CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Erik J. Aidukas

Project Number
S0501

Project Title
Does Electrode Surface Area Affect the Yield of Hydrolysis?

Abstract

Objectives/Goals
The purpose of this experiment was to determine if surface area of electrodes in a Hoffman Voltameter affect the yield of hydrolysis. It was hypothesized that regardless of surface area, all electrodes would have the same hydrogen yield.

Methods/Materials
A Hoffman Voltameter, distilled water, sodium chloride and sodium bicarbonate as a solute, a volt meter, and six pairs of modified copper wire anodes and cathodes were used to perform hydrolysis. One set of electrodes minimized surface area, one set maximized surface area, and one set was similar to the standard shape and surface area.

Results
Three electrodes were compared in two electrolytic solutions. Results were measured in milliliters of hydrogen yield under atmospheric pressure. In the 0.05 M NaCl solution, 3.5 mL, 3.5 mL, and 7mL yields were made with the electrodes that maximized their surface area, minimized their surface area, and were standard in shape, respectively. In the 0.1 M NaCHO(3) solution, 4 mL, 4 mL, and 7mL yields were made with the electrodes that maximized surface area, minimized surface area, and were standard in shape, respectively.

Conclusions/Discussion
Because altering the shape to change the surface of the electrodes, the distance between the anode and the cathode was changed. To account for this variable, comparisons of correlation coefficients were made. The correlation coefficient between surface area and hydrogen production was 0.71 for NaCl (aq) and 0.71 for NaCHO(3) (aq). The correlation coefficient between the distance between the electrodes and hydrogen production was 0.77 for NaCl (aq) and 0.77 for NaCHO(3) (aq). The r^2 value clearly shows that the distance between the electrodes was more important than their surface area. Since this variable was not controlled, little can be concluded. Keeping constant the electrode length and only altering the surface area by changing one dimension would solve this problem.

Summary Statement
To find a more efficient means of producing hydrogen, I tried to see if the surface area of the electrodes I made would affect the hydrogen yield of hydrolysis.

Help Received
Teacher loaned necessary materials and lab equipment; my parents helped with the display.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Sabrina Angell; Cassandra Hutchings

Project Number
S0502

Project Title
One + One = Boom

Abstract

Objectives/Goals
The objective of this project was to see which soda reacts the highest and quickest shen two cinnamon mentos are added. our hypothesis is that Mountain Dew would react the highes and quickest.

Methods/Materials
50.8 fluid oz of each of the following sodas: pepsi, mountain dew, coke, sprite rootbeer, diet coke, orange.
meter stick for measuring soda height
3 water bottles
water for rinsing out the bottle after each soda
stop watch
tape
2 cinnamon mentos for every bottle of soda (about 42 mentos)

Results
diet coke reacted the highest
orange soda was the quickest to react

Conclusions/Discussion
we discovered our hypothesis was incorrect. Diet coke was the highest to react. Orange was the fastest to react. Not Mountain Dew

Summary Statement
We tested the reaction between cinnamon mentos and soda

Help Received
received verbal heal from teacher, Erin Vaccarro about where to perform our tests. (inside vs outside), watch some episodes of Myth Busters to see which mentos they used.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Alexandra M. Courtis

Project Number
S0503

Project Title
Bright, Luminescent Silicon Nanoparticles for Biological Applications

Abstract

Objectives/Goals
In recent decades, there has been increased interest in fluorescent semiconductor nanoparticles or quantum dots (QDs). QDs behave like single atoms and provide clear benefits over the organic dyes currently used for tracking biological processes. Since the production of QDs is very costly, the search continues for an industry-ready synthesis of nanoparticles with optimal characteristics for bioimaging. Towards this goal, I explored creating silicon QDs as silicon is electrochemically stable and the second most abundant element in the Earth#s crust.

Methods/Materials
The first part of my project dealt with synthesizing the compound sodium silicide (NaSi). My synthesis involved reacting sodium and silicon in a high temperature furnace. To create spherical Si-QDs, I developed an approach that reacts NaSi with ammonium bromide in dimethyl formamide (DMF) on a Shlenk line. I terminated the QDs with propylamine rendering them air and water stable. I also developed a synthesis in dioctyl ether (DOE) that yields luminescent, octane terminated silicon nanorods. To test if the QDs would be bright enough to image a human cell, I performed cell studies with human monocytes.

