

Biodiesel: The Hidden Fire Hazards

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On the evening of 20th of May 2008, Salem Township Fire Department was dispatched to the mobile home park to a vacant lot that contained several white milky liquid puddles on the ground that had a putrescent (rotten food/ French Fries) smell.

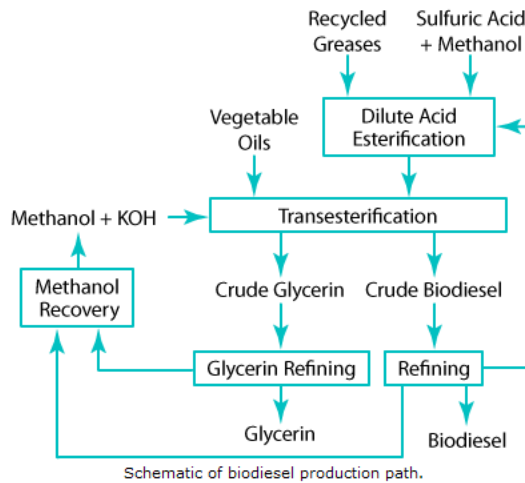


Upon investigation of the area, it was learned that biodiesel was being manufactured/processed in a non-descript shed approximately 20' x 10'. The area, shed and surrounding property gave no indication of the production of biodiesel except for the illegal byproduct dumping.



Upon entering the shed, we were presented a poly tank, a modified hot water heater with various home plumbing and gauges, numerous glassware and approximately 100 gallons of used vegetable oil.

The manufacture of biodiesel can follow a couple of different paths as indicated below:



Source: http://www.eere.energy.gov/afdc/fuels/biodiesel_production.html





In interviews with the home owner, he described his batched manufacturing process that produces approximately 30 gallons of biodiesel per job, as follows:

1. Used Vegetable Oil (27 gallons) is pumped into the modified hot water heater. The electric hot water heater has been modified by creating a closed loop piping system that allows the oil to be drawn from the bottom of the heater via an electric pump and then pumped to the top of the hot water heater. The plumbing also allows for the drawing and pouring in of liquids into the hot water heater through a series of gate valves that keeps all of the vapors/liquids contained within the hot water heater. Also the overpressure (T&P) valve has been relocated to the top of the tank. The tank also has a pressure gauge added.
2. The used vegetable oil is heated to 130F via the electrical element in the hot water heater.
3. 1,000 grams of KOH (potassium hydroxide) flaked is mixed with 5 gallons of CH₃OH (methanol) to create methoxide and is poured into the hot water heater via the plumbing and valves and then circulated for one hour.
4. The mixture is allowed to settle overnight.
5. The mixture phase separates into biodiesel on top and glycerin/methanol mixture. The glycerin/methanol mixture is removed from the bottom.
6. The biodiesel is polished by a water spray in the poly tank. This produces glycerin/methanol mixture (white liquid substance that was found being dumped as a byproduct, further refinement could make this into soap). The biodiesel is further heated to drive the water off. Note the processor is now using the bubbling air instead of water to purge the biodiesel of methanol.
7. No other modifications to the fuel or engine are necessary to use the fuel. The cost of manufacture (based on free used vegetable oil) is approximately \$1.00/gallon of biodiesel fuel.

Hazardous Chemicals

1. Potassium Hydroxide – tech grade
 - a. Caustic Material
2. Methanol
 - a. Very Flammable
 - b. PEL 200ppm/TWA
 - c. Posion
3. Methoxide
 - a. Poison
 - b. Corrosive
 - c. Flammable
4. Glycerin & Methanol
 - a. See methanol
5. Isopropanol – IPA (incidental amounts)
 - a. Flammable
6. Phenolphthalein (incidental amounts)
7. Biodiesel
 - a. No hazards outside of normal diesel.

Conclusions:

The production of biodiesel does not take much room and the process is not easily detected outside of the process area. The end product of biodiesel is similar in hazards to regular diesel. However, the intermediate chemicals and process chemicals used to make the biodiesel pose high hazards, especially if stored in large quantities. The byproducts can pose a hazard to animals and humans if not properly disposed. Additionally, if the processor is not careful they can poison or burn themselves. The person that was manufacturing the biodiesel had a dust mask, safety goggles, nearby garden hose with local water supply and a small portable ABC fire extinguisher as safety equipment. Finally, anytime an amateur modifies or makes a pressure vessel, care must be exercised to prevent a possible explosion.

If a response to an incident occurs the following protective measures should be considered:

1. Methanol burns with an invisible flame.
2. Corrosive burns are possible.
3. Overpressure of the hot water heater can occur.
4. Past accidents have occurred with overheating the oil, causing a fire.
5. Methanol vapor can be released causing poor air quality in a confined space.
6. PIDs will not detect methanol.
7. Large storage of oils can add to the fire load.
8. Other chemicals such as sulfuric acid can be used in other processes.
9. Potential for more home brewers as the fuel prices increase.