

Community Renewable Energy

Leech Lake Biodiesel
Pilot Project

Biodiesel-noun; a fuel comprised of mono-alkyl esters of long chain fatty acids derived from vegetable oils or animal fats_ designated B100 (100% biodiesel) by the American Society for Testing and Materials

Biodiesel
Growing a New Energy Economy



Waste>Fuel>Energy

- ❖ What is Biodiesel?
- ❖ What do I need?
- ❖ How do I make it?

- Benefits
- Uses
- Energy Values

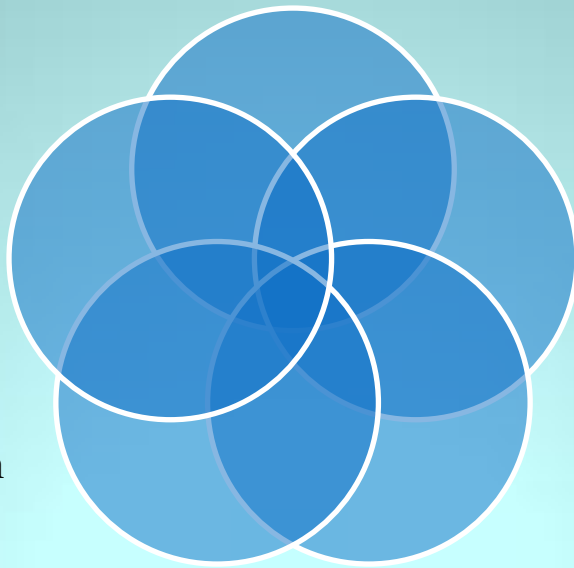
- ❑ Who is involved?
- ❑ What resources are available?
- ❑ Questions

Community Renewable Energy

What is Biodiesel?

A cleaner burning diesel fuel made from natural renewable sources such as vegetable oils or animal fats

Derived from the chemical process transesterification that separates the fat or oil into biodiesel and glycerin



Methyl Esters –
Chemical name for biodiesel

Non-petroleum based diesel alternative that is environmentally friendly and economically sound

What do I need?

- A. Safe Secure Location
- B. Quality BioD Processor
- C. WVO
- D. Lye (NaOH)
- E. Methanol
- F. Titrate kit
- G. Safety equipment
- H. Knowledge and research of all the above

Lye



WVO



Freedom Fueler
Waste Vegetable Oil
Digester-80gal System

homebiodieselkits.com

This system comes complete and ready to use. It has its own built-in pumping system, filtration system, heater, vacuum hoses, labeled valves, gauges, two mixing tanks, and even a direct fueling pump!



Test kit and Safety

- You will need a titration test kit. Some manufacturers provide these kits with the processor system. The titrate test is simple and only requires small amounts of related material for results. It is basically comprised of a phenolphthalein solution and isopropyl alcohol, as well as some pipettes or syringes.
- Safety should be a priority in the entirety of the process. From collection of oil to the use of caustic chemicals to finished product. Recommended equipment would be chemical grade - safety goggles, long gloves, respirator, and lab coats/aprons.

Phenolphthalein



Isopropyl Alcohol

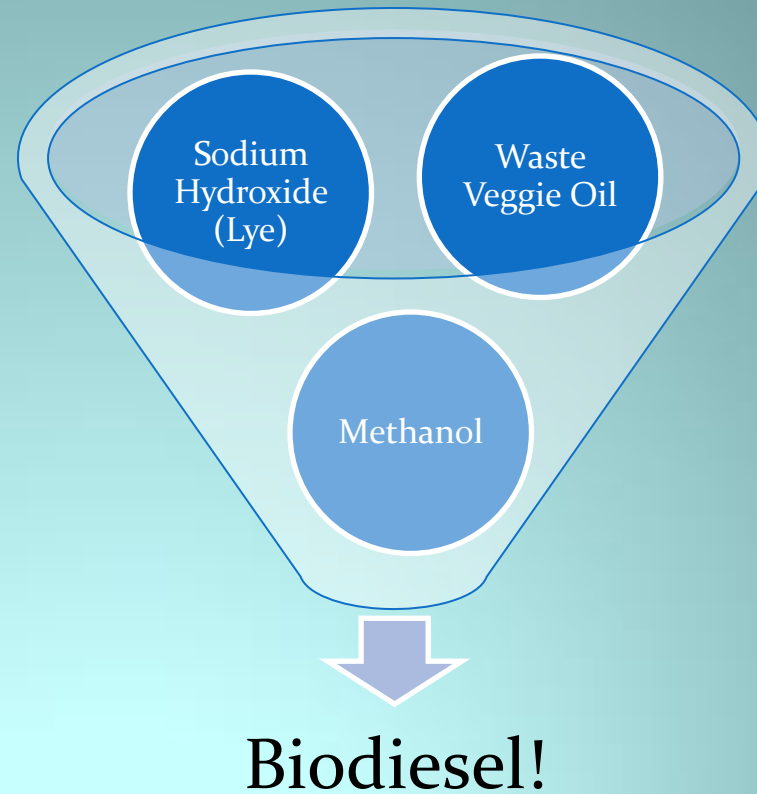


1 - 10 mL Syringes



How do I make it?