Results
I confirmed the synthesis of NaSi with Powder X-Ray Diffraction. The properties of the QDs were explored via UV-Vis, PL, and Transmission Electron Microscopy. My QDs are luminescent, monodisperse, and produced in 3X higher yield than prior publications on such a synthesis. Confocal microscopy scans indicated that the QDs are bright enough to image cells. Regarding the DOE reaction, a solution state synthesis to create Si nanorods had never before been accomplished. Creating luminescent Si nanorods was immensely significant as it proves that shape control of Si at the nanoscale is possible.

Conclusions/Discussion
I have demonstrated the facile synthesis of water-soluble propylamine capped Si-QDs. The QDs have optimal fluorescence, are homogenous, and their synthesis provides for high yield. Cell studies on monocytes showed that the particles can image cells. This extends the utility of the QDs beyond inorganic chemistry into biology and medicine as potential candidates for bioimaging. An unexpected result of my work was the creation luminescent silicon nanorods. The shape of the nanorods would be preferable for bioimaging applications due to their smaller diameter and are further proof of the applications my work could have for medicine.

Summary Statement
I created silicon nanoparticles, visible only under ultraviolet light, which will help doctors image malignant cells in the body in a safer way.

Help Received
Performed research at the Lab of Professor Susan M. Kauzlarich and the Lab of Angelique Louie at the University of California at Davis.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Jeanette M. Fong

Project Number
S0504

Project Title
Dissolution Rates of Different Brands of Ibuprofen in Varying pH Solutions

Abstract

Objectives/Goals
The purpose of this experiment was to compare the dissolution of different brands of ibuprofen tablets in 15-minute time periods, using varying pH solutions. Ibuprofen is a widely-used non-narcotic pain reliever (Ibuprofen, 2006). The hypothesis, the different types of ibuprofen would dissolve at the same rate, was disproved.

Methods/Materials
In order to conduct this experiment different brands of ibuprofen, Pharma TRUST generic ibuprofen, Advil tablets, Nuprin caplets, and Motrin tablets, were used. The tablets and individual coffee filters were weighed and the tablets were tested in three pH solutions. After 15 minutes the buffer and the tablet remnants were poured into a coffee filter, left to dry, and weighed.

Results
The results indicate that these tablets would dissolve the fastest in the stomach, resulting in faster absorption rate (Pharmacology, 2002) and thus bringing faster pain relief.

Conclusions/Discussion
Pharma Trust generic ibuprofen cost 2.5 cents per tablet, Motrin tablets cost 19.5 cents per tablet, Nuprin caplets cost 13.7 cents per caplet, and Advil costs 16.7 cents per tablet. If one wanted the fastest pain relief, they would take Pharma TRUST ibuprofen over name-brand ibuprofen because it dissolved the fastest. Coincidentally, Pharma TRUST is also the cheapest brand of ibuprofen by 11.2 cents. However, if one was desperate for fast pain relief at any cost, taking either Pharma TRUST ibuprofen, Motrin, or Nuprin caplets, would have close to the same effect because the average percentages dissolved after 15 minutes were within 5% of each other. Meanwhile, Advil, the #leading# name-brand pain reliever, did not perform as well as advertised. Generic Pharma TRUST ibuprofen is 6.68 times cheaper than Advil and dissolves 19.729% better. These results correspond with the results found in previous research (McKee, 2005).

Summary Statement
I compared the dissolution rates of different brands of ibuprofen by comparing weight change to determine whether name brand ibuprofen is justified in its cost.

Help Received
Eva Stamper, used equipment under her supervision; Mother and Father, monetary support

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Jacob S. Gilbert

Project Number
S0505

Project Title
Molar Volume of Pentaamminecobalt(III) Amine Complexes: Effect of Increasing the Number of Carbons on the Amine Ligand

Abstract

Objectives/Goals
The goal of this project was to determine the relationship between increasing the length of amine chains in aminopentaamine cobalt(III) complex ions and the molar volume of those substances.

