CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)	Project Number
Angie Afman; Kristin Hempy	**S0801**

Project Title

Beach Grooming: Does It Banish the Beachhoppers?

Abstract

Objectives/Goals

The objective was to determine whether beach grooming, the removal of wrack from beaches, decreases the population of macrofauna found on the beach. We compared the macrofauna population found on groomed beaches to that on ungroomed beaches, in quantity, mass, and variety.

Methods/Materials

We chose to test two groomed and four ungroomed beaches. We established two ways to measure the amount of macrofauna on a beach. We tied three kelp blades together with surf grass and placed three of these kelp blade sets in three different quadrats at the tide line on each of the six beaches. We had traced each kelp blade on paper before placing the kelp on the beach overnight. We returned the next morning and traced the blades again. By massing the pre vs. post consumption traces, we calculated the percentage eaten by the macrofauna. Secondly, we placed 3 pitfall trap cups in each quadrat, above, at and below the tide-line, on one groomed and two of the ungroomed beaches. We then analyzed and compared the quantity, mass and variety of macrofauna found.

Results

From weighing our original kelp blade sketches and the morning after/eaten kelp blade sketches, we calculated the percent change. We found that the following ungroomed beaches had a larger percent change than groomed beaches. Isla Vista Beach had a 96% change from pre to post consumption, Arroyo Burro Beach a 79% change, Campus Point West Beach a 47% change and Campus Point South a 33% change. The groomed beaches, Leadbetter and East had a 35% and 26% change, respectively. The pitfall trap cups, left for one hour after sunset, resulted in 5,105 macrofauna samples at ungroomed Isla Vista, 1,863 macrofauna samples at ungroomed Arroyo Burro, and on the groomed East Beach, 391 macrofauna.

Conclusions/Discussion

We concluded that the grooming of a beach decreases the amount of wrack on the beach. Because the food source is diminished, the macrofauna population on groomed beaches decreases, as was evidenced by our pre vs. post consumption measurements and our massing of the actual macrofauna accumulated in the pitfall trap cups. We question whether beach grooming is necessary, and are concerned if macrofauna disappear from our beaches, what other bird and wildlife populations will be affected by a reduced food supply and diminish as well.

Summary Statement

The objective of this science project is to determine whether the grooming of beaches, removing wrack with tractors and rakes, decreases the macrofauna found on the beach.

Help Received

Dr. Jenifer Dugan of the UCSB Marine Science Institute served as a mentor and allowed us to use her lab to analyze our data.

CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)

Anthony J. Bonilla

Project Number

S0802

Project Title

Tracking Atmospheric Haze

Abstract

Objectives/Goals

To find how bad the air quality was for the cities: Orange, Anaheim Hills, Anaheim, Fullerton, Villa Park. To find the average for each city and compare it against the national average. To find if air quality changes from day to day.

Methods/Materials

Haze montoring device(resistor, green LED, Circuit board, Case, 2 nine-volt batteries, wiring), volt meter, floss, tape measure, paper, pen.

Results

Examples of a few aerosol optical thickness readings (AOT):Orange- Orange- Day 2=.38, Orange- Day 3=.29,Orange- Day 4= .32, Orange- Day 5= .39, Orange- Day 6=.35, Orange- Day 7=.47, Orange- Day 8=.461, Orange- Day 9=.44, Orange- Day 10=.39, Orange- Day 11=.43, Orange- Day 12=.415, Orange-Day 13=.434, Orange- Day 14=.419, Orange- Day 15=.456, Anaheim Hills- Day 1=.36, Anaheim Hills-Day 2= .35, Anaheim Hills- Day 3=.34, Anaheim Hills- Day 4=.33, Anaheim Hills- Day 5 = .37, Anaheim Hills- Day 6= .37, Anaheim Hills- Day 7=.5, Anaheim Hills- Day 8=.43, Anaheim Hills- Day 9=.48, Anaheim Hills- Day 10=.41, Anaheim Hills- Day 11=.45, Anaheim Hills- Day 12=.424, Anaheim Hills- Day 13=.418, Anaheim Hills- Day 14=.383, Anaheim Hills- Day 15=.451, Anaheim- Day 1= .37, Anaheim- Day 2= .32, Anaheim- Day 3= .35, Anaheim- Day 4= .37, Anaheim- Day 5= .41, Anaheim-Day 6=.36, Anaheim- Day 7=.50, Anaheim- Day 8=.44, Anaheim- Day 9=.45, Anaheim- Day 10=.38,Fullerton- Day 1= .39, Fullerton- Day 2= .36, Fullerton- Day 3=.33, Fullerton- Day 4= .33, Fullerton- Day 5= .38, Fullerton- Day 6= .37, Fullerton- Day 7=.42, Fullerton- Day 8=.43, Fullerton- Day 9=.49, Fullerton- Day 10=.39, Villa Park- Day 1= .38, Villa Park- Day 2= .37, Villa Park- Day 3=.37, Villa Park- Day 4=.36, Villa Park- Day 5=.39, Villa Park- Day 6= .35, Villa Park- Day 7=.48, Villa Park-Day 8=.43.

Data points are composed of gross voltage for each reading, net voltage for each reading, aerosol optical thickness for each reading, and the time for each reading.

Conclusions/Discussion

Air quality does change on a day to day basis. The average AOT of Orange was .427, average AOT of Anaheim Hills was .418, average AOT of Anaheim was .420, average AOT of Fullerton was .419, average AOT of Villa Park was .421, average overall AOT was .421. The average overall change between days was .06136 AOT. We have poor Air Quality. Our average AOT is .421 and is far above the average .2 AOT. Some ways to correct this are to lower smog emissions, and have stricter building codes.

