



**CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY**

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Project Title Burn That Fat! The Predictive Role of Free Fatty Acids in Biodiesel Fuel Degradation	
Abstract Objectives/Goals Free fatty acid numbers are often used as arbitrary measures of fuel quality. An increase in fatty acids should thus correlate with fuel degradation, such as polymerization that restricts fuel flow. I plan to evaluate the environmental conditions the fuel encounters in storage and during engine use to characterize fluctuations in biodiesel properties. Such information can help predict the performance and shelf life of biodiesel fuel and give insight into improving and promoting biodiesel fuel as a viable alternative fuel. Methods/Materials Titration for free fatty acids and a filtering process mimicking a typical fuel system lays the groundwork for a model that predicts the relationship between free fatty acid values and polymerization of fuel. For the purposes of this study, established diesel sources and biodiesel made from soybean oil were used in order to limit confounding factors. Rather than wait for the fuel to degrade, degradation was induced in samples through alternating cycles of exposure to heat and cold. Results As environmental stresses were placed on the fuel, there was a general upward trend in fatty acid concentration. In terms of filtration, there was a decrease in the amount of fuel filtered in the set amount of time, though minimal. Conclusions/Discussion From the data obtained from free fatty acid determination, thermal stress of the fuel had a considerable effect. Although flow was not significantly correlated with increased free fatty acids initially, the clear trend that free fatty acids had with time could be modeled. The magnitude of the results are seen in comparison to the free fatty acid value of stored biodiesel. In future studies, opacity and color may also serve as indicators of flow restriction and degradation.	
Summary Statement Free fatty acids released by chemical reactions in biodiesel fuel should be an accurate determinant of fuel degradation.	
Help Received Materials and equipment were bought with grant monies from BP; Father helped cut wood pieces for experimental equipment; Biodiesel was produced by the Tongva Ecofuels Project; Used lab equipment at Innovative Organics under Doug Ward	