CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)

Joyce S. Chai

Project Number

S0902

Project Title

M. oleifera: Elucidation of the Physicochemical Properties of the Active Protein and Optimization of Water Purification

Abstract

Objectives/Goals

The seeds of the tropical and subtropical plant, Moringa oleifera, have undergone studies in environmental science as a primary coagulant for water treatment. This investigation attempts to account for the coagulation abilities of the Moringa oleifera seed by elucidating the physicochemical properties. Furthermore, using analyses of particle size and zeta potential, optimum environmental conditions were proposed.

Methods/Materials

The protein was isolated by filtrating a permeate of crushed Moringa oleifera seeds and deionized water through a 0.45 micrometer membrane. The size of the protein was analyzed by Dynamic Light Scattering, and the same computer program was used to determine the zeta potential of the protein at different levels of pH. Jar testing was used to simulate water coagulation with Moringa oleifera as the primary coagulant.

Results

From the particle size analyses, the active protein of Moringa oleifera had an approximate size of 100 to 450 micrometers. This supports the assertion that a larger sized protein increases the ability to agglomerate with other particles. Furthermore, as the pH level increased, the zeta potential of the protein generally decreased. Consequently, the zeta potential of the protein was zero around a pH of 4.00; thus, jar test simulations of water coagulation were conducted at pH=4.00, the optimum environmental condition. From simulated water coagulation, the investigation concluded that Moringa oleifera has an influential effect on the color and turbidity of contaminated water, and works at optimum conditions of pH=7.00 and medium dosages of Moringa oleifera.

Conclusions/Discussion

The conclusions of this investigation demonstrated three essential concepts. First, the large size of the protein accounts for the ability to agglomerate with other particles. Secondly, though zeta potential analyses demonstrated optimum conditions at a pH of 4.00, simulated water coagulation supported optimum conditions at neutral pH. Finally, optimum dosages of Moringa oleifera solely depend on the number of colloids present in the water.

Summary Statement

This investigation utilizes the physicochemical properties of the active protein in Moringa oleifera to optimize the results of water purification with Moringa oleifera acting as a primary water coagulant.

Help Received

Used lab equipment at UCLA under the supervision of Dr. Eric Hoek and Anna Jawor; Mother and Father helped in mounting the project board

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Rosalind N. Cox

Project Number
S0903

Project Title
Controlling Eutrophication Through Nitrate Reduction

Abstract

Objectives/Goals
My fourth year study of the Teichert Ponds, the storm water holding system for the City of Chico, shows they are filling in due to eutrophication caused by nutrient influx. I used three filter substrates to reduce the levels of nitrate, believing the calcium cation in the chalk and bone meal would act as a binding agent for the nitrate anion, thus reducing its conc. in solution, and subsequently reducing the rate of eutrophication. While activated carbon does not have a calcium cation, it is widely used as a filtering agent, so I tested it also.

Methods/Materials
I collected water from the inlet ditch where it enters the ponds. In the lab, I ran an initial nitrate test on this water for my control, and then tried to filter out nitrate using three different filter substrates, Activated Carbon (AC), Chalk, and Bone Meal, subjecting each to two different filtration methods, Rapid Filtration and Prolonged Filtration. In an attempt to determine the effective range of filtration for activated carbon, I tested my aquarium water for nitrate using the Prolonged Filtration process.

Results
Unfiltered pond water, my control, contained 1.0 ppm nitrate. Rapid Filtration was not effective in filtering out nitrates using any of the three filter substrates, AC, Chalk, Bone Meal, yielding 1.0 ppm nitrate, the same concentration as the pond water before filtering (the control) for all trials of each filter substrate. Prolonged Filtration using AC and chalk, yielded 0.0 ppm nitrate for all trials. Prolonged Filtration using bone meal yielded 0.5 ppm nitrate for all trials. Prolonged AC filtration of aquarium water, which had an initial nitrate concentration of 12.0 ppm, effectively reduced nitrate levels to 3.0 ppm.

