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"Cold Process" Biodiesel

Steve Veenstra developed his cold evaporation process to reduce the amount of time he had to put into making biodiesel.

Steve Veenstra says his cold evaporation process for making biodiesel is the lowest cost and easiest way there is to make biodiesel at home. He has made and burned some 4,000 gal. in fuel oil furnaces and in his 7.3-liter diesel F-250 pickup.

"I did nothing to modify the engine, and it works great," says Veenstra. "I think it runs even quieter due to the extra lubrication in the biodiesel."

Veenstra developed the process to reduce the amount of time he had to put into making biodiesel. The process also eliminates the need for water to "wash" the biodiesel, so there are no wastewater issues. Another savings comes from reduced heating during the process. The only use of power for heating is to preheat the vegetable oil to 125 degrees in an old water heater before it's moved to the reactor. The elimination of heat during the reactor stage also allows Veenstra to use poly tanks which let him visually check progress as fuel is made.

Veenstra says he currently makes 40 gal. in about 42 hrs., with only 2 1/2 hrs. of that time as actual physical labor. The rest of the time he doesn't even need to be in the area. His process eliminates many of the steps required to remove impurities in a standard process. With cold evaporation, Veenstra says, simply removing the methanol with his cold evaporation process causes impurities to drop out of suspension.

"Residual heat in the oil after pumping it out of the reactor tank pulls some of the methanol out of the raw biodiesel as it settles." he explains. "Additional steps in my process pull out about two liters of the methanol right away, and the rest evaporates gradually, thanks to a combination of spraying the surface, agitation and bubbling air through the liquid."

He says spraying the surface keeps surface tension down, encouraging evaporation. The bubbler and fan run in the evaporation tank for 24 hours, followed by a minimum of four hours of resting while the final suspensions drop out.

"My evaporation tank is designed to let the suspensions out before pumping the biodiesel out," explains Veenstra. "The biodiesel passes through a 10-micron filter and then a 1-micron bag filter to ensure quality."

He has also developed a simple system for making the methoxide for use in the reactor. He uses nitrogen gas to force methanol into a closed mixing tank with the lye to produce the methoxide, thereby avoiding mixing it by hand.

Veenstra has developed plans and tutorials for his no-wash finishing cold evaporation system and also for his biodiesel production system with its closed methoxide mixing system.

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