# CALIFORNIA STATE SCIENCE FAIR
# 2011 PROJECT SUMMARY

**Name(s)**

**Katherine J. Woolard**

**Project Number**

31339

**Project Title**

## The Effect of Different Base Oils and Biodiesel to Diesel Blends on RPM and Consumption Time in a Model Airplane Engine

**Abstract**

**Objectives/Goals**

The purpose of this project was to find out if biodiesel was a reasonable alternative to diesel in model airplanes and, if so, which base oil type with which blend of biodiesel and diesel would be the best in terms of RPM and fuel consumption time.

**Methods/Materials**

I used three different batches of home-made biodiesel each with a different oil base (peanut oil, corn oil, and safflower oil). I tested the biodiesel by combining the different biodiesels with the proper amount of diesel to attain three different percentages of biodiesel to diesel (10% biodiesel to 90% diesel, 30% to 70%, and 50% to 50%) resulting in nine different testing groups. I then injected each sample one at a time into a diesel model airplane engine that was securely attached to a table, running a shot of pure diesel between each test to eliminate contamination. Using a stopwatch and an RPM measurer, I collected the data and recorded it in the laboratory notebook.

**Results**

The peanut biodiesel in a 10% blend showed to have the highest RPM out of all the different biodiesel blends. The safflower biodiesel in a 50% blend resulted in the longest fuel consumption for the three blends. It was shown that all the 10% blends when compared to the 50% blends had the highest RPM while the 50% blends all had the longest fuel consumption time. When an ANOVA was run, all the results were shown to be statistically significant.

**Conclusions/Discussion**

Biodiesel is a longer chain molecule than diesel, meaning that a higher compression ratio in the engine would be required to burn it. This would account for the fact that the 50% blends took longer to burn than the 10% blends because of the higher concentration of larger chain molecules. Also, each base oil had a different make-up of fatty acids (capric, lauric, myristic, palmitic, stearic, oleic, linoleic, and alpha linoleic) with a different number of carbon molecules and carbon double bonds on the molecular chain. When analyzed for the different amounts of heat energy that are released, it was shown that the heat outputs by the different oils were remarkably similar with a maximum difference of 4.4 kcal.

**Summary Statement**

This project was designed to test the effectiveness of different base oils in biodiesel and blends containing biodiesel and diesel in various amounts on the RPM and fuel consumption time in a model airplane engine.

**Help Received**

Father oversaw lab work and oversaw conduction of experiment