Conclusions/Discussion
Prolonged Filtration, using AC and chalk, was the most effective way of binding and removing nitrates, reducing them from 1.0 to 0.0 ppm. Prolonged Filtration with bone meal was less effective, reducing them from 1.0 to 0.5 ppm. AC showed a large potential range for reducing nitrate levels, reducing them by 75% from 12 to 3 ppm in the aquarium water. The Rapid Filtration method was not effective in filtering out any nitrates as the levels were unchanged. If the City of Chico does not reduce the nitrate influx and slow the eutrophication of the Teichert Ponds, they risk losing their ability to use the ponds as a waste water holding facility, as they will fill in with vegetation.

Summary Statement
This experiment tests which filter substrate, AC, chalk, or bone meal, when coupled with rapid or prolonged filtration, is most effective in removing nitrates from pond water, thus reducing nutrient input and slowing eutrophication.

Help Received
My father drove and accompanied me to the ponds and helped me construct my board.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Taras B. Dreszer

Project Number
S0904

Project Title
Heat to Hydrogen: Testing Effects of Temperature on Bacterial Hydrogen Production

Abstract

Objectives/Goals
The purpose of this project was to find out if maintaining the bacteria at 30 degrees Celsius (optimal bacterial growth temperature) to increase growth and gas production could achieve a net gain in energy over growth at room temperature.

Methods/Materials
Bacteria (Clostridium acetobutylicum) were isolated by heat shocking, and cultivated in a sucrose and distilled water solution. Bacteria were fed blended cornstalk in a glass 250 ml flask, with a pressure relieving valve open to the air. The apparatus was completely filled with water. Two conditions were tested, one at room temperature, and one incubated at 30 degrees Celsius. Controls without bacteria were used and did not produce biogas Biogas was measured and estimates of hydrogen were made based on research.

Results
16.2 ml of biogas was produced by the room temperature condition, and 20.6 ml of biogas was produced by the incubated condition, which correlates to roughly 12.96 ml hydrogen produced by the heated test, and 9.72 ml hydrogen produced by the control meaning that it would take far more energy to incubate the organic waste (2.5 kcal) than would be gained (0.00243 kcal).

Conclusions/Discussion
It would take far more energy to incubate the organic waste than would be gained. According to these results, not nearly enough hydrogen would be produced to power transportation through converting all of the cornstalk in the US. However, with certain improvements, this could become a practical energy source. Though the hypothesis was rejected and the project did not show that this energy source was a practical one, this method could still play a valuable role in replacing fossil fuels.

Summary Statement
The purpose of this experiment is to improve the yield of hydrogen producing bacteria by changing growth temperature.

Help Received
Christine Hutton advised me in handling bacteria, advised me throughout the project, and provided some of the equiptment I used.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Laura Essayah; Sydney Frazer

Project Number
S0905

Project Title
Bacteria, Baby!

Abstract

Objectives/Goals
We wanted to determine, out of a charcoal, paper, and ceramic filter, which filter would eliminate the most bacteria.

Methods/Materials
The materials we used were two large beakers (one for sterilization and one for melting agar), twelve Petri dishes, one bottle of agar, one thermometer, hot mitts, two burners, twelve Ziploc bags, disinfectant spray, and safety gloves. To test each of the filters, we put drops of unfiltered and filtered water on agar gel to watch for bacteria colony growths.

Results
We found that no bacteria was present in the water sample we used. We then replated the water after filtration on the agar, and once again found that no bacteria grew. We then decided to look under the microscope at the particles to determine which filter worked the best, which was the paper filter. When we attend California State Science Fair, our results may vary from this because we are going to retest prior to state.

Conclusions/Discussion
When no bacteria grew with our unfiltered water sample, we decided to base our results on what we saw when looking through the microscope. With that said, we found that the charcoal filter filtered out the most, while the ceramic filter was average.

Summary Statement
For our project, we tested which of three filters, ceramic, charcoal, and paper, would filter out the most bacteria from a pond water sample.

Help Received
Revisions by Mr. Smith

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
John B. Faughnan

Project Number
S0906

Project Title
A Comparison of Different Methods of Water Purification in Disinfecting Coliform Bacteria

Abstract

Objectives/Goals
The objective of my project was to determine which common method for purifying water was most effective in removing coliform bacteria from contaminated creek water.

