

Biodiesel

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What is Biodiesel?

- Biodiesel is a renewable fuel made from vegetable or animal sources
- Biodiesel can also be made from used vegetable oil
- Biodiesel can be used in every application petroleum diesel can be

- Biodiesel can be used in any mix ratio with petroleum diesel or straight (100%)
 - More than ~15% biodiesel will gel around 30°F even with a anti-gel fuel additive
 - Unreacted free fatty acids cause this
- It is possible to modify your engine to heat the biodiesel

Longer Diesel Life (LDL)

- Year round diesel fuel additive
- Improves fuel economy 6-10%
- Engine stays cleaner and more efficient
- LDL decreases exhaust pipe smoke levels up to 50%, and reduces emissions levels up to 15%
- Prevents the growth of bacteria
- Anti-gelling agent

Tax Issues?

- Form 637 is the registration application that all biodiesel producers and blenders must complete
- Form 720 is the Quarterly Federal Excise Tax Return
 - Used to report and pay federal excise tax
- Contact your tax professional

EPA Issues?

- All fuels and fuel additives must be registered with the EPA and are subject to health effects regulations

Engine Warranty?

- Most engine companies have adopted D 6751 to define biodiesel and provide information to customers regarding biodiesel
- Any biodiesel not up to the D 6751 standard can damage your engine and void your warranty
- Contact your manufacturer

How Biodiesel is Made

- Vegetable Oil + Methanol + Sodium Hydroxide + Time = Biodiesel
- Determine pH of used oil
- Add 40 gallons of used oil
- Add correct amount of sodium hydroxide
- Add methanol
- Mix for 1 hour
- Let sit overnight

- Drain the glycerin byproduct
 - Used as soap or composted
- Pump biodiesel into storage tank

- That's it!

- (*sodium hydroxide cannot be liquid, only anhydrous sodium hydroxide can be used)

Testing pH

- Determining the pH level of the oil with litmus paper or a pH meter
- Dissolving 1 mL of the oil to be tested in 10 ml of isopropyl alcohol
- Gradually adding a lye/distilled water solution (1 gram of lye dissolved in 1L of distilled water) to the oil/isopropyl alcohol mixture, one mL at a time, until the pH test indicates that the pH has reached 8 or 9

- The number of mL added will then give the number you need to calculate the amount of lye needed to process the used oil into biodiesel
 - the number of mL of lye/distilled water solution plus 3.5 equals the grams of lye needed per one liter of used vegetable oil being processed
 - 40 gallons or 151.416L

Methanol

- FuelMeister processes 40 gallons of oil at a time
- Pump in 8 gallons of methanol
- In a test batch, using 1L of oil, 200mL of methanol is used
- 1:5 methanol to oil ratio
- 6.875 batches per 55 gallon barrel
 - 275 gallons of biodiesel





Why?

- Vegetable oils are mostly made up of triglycerides, consisting of 3 fatty acids linked through an ester bond to a backbone of glycerin
- Methanol breaks down a single triglyceride into 3 methyl esters from the fatty acid and 1 molecule of glycerin.
- Esters are then purified and can be burned

Drawbacks

- Gels in cold weather if too high a percentage of biodiesel
- Initial investment
- 11% lower energy content per gallon
- Nitrogen oxide emissions
- Sodium hydroxide is corrosive
- Methanol is highly combustible

- Degrades rubber seals and tubes
- Initial fuel filter clogging (B100)

Benefits

- 80% lower emissions than petroleum diesel
- Biodegradable
- Smoother running engine
- Longer engine life
- ~70¢ a gallon to make
- Better lubricity than low-sulfur petroleum

- Flash point greater than 150°C, compared to 77°C for petroleum diesel
- Reduces the country's dependence on imported oil
- Degrades 4 times faster than petro-diesel
- Non-toxic

	Gasoline	Petro-Diesel	Biodiesel
Greenhouse Gases	35%	0	-70%
Particulates	-70%	0	-55%
Nitrous Oxides	-55%	0	5%
Volatile Organics	170%	0	-55%
Carbon Monoxide	415%	0	-45%

Costs

- Fuel Meister - \$2,495.00
- LDL (12 quarts) - \$126.00
- 2 hours labor – \$41.98
- Methanol – \$150.00
- Sodium Hydroxide – \$75.00

- Total Initial Cost – 2887.98

\$ Saved

- $\$70 * (52\text{weeks}/8\text{weeks}) = \455.00
- \$2000.00 diesel fuel
- $\$2000 * (.5) + (2000 * .5) (.20) = \1200.00

- Total Saved - \$2455.00 (~\$6.90/day)
- Total Saved - \$1655.00 (~\$4.53/day)

Payback

- $\$2887.98 / \$6.90 = 418.55$ days
– 1.15 years
- $\$2887.98 / \$4.53 = 637.52$ days
– 1.74 years

Sources

- www.freedomfuelamerica.com
- www.chemistry.org
- www.azurebiodiesel.com
- <http://www.eere.energy.gov/afdc/altfuel/biodiesel.html>