



CALIFORNIA STATE SCIENCE FAIR 2008 PROJECT SUMMARY

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Project Title The Potential for Vegetable Oil Based Fuels as a Substitute for Diesel	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals This research explores the potential for vegetable oil based fuels as substitutes for diesel. Increased oil prices and environmental concerns have focussed attention on alternative fuels. Our project hypothesis is that the use of waste vegetable oil (WVO), virgin vegetable oil (VO) and Bio-Diesel made from vegetable oils are all viable alternatives to using petroleum based diesel fuel.</p> <p>Methods/Materials To reach our conclusions, the research addressed the trade-offs in emissions, performance and economics of running vegetable oil based fuels in cars as compared to diesel. In addition, emissions data was collected for eight randomly selected gasoline cars to understand the emissions from gasoline. The economics of using corn derived ethanol (E-85) was also included in this study although the team did not conduct any emission testing on this bio-fuel. A 1987 Mercedes Benz 300 Turbo Diesel was converted by Lovecraft Bio-Fuels to run on vegetable oil. The conversion requires specialized pumps, filters and heat exchangers to accommodate the higher viscosity fuel. In addition, the vehicle was outfitted with a secondary test tank to accurately measure fuel consumption. Testing was conducted on a fixed course of 11.4 miles. The vehicle was driven in a controlled manner replicating each run with a variation of only 2-3% between tests. The amount of fuel consumed was measured in grams and converted to gallons.</p> <p>Results The results support our hypothesis that vegetable oil as a viable fuel source. The emission of carbon monoxide for diesel engines was lower than the typical gasoline car. Nitrous Oxides, however, appear to run 4-6 times higher than gasoline, an issue that can be corrected if pollution control equipment were to be installed on diesel cars. WVO appears to produce 17.5% lower NO emissions than diesel fuel. The fact that the CO₂ emissions from vegetable oil fuels are re-cycled by plants means the environmental impact is significantly lower than petroleum fuels which release new carbon into the atmosphere.</p> <p>Conclusions/Discussion WVO, which requires no special processing, is the most environmentally favorable. In terms of economics, WVO fuel is considerably cheaper at a \$0.02 per mile in cost versus Diesel at \$0.12 per mile. Bio-Diesel (\$0.15/mile) and gasoline (\$0.17/mile) were considerably higher. Ethanol came in at \$0.25 per mile undermining its potential as a viable substitute for gasoline.</p>	
Summary Statement Our project studies the potential for vegetable oil based fuels as substitute for diesel to meet the combined goals of reducing fuel cost, lessening dependence on foreign oil and decreasing carbon dioxide emissions.	
Help Received High School teacher Marta Wood provided guidance on our scientific process. Lovecraft Biofuels assisted with the retrofit of the 1987 Mercedes. Lunada Bay Automotive provided emissions testing. Parents provided advice and logistical help.	