Methods/Materials
I obtained a water sample from Bushidell Creek, in Piedmont, California. I used portions of that sample to test several forms of water purification: solar, chlorination, iodination, and boiling, making sure there was no cross contamination. I tested the samples for the presence of coliform bacteria using commercially available test kits, testing both 100% concentration, as well as samples diluted with distilled water to 90%. The materials that I used were: contaminated water from Bushidell Creek, coliform test kits, iodine tablets, Clorox bleach, rubbing alcohol, a stove, an incubator, distilled water, and containers of various sizes.

Results
In my tests, boiling proved the most effective method of purification, removing the most coliform bacteria from the water at 100% concentration, making the water safe to drink. Iodine tablets and chlorination also made the water safe to drink at 100% concentration, but were not as effective as boiling. The water treated with solar purification was not safe to drink at 100% concentration, but it was safe to drink when diluted to 90% with distilled water.

Conclusions/Discussion
The results of my project indicate that boiling was the best purifier of the methods tested; however, because of the expense of energy, the most practical and cost effective method on a large scale would be using bleach, which would eliminate the release of greenhouse gasses into the atmosphere and the use of fuels. The results of this project hold great promise in humanitarian efforts aimed at brining clean, safe water to developing countries, saving countless lives.

Summary Statement
My project compares different traditional methods of purifying contaminated creek water to determine which methods best remove coliform bacteria from the water.

Help Received
Ms. Christopherson, my science teacher, provided advice on how to make my project a success; my mom, Claire Faughnan, provided the transportation to and from the water source to gather my sample and the funding for my test kits; Dr. Matthew Gerhardt advised me on my science project.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Alexander Fung

Project Number
S0907

Project Title
Shower Drain Water Heat Recovery through Submersive Heat Exchanger

Abstract

Objectives/Goals
The purpose of this experiment was to determine the practicality of using warm shower drain water to preheat the cold water supply through a submersive heat exchanger, thereby reducing the amount of hot water needed and thus saving energy.

Results
All tests involved simulating the conditions of a 40 deg C and 2.5 gallons/min (9.5 liters/min) shower. Three heat exchangers were built:
1) An externally wrapped model utilizing a copper line wrapped around a metal P-trap: The warmed water output was routed to the shower cold water inlet. An energy savings of 3.6% was achieved. This represents an annual cost savings of $5.10 for a typical family (assuming four 8-minute showers per day and natural gas price of $1.3418 per therm).
2) A submersive model utilizing a straight copper line submerged in warm shower drain water in an acrylic box: The warmed water output was routed to the shower cold water inlet. An energy savings of 7.5% and an annual cost savings of $10.65 were achieved.
3) A submersive model utilizing a coiled copper line: Three tests were conducted by routing the warmed water output to the shower cold water inlet and/or the water heater. The best test yielded an energy savings of 17.1% and an annual cost savings of $23.60.

Conclusions/Discussion
My experiment has shown that a significant amount of energy can be recovered from the shower drain water. Future models should aim for higher efficiencies by using tighter copper coiling and concentrators to channel drain water to maximize heat transfer.

Summary Statement
My heat exchanger saves energy by transferring heat from shower drain water into a cold water supply via submersion.

Help Received
My father taught me to use power tools, and helped in constructing the wooden display. My mother helped me make the display board.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Sirisha Grandhe; Susan Iyican; Guy M. Rodgers

Project Number
S0908

Project Title
Compact Contained Device for the Increased Efficiency of the Compost Mulching Process

Abstract

Objectives/Goals
In Bakersfield there exists a serious lack of environmental concern. With this project, we hope to diminish the amount of strenuous work involved with the composting process by allowing people to recycle their used food scraps into composting material in just one week instead of the usual length of several months. By making this process shorter and easier, we hope to encourage more people to recycle their used food scraps into organic fuel, instead of adding it to the already overgrown landfills found in the United States.

Methods/Materials
Materials: 2 five-gallon buckets; 12 pounds of assorted fruits and vegetables (including apples, bananas, carrots, and tomatoes); 40-watt light bulb; power drill; electric food beater attachment; fertilizer containing ammonium phosphate and ammonium sulfate; 12 oz. of water; pH meter; thermometer.