Methods/Materials
Five compounds, each with a different length of amine chain, were dissolved in water. Five to six solutions of varying concentrations were prepared for each compound. Each solution#s density was then measured using a density meter. Then the molar volume was calculated for each solution. This is a function of the molar masses of water and the solute divided by the density of the solution.

Results
The molar volume of the complexes proportionately increased as the number of carbons in the amine chain (CH3 - (CH2)n # NH2) increased.

Conclusions/Discussion
Adding more carbons has no apparent effect on the molar volume other than causing a proportionate increase.

Summary Statement
The focus of my project was to determine the effect that increasing the number of carbons in the amine chain in specific cobalt complexes had on the density and therefore the molar volume of those aforementioned complexes.

Help Received
Mother helped assemble poster; used lab equipment at the Joint Science Department of the Claremont Colleges; Dr. Robert Pinnell helped synthesize some compounds; Dr. Tony Fucaloro for beginning research on these topics; Dr. Andrew Zanella for direct guidance and help throughout.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Zane B. Golas

Project Number
S0506

Project Title
Electrolysis

Abstract

Objectives/Goals
To find the variables that will allow for maximum efficiency of hydrogen production during the electrolysis of water.

Summary Statement
How different variable effect the amount of hydrogen produced during the elctrolysis of water

Help Received

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Christopher M. Hoage

Project Number
S0507

Project Title
"Ship"wrecked Science II: The Death of Heavy Metal

Abstract

Objectives/Goals
The objective of my project was to determine what factors cause certain types of metal to decay faster than others.

Methods/Materials
I used 36 glass jars filled with sea water, river water and distilled water to test steel, steel with rivet, brass and iron. I took observations every night and took a chemical analysis at the end of the project.

Results
I found that a combination of things lead to the deterioration of the metal. The worst preserved sample was the sea water, steel with rivet, outside, because of galvanic corrosion. The best preserved sample was the sea water, brass.

Conclusions/Discussion
I found that if a metal is not near a metal of highter nobility, is in deep, cold water and dark, without organisms, it will be well preserved.

Summary Statement
My project was to investigate why shipwrecks deteriorate over time, what preserves them.

Help Received
Mother typing, father prep samples, and building board, Mr. Lea and Mr. Aleszka for information, Tim for cast iron pipe. Clive Cussler for inspiration.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
David M. Marangoni-Simonsen

Project Number
S0508

Project Title
Reaction Rates

Abstract

Objectives/Goals
The goal of my experiment was to discover if temperature effects the rate of a reaction. My hypothesis was that if temperature is raised or lowered, then the reaction rate will respectively, increase or decrease. In case my hypothesis was validated, I also wanted to see if there was a function that could relate the reaction rate to the temperature of the reaction.

Methods/Materials
Clean test tubes, Spectrum 20, Bucket of Ice, Chamber of 75°C water, Copper (II) Chloride in Crystal Form, Distilled Water, Iron Nails, Centrifuge, 3 test tube holders, Ammonia, Repeating pipette, Beakers.

15. Create 42 test tubes, half .0625M and half .125M.
16. Separate the tubes into groups of 7.
17. Designate one group to be placed into the ice bucket, another to be placed in the hot water, and for another to be used as a room temperature control and place nails into each holder with different time intervals.
20. When time is up, remove the nails and place the test tube into a holder.
21. After all reactions have finished, place each test tube into a centrifuge.
22. Use a repeated pipette to squirt 1 ml of ammonia into each test tube.
24. Now measure the absorbance of each test tube with the Spectrophotometer.

Results
I first graphed these results and discovered that temperature does significantly affect the rate of a reaction. I now could interpret this data to create an equation. I primarily used the Arhennius equation to interpret my results. I then tweaked this equation to form a linear, rather than exponential function. I could use this equation to form linear systems of each time interval. I then used the points of each interval to form a linear equation. Next, I used the average values for both the .125M and .0625M to allow me to determine the activation energy, and gas constant.This allowed me to input the constants and create two equations.
k(.125M)=1.177e^(-73.5/T)
k(.0625M)=1.108e^(-28.94/T)

Conclusions/Discussion
The experiment was successful as it proved my hypothesis and established an equation. Heating or cooling does increase or decrease the rate of the reaction by an amount which can be determined by an equation. The main flaw which could have influenced my results was the time the nails spent in each test

Summary Statement
My project was designed to find the effect temperature has on the rate of a reaction.