- 1) Need **WVO** (waste veg. oil)
- 2) **Heat** oil to 130-135F
- 3) **Titrate Test**
- 4) **Mix** Lye and Methanol
- 5) **Pour** mix into heated oil
- 6) **Mix** for reaction (agitate)
- 7) **Stop**, allow oil to separate
- 8) Remove glycerin (**drain**)
- 9) **“Wash”** Biodiesel
- 10) **Store** in dry storage



Benefits

Environment

- i. Displaces imported petroleum
- ii. Extends worldwide petroleum supply
- iii. Reduces GHG, PM, and other toxic emissions
- iv. Overall health and air quality through emission reductions
- v. Less toxic than table salt, degrades as fast as sugar

Can be made from

- I. Waste Vegetable Oil (WVO); takes a product that would otherwise be discarded as waste and turns it into usable fuel
- II. Raw Sewage; used as a substrate for algae, algae is a biofuel, which is then used to produce biodiesel
- III. Feedstock oils; soybean, canola, corn, sunflower
- IV. Animal Fats; chicken fat, lard, fish oil, yellow grease

Uses

- 1) Can be used as B100, but would need modifications and more maintenance in colder climates.
- 2) Blends are the most common; referred to as Bxx with the xx being replaced by the proportion, i.e., - 20% biodiesel added to petro diesel would be B20 diesel blend
- 3) Can be blended with other fuels too, such as; jet fuel, kerosene, home heating oil, diesel #1 and #2
- 4) The Department of Defense is the largest consumer in the US, Yellowstone National Park also fuels its fleet of over 300 vehicles as well as boilers and generators



Energy Values

Energy Output

1 unit of Fossil energy used to produce the fuel = 3.2 units of fuel energy from the biodiesel

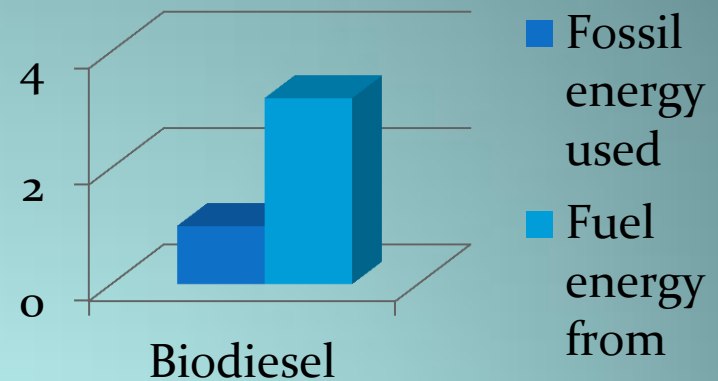
This is a result of biodiesel containing 11% oxygen by weight, compared to regular petro which has 0%, and provides for a more complete combustion and reduction in most emissions

Energy Production

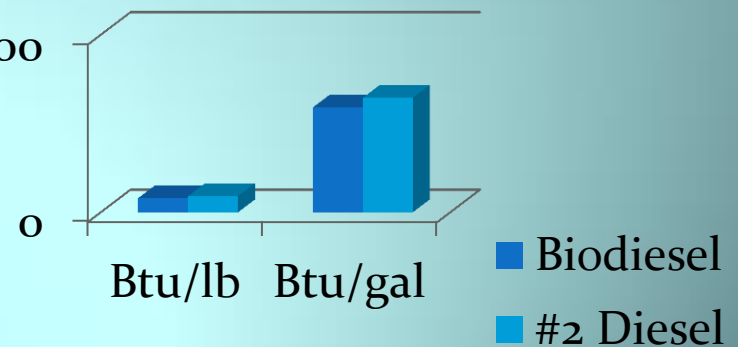
Biodiesel (B100)	vs. #2 Diesel (petro)	200,000
16,000 Btu/lb	vs. 18,300 Btu/lb	
118,170 Btu/gal	vs. 129,050 Btu/gal	

B100 contains 8% less energy per gal or 12.5% less energy per lb than regular petro diesel
This is caused by the fact that B100 is slightly more dense than regular petro

Energy output



Energy Production



Who is involved?

- Leech Lake Division of Resource Management
- United States Environmental Protection Agency (USEPA)
- Leech Lake Environmental Department – GAP Program
- Leech Lake Gaming – All 3 Casino's; Palace, White Oak, Northern Lights
- *Leech Lake Tribal College – along with Science Department developed and implemented synthesis for Chemistry classroom
- Leech Lake Solid Waste – future production handling and current resource for supplies to be reused such as; containers, buckets, barrels, pallets, etc.
- Leech Lake Fleet – utilizing production through use in buses, shuttles, trucks, tractors, etc.



*=actual photo of students' biodiesel micro-batches

What resources are available?

- 1) National Biodiesel Board Web page at www.biodiesel.org
- access reports, resources, and guides
- 2) The U.S. Department of Energy's Clean Cities Program maintains a Web site that summarizes state and local laws and incentives related to alternative fuels. This can be accessed at www.eere.energy.gov/cleancities/vbg/progs/laws.cgi
- 3) Also, the U.S. DOE has some technical documents located at www.eere.energy.gov/biomass/document_database.html
- 4) The EPA has reviewed many emission reports and has summarized them at www.epa.gov/OMS/models/biodsl.html
- 5) The National Renewable Energy Laboratory (NREL) at www.nrel.gov



Questions?

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Leech Lake

Environmental

Department

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Thank You Mii-Gwetch