Methods: Food was chopped coarsely into medium sized chunks and then divided equally into two 5-gallon buckets. One bucket (the experimental sample) was labeled "E" and the other bucket (the control sample) was labeled "C." The light bulb was attached to the bucket through the lid and the fertilizer was added to the food mixture. The temperatures of each were taken. The contents of the experimental bucket were mixed using the electric beater attachment. The pH and weights of each bucket were taken and recorded. Steps 4-7 were repeated once a day for one week.

Results
The final pH of the control sample was 4.35 while the final pH of the experimental sample was 3.9. The difference in the final pH values show that more food waste has been decomposed in the experimental sample.

Conclusions/Discussion
Our data show that we have accomplished our goal. This can be shown by the difference in pH between the control sample and the experimental sample. Since the control sample ended up with a higher pH than the experimental sample, we can assume that more humic substances were produced in the experimental sample. Humic acid is known to have a pH slightly higher than 2, but this pure substance only achieves such a low pH after other humic substances created in compositing are extracted. Therefore, these other products contribute to a higher pH level, closer to the levels our experimental sample achieved. Thus, the experimental procedure successfully catalyzed the decomposition process and produced substances that can be used as recyclable nutrients for plants.

Summary Statement
We diminished the amount of strenuous work involved with the composting process by allowing people to recycle their used food scraps into composting material in just one week.

Help Received

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Alex Guzzetta; Steven Sasaki

Project Number
S0909

Project Title
Microbial Fuel Cells: The Design, Construction, and Evaluation of a Novel Fuel Cell

Abstract

Objectives/Goals
Objectives/Goals- Our objective was to build a microbial fuel cell of our own design and see if it would produce electricity with a bacterial environment growing in the anode compartment. The second goal was to test the fuel cell with waste matter such as sewage.

Methods/Materials
Methods/Materials- The microbial fuel cell was constructed from Plexiglas, metal valves, wire, two graphite electrodes, a proton exchange membrane, and silicon sealant which would be able to both produce electricity and harbor bacteria. It was built by taking the electrode and proton exchange membrane and encasing it in a Plexiglas compartment we designed with valves and wires connecting to the electrode; we then made it airtight with the sealant. The cultivation of our bacteria was done under anaerobic conditions using nitrogen gas to replace oxygen with the following nutrients: glucose (20mg/L) Wolfe#s vitamin solution (10ml/L) Wolfe#s Mineral Solution (10ml/L) Nutrient broth (8mg/L). The cultured bacteria were inserted into the anode chamber and the cell#s electrical output was tested using an amp meter and logger pro.

Results
Control test with no bacteria present produced an average of 0.07 volts. The solution produced a background signature which was taken into account. Pseudomonas putida, bacteria known for aiding in electron transport, averaged 0.11 volts. Rhodoferax ferrireducens, our primary bacteria, averaged 0.16 volts, with a maximum of 0.174 volts. Rhodoferax ferrireducens, on average, doubled voltage output compared to the control with no bacteria. A consortium of both bacteria, averaged 0.17 volts, with a maximum of 0.194 volts. This data supports the characteristics of each bacteria found in our research. We theorize that Pseudomonas aided Rhodoferax with transporting electrons to the electrode, creating an increase in voltage.

Conclusions/Discussion
Conclusion/Discussion- With our fuel cell design and setup, we were able to measure a power output greater with the bacteria in the anode chamber than with the nutrient solution alone. This shows that our design was successful in doing what we designed it to.

Summary Statement
In our project we are utilizing the natural properties of bacteria along with a fuel cell setup to generate electricity from hydrocarbon compounds such as glucose.

Help Received
Help was received from the professors of our lab and they supplied us with the materials necessary for the construction and evaluation of the fuel cell. The professors also explained some aspects of the project such as oxidation-reduction reactions, calculations for electrical units, and re-hydrating bacteria.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Aysia V. Howard

Project Number
S0910

Project Title
Crassula portulacea and Dendranthema morifolium Used as Bioremediation Devices

Abstract

Objectives/Goals
The objective within my experiment was to determine if the Jade plant and the Chrysanthemum are efficient means of filtering the chemical Benzene from an enclosed, controlled environment under constrained environmental lighting conditions. Changing the amount of lighting that the plant was introduced to will help prove weather or not the jade plant, a CAM plant, is actively or passively doing photosynthesis.