Help Received
Parents helped construct board; Dr. Galindo taught me how to use all the necessary equipment

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Meenakshi T. Mukherjee

Project Number
S0509

Project Title
Deterioration of Dopamine in Parkinson's Disease: The Effect of Curcumin and Ascorbic Acid on the Stability of Dopamine

Abstract

Objectives/Goals
Curcumin will have, if not a greater, a similar affect upon the dopamine structure as ascorbic acid. Because of curcumin#s aromatic diketone structure it will have similar effects on removing free radicals and preventing the degeneration of dopamine. Curcumin forms complexes with metal ions as seen in our past studies. Because curcumin can complex metal ions, the dopamine iron interaction or complexation can be minimized by the addition of curcumin. This is a unique property of curcumin not present in the case of ascorbic acid. Agents, such as curcumin which can complex iron are assumed to help in reducing the effect it has on dopamine.

Methods/Materials
Curcumin, Iron (II), Dopamine, HCl, Hydrogen Peroxide, Ethyl Alcohol, vials, spatula, mass spectrometer, analytical balance.
Curcumin, Ascorbic acid, Dopamine, and iron were dissolved in ethyl alcohol. The nineteen various solutions were then made and analyzed after one week. Curcumin samples were put through a mass spectrometer in order to determine the makeup and composition. Data was then looked at and analyzed.

Results
After one week all the curcumin solutes had changed color, or had become darker signifying curcumin forming complexes with dopamine and iron. Iron complexs show formation of the iron-curcumin complex which was isolated and confirmed by mass spectra. Formation of a dopamine-curcumin precipitate which gradually turned darker as shown earlier is seen. The precipitation in the iron solutes is most probably due to the iron-dopamine and iron-curcumin complexes, or possibly a triple complex of the three agents. Interestingly, when H(2)O(2) was also present the precipitate was considerably weaker. This may be due to interaction between iron and H(2)O(2)thus preventing iron from complexing with curcumin and dopamine. Due to the lack of precipitate that was formed in test tubes containing ascorbic acid along with the light coloration of the solutes, one must draw conclusions that ascorbic acid was effective in stabilizing dopamine.

Conclusions/Discussion
Based upon the data gathered throughout the experiment, the hypothesis that curcumin will have a similar, if not greater effect upon the stabilization of dopamine as ascorbic acid does, is not supported. This is assumed to be due to the different ways in which curcumin and ascorbic acid react with dopamine and in the aiding of Parkinson#s disease.

Summary Statement
Comparison of the effects of curcumin and ascorbic acid on dopamine.

Help Received
Used the lab equipment at University of Irvine California

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Aurora L. Ostrom

Project Number
S0510

Project Title
The Effect of Lacquer on Corrosion Prevention

Abstract

Objectives/Goals
This project determined if lacquer, clear fingernail polish, prevents corrosion or reduces the rate of corrosion on copper, iron, aluminum, and steel.

Methods/Materials
Four samples of each metal were obtained. Two were coated with clear fingernail polish and the other two were left uncoated. The weights of all metals samples were then measured. A coated and uncoated sample were each placed in solutions of salt water and tap water. Weekly, the samples were reweighed and observations were recorded.

Results
The rate of corrosion was determined by a change in the weight of the sample, due to oxidation of the metal, over time. A comparison of these rates as well as visual comparisons were made between the coated and uncoated samples for each metal in both solutions.

Conclusions/Discussion
When compared to the uncoated metals, the lacquer coating was good at preventing corrosion in all the samples and was shown to significantly inhibit corrosion of the iron and copper samples.

Summary Statement
This project determines the effect of lacquer, clear fingernail polish, on the rates of corrosion of copper, iron, aluminum, and steel in salt water and tap water.

