



California Science Center
CALIFORNIA STATE SCIENCE FAIR
2001 PROJECT SUMMARY

Your Name (List all student names if multiple authors.) Martin Kemper; Casey Stephenson	Science Fair Use Only <h1 style="margin: 0;">S0410</h1>
Project Title (Limit: 120 characters. Those beyond 120 will be ignored. See pg. 9) Biodiesel	Division _ Junior (6-8) <u>X</u> Senior (9-12)
Preferred Category (See page 5 for descriptions.) 4 - Chemistry	
Abstract (Include Objective, Methods, Results, Conclusion. See samples on page 14.) Use no attachments. Only text inside these boxes will be used for category assignment or given to your judges.	
<p>Objective: To create a viable substitute for diesel fuel that produces a smaller amount of environmentally hazardous emissions when burned (i.e. SO₃ and NO).</p> <p>Materials and Methods: In order to convert the high molecular weight oils into a more volatile form the triglyceride was decomposed into three long chain esters (and glycerin). A sample of vegetable oil was obtained and mixed with a solution of 22.5% of the oil sample's weight of methanol and 1% of the oil sample's weight of strong base (KOH). The mixture was heated to 60 degrees centigrade and vigorously stirred for half an hour. The heat was then removed and the stirring maintained for 2.5 hours. The result was a two-layer solution, where the top layer is the hydrophobic biodiesel and the bottom layer is hydrophilic glycerin. The biodiesel was then decanted and #washed# with water by mixing 1mL water per 10mL biodiesel and decanting. Molecular sieves are added to remove any remaining water. Measured samples of biodiesel were burned in a bomb calorimeter to determine the energy content. Standard diesel fuel is also burned in a calorimeter in order to establish a comparison.</p> <p>Results: The biodiesel energy content was 9.68 kcal/gram on average. The value for conventional diesel fuel was 10.68 kcal/gram on average. Only small differences were detected in the energy content of the biodiesels from different sources.</p> <p>Discussion: As a pure hydrocarbon, biodiesel contains no sulfur, nitrogen or any other additives that produce environmentally damaging emissions. This makes biodiesel a very practical alternative to diesel fuel. The vast amounts of vegetable matter required to meet the huge current demand for diesel fuel, makes biodiesel very difficult to implement on a large scale. However, the technique could be used to recycle left over fats and oils from assorted industries, and could be used to ease some of the demand for conventional diesel fuel.</p>	
Summary Statement (In one sentence, state what your project is about.) Converting oils into a diesel fuel substitute, then measuring energy output compared to regular diesel fuel.	
Help Received in Doing Project (e.g. Mother helped type report; Neighbor helped wire board; Used lab equipment at university X under the supervision of Dr. Y; Participant in NSF Young Scholars Program) See Display Regulation #8 on page 4. Mother helped constructing board, Dad helped with calorimeter, used lab equipment/ chemicals from UC Santa Barbara under supervision of Dr. VanKoppen	