Methods/Materials
To carry out this experiment, a strict setup was constructed within the lab of Cal State Channel Islands. Mason jars were prepared and overdramatically sealed to prevent the leakage of the chemical thus controlling the tests. Instrumentation, such as a Gas Chromatograph, was used to determine the area of the chemical present within 100uL of the injected gas.

Results
Based upon my tests, both plants are proficient in filtering benzene. For the chrysanthemum, light is a contribution in filtering the chemical. Without an adequate amount of light, the chrysanthemum did not filter more of the chemical. This indicates that maybe the chemical was being absorbed into the plant until it reached its saturation point. Unfortunately, at this point, the jade plant is still being tested without adequate light, but it is sure to be finished before the actual fair.

Summary Statement
This project is about the remedation of benzene with common office plants.

Help Received
Used lab equipment at Cal State Channel Islands;aided transportation to Cal State Channel Islands

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Kim Nguyen

Project Number
S0911

Project Title
Which Is the Best Compost?

Abstract

Objectives/Goals
Which is the best ratio of leaves and greens to make the best compost, in term of high mass percent of nitrogen, carbon and low mass percent of water, in normal condition? My goal in this project is to make compost in different ways and to compare the texture and the ratio of carbon and nitrogen

Methods/Materials
The compost tumbler; Fresh green grass and leaves; Dry leaves, branches and soil; A small chipper or shredder; Steer manure; A tumbler thermometer; Water; Shovel; 5 gallons bucket; Pitchfork; Soil test kit #Green Garde#; Bunsen burner; Crucible; Test tubes; Balance.
Compost was prepared using fresh green grass and leaves, dry leaves and branches, and soil, and sometimes manure or other things. The materials were put into a CompostTumbler, turned nearly daily, and the temperature was measured many times a week for up to 2 months. After the temperature decreased to ambient temperature, the texture looked and smelled good, and samples were analyzed in the lab for carbon, nitrate, and water content

Results
Based on the texture, the second compost is the better one. According to the data from these experiments, water and carbon in the 1st compost is respectively 60.1% and 44.6%. In the 2nd compost, the percent of water is 59.8% and the percent of carbon is 39.1%. Based on the Nitrate test, the color of the solution of the 1st compost is darker than the 2nd compost, which means that the 1st compost has higher Nitrate level.

Conclusions/Discussion
My hypothesis was that the 2nd compost is the best compost. The results do not support my hypothesis. Based on the data, the 1st compost is better compost in terms of the level of Nitrogen and the mass percent of Carbon, even though we add steer manure, which is a rich source of Nitrogen, in the 2nd compost. However, while comparing the texture of the compost, the 2nd compost has the better texture than the 1st compost. The reason for this difference may be the longer period for making the 2nd compost and the better shredding to start.

Summary Statement
The project is about making compost in different ways and comparing the quality of the product by its ratio of carbon, nitrogen, water and its texture

Help Received
Mrs Carlberg provides me the Compost Tumbler to do this project

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Ryan A. Nock

Project Number
S0912

Project Title
The Algae Weapon: Combatting Global Warming with Oil-Producing Algae

Abstract

Objectives/Goals
Algae, when fertilized with iron, can combat global warming by photosynthesizing rapidly and consuming CO(2). Iron fertilization, however, can cause harmful algal blooms. My objective was to find a substance that, in conjunction with iron, could promote algal photosynthesis without causing an algal bloom. I hypothesized that adding Talc or oil-absorbing pads to an oil-producing algae would remove oil and redirect the algae to use its energy to produce more oil rather than to grow.

Methods/Materials
Nannochloropsis, an oil-producing marine algae, was added to seawater medium in three petri dishes. Iron was added to one dish, iron plus Talc to another, and iron plus oil-absorbing pads to a third. Twice a day for 10 days the samples were tested for photosynthesis (using pH strips) and for growth (using a color chart).

Results
Talc (plus iron) was effective at limiting the algae's growth while increasing its photosynthesis. Specifically, algae with Talc (plus iron) photosynthesized 1.5 times more than algae with iron only, but grew 0.33 times less than algae with iron only. Oil-absorbing pads had no effect on the algae's growth or photosynthesis, since the results for algae with oil-absorbing pads (plus iron) were identical to those for algae with iron only.

