Biodiesel Buccaneers

Brodie Burke Sara

Questions of the hour

- Can we make biodiesel at a cheaper cost than buying biodiesel/petroleum diesel at the pump in Olympia?
- How does methanol compare to ethanol and does it affect the cost and efficiency of biodiesel?

http://www.mpgmagazine.com/biodiesel.jpg

What Did We Do?

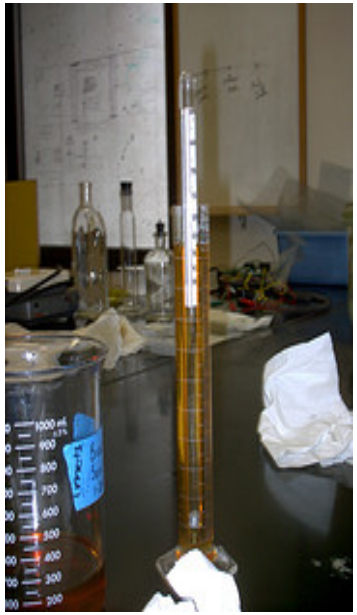
- Made 7 batches with ethanol/methanol and NaOH/KOH
- Familiarized ourselves with the organic farmhouse equipment and process
- Performed cloud point tests, pH tests, specific gravity tests, 3/27 tests and a wash batch
- Attempted to run the biodiesel in a 1 cylinder model engine to test power with a stroboscope and tachometer

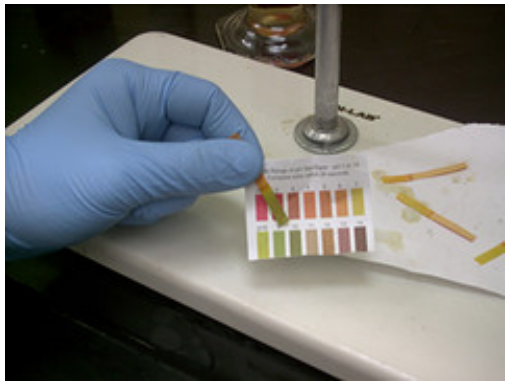
Alcohols and Catalysts

- Methanol (coal, natural gas or wood) is most commonly used (more stable biodiesel reaction)
  http://www.setamericafree.org/Rnichols.pdf
- Ethanol (grain) is less toxic and always produced from a renewable resource however it is better used with animal fat at 100% alcohol
  http://www.ybiofuels.org/bio_fuels/history_biofuels.html
- Potassium Hydroxide (KOH) is slightly less toxic than lye however it uses 9 g/L of pH balanced WVO
- Sodium Hydroxide (NaOH) uses much less: 3.5g/L
  Joshua Tickell pg. 69

Tests

- pH for titration to test the acidity of the WVO
- Specific gravity tests the density. Biodiesel should be 0.880 g/cm³ for best engine results
- 3/27 test for non-reacted oil
- Cloud point tests: the lower the cloud point the higher the quality
- The 1 cylinder engine ran off biodiesel





Results

Batches	Specific Gravity	Cloud Point Test	pH	3/27 Test
Methanol KOH	0.880 g/cm^3	9ºC	8	1 1/2 mL unreacted oil
Methanol NaOH	0.885 g/cm^3	8ºC	7 to 8	1/3 mL
Methanol KOH Wash	0.880 g/cm^3	9ºC	6 to 7	1/6 mL
Ethanol KOH	0.875 g/m^3	12ºC	8 to 9	0 droplets
Ethanol NaOH	0.875 g/cm^3	11ºC	8 to 9	1/8 mL
WVO	0.905 g/cm^3	7ºC	5 to 6	N/A

Don’t Drink this Homebrew

- Some film on the NaOH batches
- Water wash was still cloudy
- Sediment at the bottom of beginning batches
- Catalyst measurements
- Ethanol is temperamental

Cost Analysis

Batch Type	Alcohol Quantity	Price $	Lye Quantity	Price $	+ 3¢ Isopropyl Alcohol & litmus paper	$ Cost per Liter	$ Cost per Gallon
Methanol KOH	100ml	0.08	5.75g	0.04	0.03	0.25	0.99
Methanol KOH (washed)	100ml	0.08	5.75g	0.04	0.03	0.25	0.99
Methanol NaOH	100ml	0.08	2.75g	0.03	0.03	0.24	0.90
Ethanol KOH	275ml	1.65	8.625g	0.06	0.03	3.53	13.64
Ethanol NaOH	275ml	1.65	4.125g	0.05	0.03	3.51	13.57

To Answer the Question

- Yes, making our own biodiesel can be cheaper than buying at the pump because WVO is free and methanol is relatively cheap
- Methanol is more productive, of higher quality and much less is needed. Ethanol is vastly more expensive and a higher quantity is used. Methanol NaOH would be the cheapest at 0.90 cents/gal.

The Future is Uncertain and the End is Always Near

- Brodie would like to continue at the Evergreen Facilities for a larger scale production and learn about dual diesel engine conversion for WVO
- Burke would like to study fish oil for biodiesel use and eventual aviation application
- Sara would like to join the Evergreen Facilities and learn about larger production for personal use