



**CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY**

Name(s) Richard Hsiao; James Ma; Sara Thoi	Project Number S0801
Project Title Is the Methyl-Ester of the Transesterification of Soybean Oil a Viable Substitute to Standard Diesel Fuel?	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals The objective of this project is to produce and analyze biodiesel, an alternative fuel created from vegetable oil. The study of biodiesel involves comparative analysis with standard diesel to determine its viability as a substitute. Current research and data indicates that biodiesel is the viable substitute to petroleum-based diesel that we hypothesized.</p> <p>Methods/Materials Lye, methanol, and soybean oil are blended in a household blender for 15 minutes and are allowed to settled overnight. The byproduct, glycerin, settles from the heterogeneous solution and density tests are performed by a mass to volume comparison and a hydrometer. Samples are tested using Fourier Transmittance Infrared Spectroscopy (FTIR), which indicates the uniformity of bonding peaks. Lubricity and flammability tests are also performed and qualitative observations are recorded. Emission testing is done at the Universal Technical Institute.</p> <p>Results The FTIR results show that in each of the 15 batches, the same preponderance of bonding occurs that indicates the presence of alkanes, carboxyl groups, and esters leading to the belief that the desired methyl-ester product is being created. The average density of the biodiesel produced is 0.8889 g/mL. Flammability is comparable to that of national diesel and California reformulated diesel. Lastly, lubricity is similar to national diesel and shows significant benefits over California reformulated diesel.</p> <p>Conclusions/Discussion It is concluded in the FTIR results and density tests that biodiesel is being consistently produced. Based on emission research, biodiesel appears to be less environmentally harmful than California reformulated diesel. The research seems to imply that biodiesel is both environmentally and economically feasible.</p>	
Summary Statement This project is focused on producing biodiesel and analyzing whether it is a viable substitute to standard diesel	
Help Received Used lab equipment at Innovative Organics under the supervision of Doug Ward; Emissions testing was done at the Universal Technical Institute; Marla Ward was the chemical advisor; Michael Winters was the construction advisor; Ian Watson provided a blueprint for the skid	



**CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY**

Name(s) Cody R. Lewis	Project Number S0802
Project Title Wind Power: A Study to Determine the Feasibility of Utilizing Wind Power to Meet the Energy Demands of the M.J.U.S.D.	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals The formation of this project stemmed from the simple observation of a few facts. The wind, for one, has been around since the beginning of time. Enthusiastic environmental concerns have been around for about five decades. Rolling blackouts started to occur when CA State's energy supply suddenly dropped in the late spring of 2001. Moreover, recently the Muroc Joint Unified School District has plunged very low, almost to the level of a state take over due to lack of funds. Combining these few basic facts I formulated a project that would be environmentally friendly, a power grid stabilizer, and economically smart for my school district because of the free price of the power source...WIND!</p> <p>Methods/Materials To begin my project, I collected 18 months of Edison billing data from my district and 12 months of hourly wind data from the Edwards AFB Flight Line wind sensors. I needed to enlist the help of both an ENRON Director of Electrical Engineering for expertise on what size wind turbine would be best and a sales engineer to prepare a non-binding bid proposal. I also needed to utilize several conversion formulas in order to interpret my data correctly. Wind and the factors that effect wind had to be researched as well as the topography of the area. Visits to the Tehachapi Wind Farms, the Tehachapi ENRON Manufacturing Facilities, as well as the Edwards AFB Weather Observing Office were vital to my understanding the key equipment and data needed for my project.</p> <p>Results I found that a 1.5 MW wind turbine would be the turbine of choice. The 1.5 MW wind turbine was found to generate enough kWh to supply the energy needs for the original 5 Edwards schools. It became obvious that there would also be enough energy to meet the entire district's energy needs as well. After calculating the difference between the district's energy consumption and the wind turbine's energy production, there was still enough energy left over to generate a 47% cushion for expansion, growth and possible sale.</p> <p>Conclusions/Discussion All things considered, wind energy appears to be an awesome alternative for the MJUSD. This project supports that wind is cost competitive and stable for our area, quick to permit and build, consumer and environmentally friendly, and a very reliable intermittent power supply. In an area where wind is abundant, it is feasible that a 1.5 MW wind turbine can meet the energy demands of the entire M.J.U.S.D..</p>	
Summary Statement The energy needs of the entire Muroc Joint Unified School District can be met by utilizing a 1.5 MW (mega-watt) wind turbine.	
Help Received Peder Hansen: ENRON Sales Engineer prepared a non-binding bid for the 1.5 MW Wind Turbine.	



**CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY**

Name(s) Phi D. Luong	Project Number S0803
Project Title Creating Compost to Heat Water	
Abstract Objectives/Goals The objective of my experiment was to harness the heat of decomposing organic material to heat water. If water is pumped through tubing surrounded by compost, then the water can absorb usable heat because compost piles generate heat as a result of decomposition. Methods/Materials Materials: 4 Buckets with lids 4 Thermometers 2 Water pumps 24 Liters of water 5 Gallons of organic material (green grass, brown leaves, soil, banana peels) 2 Forty-foot tubing Procedure: a. Construct a compost pile in a bucket with a coil of plastic tubing running through it. b. Using a water pump, circulate water through the tubing from another bucket. c. Create an identical setup without using compost. d. Compare the water temperature of the control setup and the compost setup. Results The water in the bucket that was cycled through the compost was substantially warmer than the control bucket. There was as much as a 7°C difference between the two buckets of water. Conclusions/Discussion The purpose of this experiment was to heat water by utilizing the heat produced from decomposing organic material. The results suggest the heat of decomposing organic material may be harnessed to heat water effectively.	
Summary Statement The heat of decomposing organic material was harnessed and transferred to heat water.	
Help Received Mr. Friedlander assisted in setting up the experiment; used equipment at Valley High School under the supervision of Mrs. Estes	



**CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY**

Name(s) Jan Nick C. Marfori	Project Number S0804
Project Title Factors that Affect the Speed and Efficiency of Biodegradation in Oil Spills	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals The purpose of this experiment is to determine the factors or conditions that would affect the speed and efficiency of biodegradation in cleaning up an oil spill.</p> <p>Methods/Materials Oil spill was simulated using 5 pairs of 1-pint mason jars, containing equal quantities of machine oil(2 g) and water (150 ml). The first set of jars with oil and water, was the control. The second pair, bacteria/soil was added to the oil and water; third set, bacteria and oxygen supply; the fourth pair, bacteria and inorganic nutrients; and the fifth set, bacteria, inorganic nutrients and oxygen supply. Measurements of oil degraded by bacteria were recorded at intervals of 3-5 days for 31 days using the "greasy spot" test. To perform the "greasy spot" test, oil/water samples were taken from the jars with a dropper, and then three drops were applied to the center of pre-cut 2" x 2" squares of brown paper bag. After being allowed to dry, the diameter of the "greasy spot" was measured in centimeters.</p> <p>Results Based on the measurements taken, the first set of jars showed stable oil presence. The second set showed 9% decrease from the initial measurement. The third set showed considerable oil degradation by 51%. The fourth set showed a moderate decrease of 21%, and the fifth set showed a significant decrease of oil presence by 66%. The third and fifth set of jars, which had oxygen supply, showed the most noteworthy decrease in size of the greasy spot as well as significant decrease in the water/oil levels at the end of the experiment.</p> <p>Conclusions/Discussion The process of oil biodegradation by bacteria was fast and efficient if all the factors presented in this experiment, were involved. The oil-contaminated water containing bacteria, inorganic nutrients, and source of oxygen demonstrated the environment in which biodegradation proceeded most efficiently. The inorganic nutrients and oxygen helped the oil-degrading bacteria to grow and multiply at a much faster rate, thus speeding up the process of biodegradation. Another conclusion, formulated from this experiment, was that the increased water movement in the jars with oxygen, dispersed the oil and hastened its evaporation and degradation.</p>	
Summary Statement This experiment, thru the use of simple scientific methodology, demonstrates the process of oil biodegradation by bacteria and the factors that would speed up and increase its efficiency in cleaning up an oil spill.	
Help Received My mom provided the brainstorming that helped me understand my results and my experiment better. My dad provided transportation and the logistics for my materials. My cousin supplied the laboratory balance. Ms. Arnold, my biology teacher for affirming drawbacks and flaws in my research paper.	



**CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY**

Name(s) Holly A. Miles	Project Number S0805
Project Title Using Gas Chromatography to Analyze the Ability of O. anthropi, B. cereus and P. putida to Degrade Petroleum Oil	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals The objective of this study is to analyze the three bacteria's efficiency and characteristics concerning biodegradation, and determine the potential for application in oil spill clean-up. Also, to draw relationships between the rate of hydrocarbon degradation, time, and the number of carbons in the hydrocarbon chains.</p> <p>Methods/Materials Nineteen 25ml saltwater samples were prepared in test tubes to simulate the salinity of the ocean. Three bacteria, P.putida, B.cereus and O.anthropi, were inoculated into four different tubes (12 samples). The samples were contaminated with 1.25 ml of Exxon Crude Oil. After 18 days, the hydrocarbons were extracted from 2 samples of each bacteria and then analyzed with a Gas Chromatograph (GC). After 35 days, the analytical process was repeated using the remaining samples. Three sets of controls were run: one determining the original composition of the oil, one testing the composition after 18 days and one to determine the composition of the samples before contamination.</p> <p>Results Data from this study is based upon chromatograms, the result of a gas chromatograph test. The bacteria were found to degrade the oil in the following order of efficiency: P.putida, B.cereus, O.anthropi. P.putida proved to be dramatically more effective than the other bacteria. All bacteria degraded more oil in the second interval of 18 days than in the first.</p> <p>Conclusions/Discussion It was concluded that all three bacteria are capable of degrading petroleum hydrocarbons however P.putida is the most effective. It was found that the rate of degradation increases over time as the bacteria population increases exponentially. An inverse relationship was found between the number of carbons in a hydrocarbon and its biodegradability. This study also suggests that a prominent unifying characteristic of aerobic oleophilic bacteria is an oxygenase enzyme. Finally, it has been concluded that P.putida could effectively be used to clean up marine oil spills in its natural environment.</p>	
Summary Statement This project analyzes the ability of O.anthropi, B.cereus and P.putida to degrade petroleum hydrocarbons after a marine oil spill.	
Help Received Used Gas Chromatograph equipment at UCLA under the supervision of Dr.Indira Venkatesan and Professor Edward C. Ruth	



**CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY**

Name(s) Amy F. Ng	Project Number S0806
Project Title Development of a Portable Laser Spectrophotometer for Chlorophyll Measurement and Environmental Water Monitoring, Part 2	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals The purpose of this project is (1) to refine the construction of the previous laser spectrophotometer by making the instrument more sensitive and more susceptible to environmental light; (2) to optimize the instrument performance based on Beer's Law; (3) to use the spectrophotometer for reliable field analysis of environmental waters; and (4) to obtain assurance of its performance.</p> <p>Methods/Materials A laser pointer emits 670 nm light was used for absorption spectroscopy of chlorophyll. The laser intensity was measured by using a pocket power meter. A neutral density filter was employed to reduce the laser intensity in an attempt to increase the instrument sensitivity. A 1-cm tube and a 2.5-cm container were compared as the sample cuvette. A light-block wrap was constructed with block-out cloth and used for minimizing the background environmental light. Environmental waters were collected and analyzed with this field-assembled portable laser spectrophotometer. Finally, the performance of this instrument was compared to that of a commercial, desk-top spectrophotometer.</p> <p>Results It was found the intensity of the source laser did not affect the absorbance sensitivity. The larger sample cuvette gave higher absorbance signals. The light-block wrap used to enclose the instrument was able to reduce environmental light readings to a negligible level. The measurements obtained were consistent with the cleanliness of the water sample. Finally, this portable laser spectrophotometer gave a similar sensitivity to that of the commercial spectrophotometer.</p> <p>Conclusions/Discussion A hand-held laser spectrophotometer has been designed and constructed with pocket components, and evaluated theoretically (Beer's Law) and practically for chlorophyll measurement and water quality analysis. The sensitivity of the laser spectrometer is found to be comparable to that of a commercial unit. Finally, the laser spectrometer is proven useful and is ready for practical field-analysis.</p>	
Summary Statement A hand-held laser spectrophotometer has been designed and constructed with pocket components, and evaluated theoretically (Beer's Law) and practically for chlorophyll measurement and water quality analysis	
Help Received Science teacher provided the knowledge. Parents helped with suggestions for board lay-out.	



**CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY**

Name(s) Brianna E. Page	Project Number S0807
Project Title Don't Drink That Water!	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals To discover whether putting various waters through a reverse osmosis process would lower the levels of pH, total dissolved solids, and alkalinity in them.</p> <p>Methods/Materials My materials included two liters of water from the Arroyo in Moorpark, two liters of tap water, two liters of water from our public jacuzzi, and three bottles of Crystal Geyser bottled water, each 750 mL. I also used a pool chlorine balance test kit which included materials for the pH test and the alkalinity test and a total dissolved solid tester. The reverse osmosis process consisted of a sediment filter, pure carbon block, and the reverse osmosis membrane.</p> <p>Results The reverse osmosis process highly affected the various types of water. The pH levels were all brought down to 7, except for the bottled water which stayed constant at 5.5. The level of total dissolved solids was also brought down to 20 ppm (parts per million) The alkalinity was also considerably brought down to 10.</p> <p>Conclusions/Discussion My hypothesis was correct. Some people may be unaware of the importance of the reverse osmosis procedure and how often it is used in our society. This project was done to inform others about the quality of the water they are drinking.</p>	
Summary Statement The effects of reverse osmosis on various types of water.	
Help Received Used equipment of Mr. Tim Gayvert	



**CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY**

Name(s) Andrew T. Redman	Project Number S0808
Project Title Development of a Shape Memory Alloy Actuated Flue Damper	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals To design, construct and test a device which reduces natural gas use in waterheaters by reducing the passive heat loss up the flue pipe. The device had to be safe, easy to construct and install, and inexpensive to manufacture.</p> <p>Methods/Materials Incorporate a Shape Memory Alloy wire to actuate a damper valve when heat is present in the waterheater flue pipe. Test the system on a home waterheater over a period of time sufficient to determine the rate of passive heat loss, given the ambient air temperature fluctuations surrounding the water heater. The device was constructed of a 24" x 4" dual wall flue pipe and bulk pieces of aluminum, brass and stainless steel.</p> <p>Results After testing the damper against data obtained without the damper, the data indicates that the device causes a eight to eleven percent reduction on the cycle time (time period between ignitions) of the tet waterheater. This cycle time reduction would correlate directly to a reduction in natural gas consumption.</p> <p>Conclusions/Discussion The device appears to have merit as a practical, simple and inexpensive to build and install consumer product which can reduce water heating bills by eight to eleven percent.</p> <p>I have been encouraged by the San Diego Science Fair judges to patent this device. I would appreciate any advice or guidance in this matter.</p>	
Summary Statement Reducing natural gas consumption by reducing passive heat loss from home water heaters.	
Help Received My father helped with some of the metal work and he paid for the components.	



**CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY**

Name(s) Shamsher S. Samra	Project Number S0809
Project Title Heat of Condensation: A Natural Source of Protective Heat: A Second Year Study	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals Current farming methods used to protect agricultural crops from frost are energy consumptive and expensive. This investigation is an attempt to practically apply the theory of heat of condensation into agricultural fields to prevent frost destruction in crops. This investigation will use previously acquired knowledge about the tendencies and properties of heat of condensation and attempt to create an ideal structural matrix that can promote water nucleation.</p> <p>Methods/Materials Using a self-designed computer program and a thermister interface, air temperature differences were monitored beneath structural net matrixes and the adjacent experimental control of ambient air temperature. Structural matrixes used during the investigation included: three 5#x5# plastic nets, two containing hole diameters of .5# and a third net containing hole diameters of .1#. One .5# net and the .1# net were suspended 9# above ground; the third net was suspended 3# above the ground. Comparative temperature readings were simultaneously recorded at hourly intervals from the hours of 6:00 p.m. to 7:00 a.m., during the winter months.</p> <p>Results Data from the investigation showed a significant difference between ambient air temperatures and temperatures beneath the net matrixes on cold nights. As temperatures decrease, marginal differences between the ambient air temperatures and temperatures beneath the net matrixes would increase. Ideal conditions for heat of condensation were overcast nights without any wind. As readings were taken in later months and temperatures rose, marginal differences between the ambient air temperature and temperatures beneath the nets decreased.</p> <p>Conclusions/Discussion Data and statistical analysis showed that a structural matrix might increase the rate of nucleation of water vapor, which does increase the relative air temperature through heat of condensation. Data analysis showed an increased temperature difference between the matrixes and the experimentally controlled ambient air temperature on cold nights; therefore significantly reducing the possibility that this phenomenon is caused by heat being re-released from the surface. Results suggest that a matrix, such as netting, could be practically applied in agriculture to protect crops, thus serving as a natural source of protective heat with an associated advantage of energy conservation.</p>	
Summary Statement Creating an ideal situation to promote and harness the effects of heat of condensation, so that they may be practically applied in agriculture, in the form of a structural matrix, to prevent frost destruction.	
Help Received Mother took pictures of me to put on board;statistics teacher helped teach me how to mathamatically calculate statistical data.	



**CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY**

Name(s) Anjali Tripathi	Project Number S0810
Project Title Fast Trash: Safely Speeding Up Rates of Decomposition in Models of a Landfill	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals The objective of this project was to find which treatment group in landfill models had one of the fastest rates of decomposition, while releasing less amounts of gas.</p> <p>Methods/Materials Six treatment groups were kept at different temperatures and different liquids were added to them. Five of these test groups were: water, a 10% sugar solution, a 10% salt solution, heat(33°C)and cold (18°C). The sixth group was the control, it was kept at 25°C and no liquids were added to it. Six sets of models were made for each of the six groups. The models were made from plastic empty milk bottles (which are made from the same material as landfill liners) filled with layers of soil and objects that represented each type of trash. Every week, for six weeks, one model from each treatment group was opened and the mass of the different objects was recorded. The amount of gas emitted by the models was measured by using a system of water displacement.</p> <p>Results The group with heat had the fastest rate of decomposition and released the most amount of gas. The control group had the slowest rate of decomposition and gave off the least amount of gas. The group with the 10% sugar solution had the second fastest rate of decomposition, while emitting the third least amount of gas.</p> <p>Conclusions/Discussion In landfills, garbage usually takes decades to decompose and the gas released contributes to the greenhouse effect. Not all landfills are identical. For some landfills it might be a good idea to add different liquids or increase the temperature to optimize rates of decomposition and gas emissions. The results suggest that adding a 10% sugar solution would be beneficial for increasing rates of decomposition and minimizing gas emissions for the average landfill.</p>	
Summary Statement This project is about how different temperatures and liquids increase rates of decomposition while producing less gas in landfill models.	
Help Received Dr. Robert Anex, Dr. Dennis Truax, and Mr. Ray Huitric answered questions. Parents proofread. Advisor supervised.	



**CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY**

Name(s) Vijay Yanamadala	Project Number S0811
Project Title Reclaiming the Ecosystem: Eutrophication Control with Calcium Carbonate Filters and Denitrification in Fresh Water Lakes	
Abstract Objectives/Goals Eutrophication, the process by which a lake becomes rich in dissolved nutrients due to point and non-point pollutant sources, is a major cause of the loss of natural lake ecosystems throughout the world. Especially in Madrona Marsh, one of the last remaining vernal marshes in the Greater Los Angeles Area, cultural eutrophication has become a major problem. Methods/Materials This experiment involved the testing of calcium carbonate as a phosphate binder in the laboratory and in the real ecosystem. A calcium carbonate lacing procedure was first carried out in order to determine its efficacy in Madrona Marsh. This was followed by an ammonia study. Ammonia interferes with the solubility of calcium carbonate and therefore hinders the reduction of phosphate. Various approaches for reduction of ammonia were tested including aeration, use of bacteria growth medium, and plants, mainly in an attempt to increase population of Nitrobacter and Nitrosomonas. In addition soil sampling, sediment analysis, microscopic plant analysis, microorganism and macroinvertebrate identification, and rate law formulations were conducted. This was followed by the construction of various phosphate binding calcium carbonate filters, which utilized the ion exchange principle, including a spring loading filter, PVC pipe filter, a galvanized filter, and an agitator clarifier system. All were tested with the aid of Stoke's Law. Results Calcium carbonate was found to be an excellent phosphate binder, reducing up to 70% of the phosphates in the lacing procedure, and the ammonia control phase also worked successfully, reducing ammonia, on average, by 0.2 ppm. The auxiliary phases were successful in determining the safety of the calcium carbonate, and the filters were built on that basis. The filters worked well, reducing phosphates significantly and producing high flow rates and clarity overall. Conclusions/Discussion The experiment was extremely successful in designing a working phosphate binding and ammonia reducing filter, and a large scale filter is currently being constructed in Madrona Marsh; this filter will reduce phosphate and ammonia levels substantially in the following years.	
Summary Statement Various nutrients such as phosphates flow into lakes through a process known as eutrophication, which results in major ecological and economic problems; I attempted to find a solution to eutrophication by reducing phosphate in the water.	
Help Received Used lab at high school	