Conclusions/Discussion
Talc and iron can be added to oil-producing marine algae to increase the algae's photosynthesis without causing an algal bloom. This suggests that oil-producing algae can be a useful natural weapon in the world's fight against global warming, if substances such as Talc are used to prevent or mitigate harmful side-effects like algal blooms.

Summary Statement
My project tested whether Talc or oil-absorbing pads, in conjunction with iron, could be added to oil-producing marine algae to increase the algae's photosynthesis without causing an algal bloom.

Help Received
A hazardous waste expert provided the oil-absorbing pads. Professor Ralph Lewin at U.C.S.D. sent me a scholarly article discussing several varieties of oil-producing algae, i.e. diatoms.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Nicholas L. Okita

Project Number
S0913

Project Title
The Efficiency of Various Materials in Cleaning Up an Oil Spill

Abstract

Objectives/Goals
The objective is to determine the efficiency of various materials in cleaning up a simulated oil spill by measuring the amount of oil and water absorbed.

Methods/Materials
Five (1-3/4x1-3/4 inch) strips of ten different materials (burlap, blown polypropylene, cotton, polyester, wool, nylon, acetate, fleece, paper towels, polyethylene) were tested. Each material was individually placed in a beaker filled with 200 mL of water and 10 mL of motor oil. The solution was then filtered through a coffee filter to eliminate excess oil. The amounts of oil left in the beaker, oil gathered by the materials, water left in the beaker, and water gathered by the materials were recorded. Each material was tested a total of ten times.

Results
The results show that polypropylene picked up the most oil leaving minimal traces of oil in the beaker. Fleece also absorbed a majority of the oil leaving .5 to 1 mL in the beaker. The polyethylene and nylon were both poor in absorbing oil leaving as much as 4 to 5 mL of oil in the beaker. However, polyethylene and nylon also rejected the most water.

Conclusions/Discussion
The polypropylene absorbed the most oil (average 9 mL) although it collected more water than expected (average 3 mL). Burlap also collected the majority of the oil due to its organic properties. Overall organic materials proved to be most absorbent, but synthetic materials were the most efficient. Polyester and nylon absorbed the least oil but also relatively low amounts of water. This made polyester the most efficient material because 81% of the liquid absorbed was oil.

Summary Statement
The objective is to determine the efficiency of various materials in cleaning up a simulated oil spill by measuring the amount of oil and water absorbed.

Help Received
Mr. Bob McClure of Advanced Cleanup Technologies, Inc. provided information about oil spill clean up.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)

Daniel M. Rubin

Project Number

S0914

Project Title

Biodiesel Burn-Off: Using Calorimetry to Compare Various Biodiesel Fuels to Commercial Diesel

Abstract

Objectives/Goals

Purpose: To determine if Biodiesel made from vegetable oil/animal fat is an effective fuel by burning the oil, heating water, and measuring how much water temperature is raised.
Problem: Which is best â## biodiesel from oil or fat, or commercial diesel.
Background: Biodiesel is a diesel equivalent fuel made from animal fat or vegetable oil and is non-toxic and biodegradable with fewer emissions. The process to make Biodiesel is called transesterification. The simplified process is: A triglyceride reacts with Methanol (CH30H) to yield fatty esters with three R's and Glycerol.

Methods/Materials

Materials:
Animal fat/vegetable oil, Methanol, Lye, 2L Plastic soda bottle, Balance, Glass, Mixing vessel, Tin can, Fire resistant dish to burn fuel, Temp Probe, Commercial Diesel, Water
Procedure:1. Heat waste oil/fat to 120oC to remove water and heat until spitting and popping stops. 2.Heat new oil to 55C. 3.Cool oil to 60C. 4.Mix 250mL. Methanol and 4g NaOH for new oil, 6-7g for used oil in a well-ventilated area until lye dissolves. 5.Add methanol to achieve 250 ml. 6.Pour oil and Methoxide into 2L soda bottle, seal and shake for ten seconds. 7.Wait 1-2 hours. Biodiesel will be top layer; glycerin will be bottom layer.
To test the heat capacity of oil produced. 1.Place 10g fuel in a dish under a tin can with 50ml of water in it. 2.Record the starting temperature of the water. 3.Burn the entire fuel sample. 4.Record the highest temperature the water reaches. 5.For a control burn 10g of commercial Diesel. 6.Using the equation E=(S)(m)(DT), where S is the specific heat capacity of water (4.18 joules per A°C), m is the mass of water, and DT is the change in heat, calculate the amount of energy produced.