Help Received
Used balance at Naval Air Weapons Station, China Lake. Father supervised use of balance and project. Mother helped with the display board.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Cameron B. Seebach

Project Number
S0511

Project Title
Kinetics of the Zinc-Copper Voltaic Cell

Abstract

Objectives/Goals
This study was on the kinetics of the zinc-copper voltaic cell. The goal was to determine the order of the reaction with respect to Cu2+ concentration, which was ultimately done by exploiting the direct proportionality of the cell current to the rate of reaction.

Methods/Materials
There will be one concentration of KNO3 solution, but the CuSO4 and ZnSO4 concentrations will vary. Place the necessary amount of ZnSO4∙7H2O in a 1 L volumetric flask filled partially with distilled water. Swirl the flask gently to dissolve as much of the solid as possible. Pour the ZnSO4 solution into a beaker and the CuSO4 solution into another beaker. Secure the U-shaped drying tube with a clamp. Pour the KNO3 solution into the tube until the level in each arm reaches the lip. Plug the ends of the arms with cotton balls, unclamp the tube, and carefully invert the tube over the beakers containing the ZnSO4 and CuSO4 solutions, placing one arm in each beaker. Cut the zinc and copper strips to the same length and mark a line on both strips about 1 cm from the top. Place the marked zinc strip in a clamp and tighten the wing nut until the strip is secure. Immerse it in the ZnSO4 solution by lowering the clamp until the solution reaches the penciled line on the strip. Repeat the procedure in step 4 with the copper strip and the clamp on the ring stand next to the beaker containing the CuSO4 solution. Connect the grabber end of a black multimeter lead to the zinc electrode and the grabber end of a red multimeter lead to the copper electrode.

Results
The plots of cell current versus time reveal that the current, and thus the rate of reaction, increased during certain time intervals. The equations for chemical kinetics I am using do not allow such a possibility, so I concluded that this effect is likely due to variations in temperature or system conductivity. As such, I selected portions of the cell current data, eight total, which appeared to be free of these effects and used them to obtain time series of [Cu2+].

Conclusions/Discussion
The greatest limitations on this experiment, if not the only, were systematic effects from various sources. The predicted culprits are temperature variation, variation in system conductivity (solution and/or electrodes), induced currents from the magnetic stirrer, effects of stirring at regular intervals with a glass rod, and interference from cellular telephone towers.

Summary Statement
The primary goal was to determine the order of the reaction with respect to Cu2+ concentration, which was ultimately done by exploiting the direct proportionality of the cell current to the rate of reaction.

Help Received
Used lab equipment at Ribet Academy

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Eric K. Soderstrom

Project Number
S0512

Project Title
Surface Plasmon Resonance: Using Surface Plasmons to Detect Chemical Changes

Abstract

Objectives/Goals
The goal of my project was to investigate how surface plasmon resonance (SPR) can be used to detect and measure changes in chemical solutions and protein-protein interactions. My hypothesis was that the SPR phenomenon could be used to observe (1) the kinetics of a simple chemical reaction, and (2) binding between daclizumab (a protein drug) and daclizumab-specific anti-drug antibodies.

Methods/Materials
SPR is an oscillating wave of electrons that results from the interaction between the photons of a laser beam and the electrons in a thin metal layer. SPR occurs only at a very specific angle of incidence, and that angle is affected by the substance placed in contact with the metal layer. I constructed an SPR spectrometer using a small laser pointer, a photodetector, a semicircular prism, and other spare optical components on loan from IBM Almaden Research Center. In my preliminary experiment, I used the spectrometer to determine the relationship between the SPR angle of several sucrose solutions of varying concentration. I also used my SPR spectrometer to observe the kinetics of a reaction between glycerol and HCl. To validate that the SPR phenomenon could be used to detect the interaction between daclizumab affixed to the metal surface and its ADAb, I attempted to generate a standard curve showing a dose-response relationship between ADAb concentration and SPR angle shift.

Results
By plotting the shift in SPR angle, I was able to observe a positive correlation between increasing sucrose concentration and the SPR angle. I was also able to estimate the rate of the chemical reaction between glycerol and HCl. I was initially able to detect a shift in SPR angle that was proportional to the concentration of ADAb in the sample, which was the desired result. However, after additional experimentation, I was unable to attribute this shift to specific binding between daclizumab and its ADAb.

