Examining Biodiesel

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On Tuesday we converted vegetable oil into biodiesel using methanol and potassium hydroxide. Today we will look at some of the properties that make biodiesel a more useful fuel source than vegetable oil. In addition, we will also look at some of the other side effects of the reactions we have undertaken. In all of these experiments, it will be important to handle the materials in a cautious fashion. Use gloves whenever handling any of the chemicals, and wear goggles when observing the reactions at close range.

1. Drain the dark glycerol layer from the separatory funnel into a bottle. Reserve the liquid for subsequent steps. Also drain some of the biodiesel from the separatory funnel for use in the following experiments.

2. Compare the viscosity (thickness) of the remaining biodiesel with that of the original vegetable oil using the following technique. Mark a Pasteur pipet at 10 cm and 4.5 cm from the tip of the pipet using a marker pen. Holding the tip closed with a finger, fill the Pasteur pipet with vegetable oil to the 10 cm mark. Open the tip of the pipet, and record the amount of time it takes for the oil to drain to the 4.5 cm mark. Repeat this two more times, and average the times together. Repeat the experiment three times using biodiesel instead of vegetable oil, and determine the average time for the three experiments. Which liquid is more viscous?

3. One of the concerns with biodiesel is how it performs at lower temperatures. Let a small amount of biodiesel sit on ice for several minutes. Measure the viscosity of the biodiesel as above. Does the biodiesel change in appearance or viscosity?

4. Compare the color of the glycerol layer with the purified glycerol from the instructor. How do they differ? What do you suppose causes this difference?

5. Take a small sample of the glycerol from the biodiesel reaction and start adding vinegar to the glycerol in small amounts. What happens to the solution? Does this tell you anything about the source of the differences in the glycerol samples? (Hint: vinegar is an acid.)

6. The most critical element of biodiesel is its ability to be burned in an engine. While we will not be running a diesel engine in lab, we can demonstrate the flammability by constructing primitive oil lamps to burn the different products of the reaction. To do this, add a small amount of each different liquid (vegetable oil, glycerol, crude biodiesel, purified biodiesel) to a different crucible. To each crucible add a short segment of string, submerging the string in the liquid before placing the end in the mouth of the crucible. Then light the end of the string. Compare the flames at the ends of the different lamps. Which solution appears to burn the brightest? Where does the flame burn in each of the lamps?