Conclusions/Discussion

Conclusion: The fuel made from peanut oil produced the most energy. From these results it is the best candidate for biodiesel.
Discussion: The experiment set up was a fairly simple, but it was difficult to achieve good results at home. Many conditions could not be controlled. It was difficult to create a dish to burn the fuel. A ceramic dish cracked. I finally used a tinfoil boat but it took two tries to make one that didnâ##t leak. I had a problem lighting the fuel but I found a way to do it with a propane torch. My findings were that a homemade diesel fuel yielded more energy per gram, and produced far less smoke and particulates that than commercial diesel.

Summary Statement

Comparing home made diesel fules to commercial diesel.

Help Received

Mother provided lab materials

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Jennifer C. So

Project Number
S0915

Project Title
Application of Magnetic Flux and Electric Field to the Recycling and Deodorization of Seawater: A Three Year Study

Abstract

Objectives/Goals
Most modern water treatment systems utilize carbon filters, chemicals, and physical processes to deodorize and remove particles, but this project applies electrodes and magnetic flux to try to accomplish these goals.

Methods/Materials
2 water-recycling models were designed and built, each consisting of a basin with an untreated seawater source, a 5-feet tall plastic soda bottle tunnel perforated with a 9x9 matrix of 1mm-diameter holes on opposing sides of each soda bottle segment, a container for condensation to take place, and tubes to allow the final water condensation to effectively flow out of the systems. Having connected all these components together, we then placed an electrode into each system and applied a 115-V power supply. A magnet stand was added to the circumference of the model. To initiate vaporization, a water heater was placed into the untreated seawater source for tens days. As a control, trials were experimented without the magnet stand and electrode during the same time. Each day, temperatures were measured and the external conditions of the models were observed.

Results
After the electromagnetic treatment, Concentration levels dropped:Carbon dioxide dropped from 2568 to 69 ppm, Nitrate dropped from 39 to 1.3 ppm, iron content dropped from 310 to 2.3 ppm, sulfate dropped from 298,098 to 110 ppm, and manganese content dropped from 0.007 to 0.006 ppm. A similar conclusion can be drawn from the water samples treated without electromagnetism due to the distillation, but the same variables tested did not improve as much as that of the water treated with electromagnetism.

Conclusions/Discussion
This study demonstrated that the application of the right-hand rule of magnetic flux and the inclusion of electrodes produced cleaner and deodorized water, based on the reduction in the levels of carbon dioxide, fluoride, manganese, phosphourus, chloride, salts, nitrates, iron and sulfates, major odor-producing agents of seawater. Coastal waters bear the brunt of our enormous inputs of wastes into the oceans, causing widespread pollution of beaches, proliferation of human viruses, and harmful algal blooms (HABs) which may lead to dead zones. Therefore, it is imperative that seawater be purified through cost-effective and efficient means, and this investigation is considered to be a small step towards this goal.

Summary Statement
This study demonstrates that the application of the right-hand rule of magnetism and inclusion of electrodes indeed produces water with reduced levels of impurities and odor-producing compounds.

Help Received
Ion selective electrodes, Vernier LabPro Software, and spectrophotometers were graciously provided by my school faculty members, Ms. A. Anguiano and Ms. R. Grabow. Many thanks to Mr. M. Anderson of UCR for allowing me to analyze the water samples free of charge, and last, but not least, I acknowledge

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Nisha R. Wadhwa

Project Number
S0916

Project Title
The Ability of Baccharis salicifolia to Absorb Cadmium as an Effluent: Implications for Phytoremediation

Abstract

Objectives/Goals
Cleanup of soil pollutants is often expensive and environmentally unsound. Phytoremediation is an area of frontier science that provides a safe and cost-effective alternative to the conventional cleanup methods. This study featured a native California plant, Baccharis Salicifolia, or mule fat, identified the maximum tolerable dose of cadmium that can be administered weekly as well as the implications for a large-scale phytoremediation project.