Conclusions/Discussion
My preliminary experiments confirmed my hypothesis. SPR angle shifts were proportional to changes in sucrose concentration and could be used to follow the progress of a chemical reaction. However, the primary experiment was inconclusive. Although the initial protein-binding results were inconclusive, I hope to be able to repeat the experiment in the future using improved sample handling techniques, and to extend this project to more detailed investigations of the daclizumab-ADAb interaction.

Summary Statement
I built a surface plasmon resonance (SPR) spectrometer and explored how SPR can be used to detect protein binding and other chemical changes.

Help Received
Felix Guzman provided HCl and Glycerol; Used lab equipment from IBM Almaden Research Center; Michael Jefferson provided lab space and guidance; Steve Keller of PDL BioPharma provided lab space and materials

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Anirudh A. Srirangam

Project Number
S0513

Project Title
Synthesis of a Diketopiperazine: The Key Structure of the Norgeamide

Abstract

Objectives/Goals
In early 2006, scientists discovered the Norgeamide; a natural product found in a marine-derived fungus. The Norgeamide has shown some interesting biological activity, such as potential treatments for certain cancers, implying that its synthesis could be of help to the medical world. The natural product itself is extremely scarce in nature and needs to be chemically synthesized. The noregeamide is stereochemically challenging, due to the selective oxidation at the 2-position of the proline, making it difficult for scientists to synthesize. The purpose of this project is to synthesize the key intermediate of the Norgeamide; a diketopiperazine structure.

Methods/Materials
Starting from commercially available cis-3-hydroxy-L-proline, an esterification reaction resulted in an ethyl ester. This ethyl ester was then coupled with Fmoc protected L-Phenylalanine to result in a dipeptide. Finally, the structure was cyclized to give the hydroxy diketopiperazine intermediate whose structure was confirmed by a single crystal X-ray structure analysis. This compound was dehydrated under Mitsunobu conditions to give the diketopiperazine structure.

Results
All reactions were carried out with fairly high yields and gave an overall yield of about 41%. Each structure constructed after every reaction was confirmed by structural elucidation techniques such as various NMRs, HPLC, LC-MS, and X-Ray Diffraction. The final product has been achieved and is now an available key intermediate for the construction of the Norgeamide.

Conclusions/Discussion
The final diketopiperazine 7 has been constructed and is now ready for N-acyliminium ion chemistry to introduce the hydroxyl/methoxyl functionality at the bridge carbon. The scheme for the synthesis was developed through the use of retrosynthetic analysis. This route is general and applicable to the construction of diketopiperazines carrying various substituents at the 4-position. This can be achieved by using suitable amino acids in place of phenylalanine. This synthetic approach could find utility in the total synthesis of norgeamides A and B.

Summary Statement
This project focuses on the use of synthetic organic chemistry to construct natural products that show interesting biological activity but are rather scarce in nature.

Help Received
Dr. Alan Grubbs was my mentor and supervisor throughout the project; I used the lab facilities and equipment at Pfizer Laboratories in La Jolla; My Father taught me much about the organic chemistry behind the project.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Sarah J. Adams

Project Number
S0598

Project Title
Fields to Fuel: The Transesterification of Vegetable Triglycerides into Fatty Acid Methyl Esters and Glycerin

Abstract

Objectives/Goals
To analyze the characteristics of exhaust emissions from the combustion of fatty acid methyl esters (biodiesel) derived from four different types of vegetable oils and develop a matrix utilizing precursor characteristics of the underlying raw vegetable oils to help identify clean-burning and efficient alternative fuels.