Methods/Materials
The approximate maximum cadmium concentrations were determined by planting five groups of eight saplings. Cadmium was applied weekly via solutions of water and cadmium acetate in various doses. The saplings were observed during the eight-week growth period, and then harvested. Plant tissues were separated and analyzed via ICP-MS (Inductively Coupled Plasma Mass Spectroscopy), and cadmium content was determined in the leaves and shoots of various groups.

Results
Average plant tissue dry masses in addition to leaf counts, shoot length measurements, and actual cadmium content in these tissues confirm that the maximum weekly dose tolerated by Baccharis salicifolia is somewhere between twenty-five and fifty parts per million. Beyond this level, the plant is no longer a practical phytoremediation candidate because the decline in overall health drastically decreases the mortality rate in the species.

Conclusions/Discussion
As confirmed by the previous year#s study, mule fat is a relatively plausible candidate for phytoremediation, though not necessarily better suited for cadmium as an effluent. Both a single large dose and multiple smaller doses demonstrate a similarly above-average tolerance for cadmium in Baccharis salicifolia.

Summary Statement
This study identified a maximum tolerable weekly dose of cadmium that Baccharis Salicifolia can uptake while maintaining plant health.

Help Received
Katie Brandt supervised project, parents provided transportation to and from greenhouse at CSU Dominguez Hills, and Lab Technician Chris Mull helped with ICPMS at CSU Long Beach.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Margaret Yoo

Project Number
S0917

Project Title
Phase III: The Removal of Ethylene Bromide / Dibromochloropropane: Saving the Future from Yesterday

Abstract

Objectives/Goals
The objective of my experiment was to determine an economical and efficient method of EDB/DBCP removal in an acute situation of EDB/DBCP contamination by analyzing the chemical or physical removal of EDB/DBCP through the use of different adsorbents. The efficiency of each adsorbent in three different matrices of water, groundwater, treated wastewater, and surface water, was analyzed.

Methods/Materials
To prepare the 6-point calibration standard, the 0.5µg/mL intermediate solution was first created by adding 2.5µL of the 200µg/mL EDB/DBCP stock solution into a volumetric flask with 1mL of methanol. Different concentrations of the intermediate solution were used to create the 5, 10, 25, 50, 100, and 150ppt calibration standard. Water from various sources with different organic content was spiked with the EDB/DBCP stock solution to create a concentration of 100ppt. 2g of Bio-Rex 5, coconut carbon, Ambersorb 563, and Filtrasorb 600 were manually packed in separate 6mL cartridges. The efficiency of each adsorbent was determined through the filtration of three water samples representing the three different matrices of water using a vacuum pump manifold. The Gas Chromatograph/Mass Spectrometer was used for the determination of the remaining EDB/DBCP in the filtered water sample. A total of 48 samples were tested.

Results
The City of Westminster water, Santa Ana River water, and Mesa Consolidated Water District water experimental groups that represented groundwater, surface water, and colored or treated wastewater filtered with coconut carbon had no remaining EDB/DBCP after filtration. The experimental group Santa Ana River water treated with Filtrasorb 600 had the least amount of EDB/DBCP removed after filtration.

Conclusions/Discussion
The level of organic content in the water does not have an effect on the removal of EDB/DBCP for experimental groups that represented different levels of organic content did not affect the efficiency of the coconut carbon adsorbent. EDB/DBCP can damage the respiratory system, nervous system, kidney, liver, and heart and can cause cancer and infertility. Therefore, if our water supplies are contaminated by EDB/DBCP, then the affected water should be filtered using the coconut carbon for the ensured purification of the water.

Summary Statement
I determined that adsorbents can reduce the amount of EDB/DBCP in the water to the maximum contamination level goal of 0.00ppt, and the type of water, whether groundwater, treated wastewater, or surface water, does not influence the effecti

Help Received
I received training on the Gas Chromatograph/Mass Spectrometer from supervising chemist Lee J. Yoo. Lab work for the detection and removal of EDB/DBCP was done in the inorganic laboratory of