Methods/Materials
1) Measure 1.75g NaOH and 100mL CH3OH 2) Mix until both in solution 3) Add 500mL vegetable oil and mix for 15 minutes 4) Let it sit for 8-24 hours 5) Decant the separated biodiesel off the top and store it in a separate container 6)send samples of each biodiesel fuel and its corresponding vegetable oil to the lab to be tested for flashpoint, density, and energy content 7) Conduct viscosity tests 9) Obtain diesel engine 10) After several test runs, set up engine at a smog check facility and have NOx, CO, CO2, hydrocarbon, and O2 emissions analyzed

Results
My results showed that the peanut biodiesel burned the cleanest, as there were higher levels of CO2 present in the emissions, with corresponding lower levels of CO, hydrocarbons, NOx, and O2. Corn biodiesel was the most inefficient, as there were low levels of O2 and high levels of unburned hydrocarbons present, meaning that the fuel did not combust efficiently.

Conclusions/Discussion
In conclusion, the process of transesterification was conducted to break the bonds of the triglycerides that make up the raw vegetable oils so that the reaction produces free fatty methyl esters (biodiesel) and glycerol molecules. If the viscosity is reduced then the process was effective and a viable biodiesel was produced.

My results showed that the raw peanut vegetable oil had the highest viscosity and high energy content, but after the process of transesterification took place, the resultant peanut biodiesel proved to be the cleanest and most efficient fuel due to its very low viscosity and high energy content.

Corn biodiesel was the most inefficient fuel and had a fairly high viscosity when compared to the other biodiesels, as well as high energy content. The raw corn vegetable oil showed similar characteristics. Therefore it can be determined that the fuel must have high energy content and a low viscosity, and the vegetable oil must have high energy content and a high viscosity.

Summary Statement
To investigate the process of transesterification and identify the cleanest-burning and most efficient biodiesel fuel through lab analysis on flashpoint, energy content, and viscosity as well as diesel engine emissions test results.

Help Received
used the laboratory facilities at Remedy Environmentals in Anaheim; had flashpoint, density and energy content testing conducted at Enviro-Chem Inc. Laboratories; had emissions testing provided by Union 76 gas station in Villa Park; Dr. Mark Soutter from Biofuels Institute helped me understand the

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Neelam Grewal; Amanjeet Kaur

Project Number
S0599

Project Title
Going Organic: Chrysanthemum x morifolium Indicator, an Alternative to Phenolphthalein Titrations

Abstract

Objectives/Goals
To determine which of five flower petals, when soaked individually in methanol or ethanol, will produce an efficient indicator that is economically natural/safe, and will provide the most intense pH color change.

Methods/Materials
Two different studies were performed.In the first study,petals of primrose, carnation,daisy,chrysanthemum,and tulip were soaked independently in two different alcohols(methanol and ethanol).After a two hour exposure,the alcohol extracts for each flower were tested for their response in acidic,neutral,and basic conditions.This allowed for colorimetric anaylsis of each flowers response to different pH levels.Then,the second study was performed. The chrysanthemum gave the best colorimetric results, and therefore,was analyzed for its response to a much wider range of pH levels from one to fourteen.

Results
For the results in part one,the flowers that were tested gave colorimetric results.When using ethanol,there were changes in the colors, but based on the results obtained, methanol had the most dramatic color differences.The flower which had the most dramatic colorimetric results was the chrysanthemum in the methanol.In part two,when the chrysanthemum methanol indicator was expanded for a wider range of pH responses, it was found that the chrysanthemum in methanol extract gave distinctive color changes from pH one to four and pH eleven to fourteen. However, there were no visible color changes from pH four to eleven.

Conclusions/Discussion
In the original hypothesis,chrysanthemum was chosen as the flower that would provide the best indicator based on its higher anthocyanins content and that daisies would provide the least dramatic results.Based on the findings,it proved to be true.The findings show that the extraction from a plant indicator can be done in a few hours and at least the Chrysanthemum indicator can be readily made and used in a simple laboratory setting.The use of simple indicators as an introduction can serve as a stepping stone to more complex indicators, such as Phenolphthalein,but more importantly,simple plant indicators can prove to be cheaper and safer for humans as well as the environment due to their organic nature.

Summary Statement
The purpose was to determine which of the five flower petals, when soaked individually in methanol or ethanol, would produce an efficient indicator that is economically natural/safe and provide the most intense pH color change.

Help Received
Narquiz Cervantes, our chemistry teacher, provided us with equipment.