Summary Statement

How bad our air quality is.

Help Received

Mother drived me around, family friend helped wire haze monitoring device

Name(s)	Project Number
Laura J. Botzong	**S0803**

Project Title

Does Pollution Positively or Negatively Affect the Health of Purple Sea Urchins (Strongylocentrotus purpuratus)?

Abstract

Objectives/Goals
The purpose of this experiment was to determine whether purple sea urchins are healthier in a more polluted or in a less polluted environment. It was hypothesized that pollution positively affects the health of purple sea urchins.

Methods/Materials
In order to test this, two colonies of purple sea urchins were randomly selected: the first colony was located near a storm drain, and the second colony was located far away from any storm drains. Sea urchins from each of the colonies were tested for population number, individual size, and time it took and individual urchin to right itself from an upside down position.

Results
It was determined that purple sea urchins living in a more polluted habitat were fewer in number, smaller, and took longer to flip over than those in a cleaner habitat.

Conclusions/Discussion
The hypothesis was proven false; in conclusion, purple sea urchins are healthier in a less polluted environment where their food sources can thrive.

Summary Statement

The correlation between the amount of pollution in the habitats of purple sea urchins and the health of the urchins in each habitat was tested.

Help Received

Mother helped test urchins

Name(s)	Project Number
Rosalind N. Cox	**S0804**

Project Title

A Three Year Study of the Teichert Ponds: Stratification of Pollutants in the Bottom Sediments

Abstract

Objectives/Goals
This is my third year studying the Teichert Ponds, the storm water runoff holding ponds for Chico. I tested for the possibility that the pollutants were collecting in the upper strata of the pond sediment due to the fact that there has been more urban runoff containing more pollutants, due to recent development of the surrounding area.

Methods/Materials
I tested the sediment of the Teichert Ponds. I also tested the water as a baseline. I collected sediment at two sites in the ponds. I developed a core sampling instrument using PVC pipe. I pushed it into the sediment at Sites 1 and 2, collecting core samples of 9 and 19 inches, respectively. I cut the core samples into two inch segments. I considered the deepest two inch segments as the controls as this is the sediment closest to the area beneath the original excavation depth. I ran tests on the water and sediment samples for Chromium, Copper, Dissolved Oxygen, Iron, Nitrate, Phosphate, and Sulfide.

Results
I found pollutants in the bottom sediments and the water. In the sediments from Site 1, I found Iron in concentrations from 0.5 ppm to 5.0 ppm at depths from 1 inch to 9 inches. In the sediments from Site 2, I found two pollutants, Iron and Sulfide. Iron was found in concentrations of 1.0 ppm to 10.0 ppm at depths from 1 inch to 19 inches. I found Sulfide at concentrations of 0.1 ppm at 1 to 3 inches. In the water, I found Nitrate and Phosphate in the same concentrations of 3 ppm and 0.1 ppm respectively at both sites. Although not a pollutant, I also tested the Dissolved Oxygen, 3 ppm. The pH was 7.5 and the water temperature was 59 degrees Fahrenheit.

Conclusions/Discussion
If one looks at the Iron concentrations, which increase as the core samples get deeper, seems that there are more pollutants in the deeper sediments. The Iron found in increasing concentrations in deeper strata may be naturally occurring. I did not find other heavy metals in the sediments. The sulfides in the sample may have occurred as a result of bacterial action on the organic matter in the ponds under anaerobic conditions (LaMotte, 2001), which is possibly why I found Sulfides only in the upper layers, the same strata where I found decaying organic matter. Using my testing techniques, I did not find that there was a large accumulation of pollutants in the sediments of the Teichert Ponds. Rather, it seems as if there is significant pollution in the water.

Summary Statement

This study focuses on whether or not the sediment in the upper strata of the Teichert Ponds' bottom contains more pollutants than the lower layers due to the fact that there has been more urban runoff in recent years.

Help Received

My dad drove and accompanied me to the ponds and helped me set up my backboard.

Name(s)	Project Number
Nathaniel L. Foote	**S0805**

Project Title

Comparing CO Emissions between Hybrids and Gas-Powered Cars

Abstract

Objectives/Goals

The objective is to compare the carbon monoxide emissions between gas-powered cars, both modern and pre-Clean Air Act(1988), to those of gas-electric hybrid cars.

Methods/Materials

Four different cars' CO emissions were compared: a 1998 Toyota Sienna minivan, a 1970 Mercedes-Benz 280 SEL, a 2003 Honda Civic Hybrid, and a 2004 Toyota Prius(hybrid). An air pump containing a carbon monoxide detector solution was placed ten inches from the exhaust pipe of each car and the exhaust was run through the solution at a rate of two liters per minute for twenty minutes. The solution changed to a shade of yellow based on its concentration of CO. That color was matched to one on a chart, which corresponded to a concentration in parts per million of CO. Based on my results and the 4:1 driving to idling ratio of the average city driver, I calculated a city-driving average of CO emissions.

Results

Both hybrids shut off the gasoline engine when idling, so there were no emissions for either at an idle. When revved up to 1700 RPM, the Civic had a 20-PPM concentration while the Prius' exhaust contained 23.5 PPM of CO, giving them a 16 and 18.8 PPM city-driving average, respectively. The Sienna registered at 62.5 PPM while idling and 48.5 PPM while revved, therefore yielding a city-driving average of 51.3 PPM. The Mercedes registered at an astounding 330 PPM at an idle and 320 PPM at rev and has a 322 PPM city-driving average. The city-driving average is the most important statistic, and the Sienna on average emits only 1/6 of what the Mercedes does, with the hybrids basically halving the emissions of the Sienna.

Conclusions/Discussion

It is clear how greatly the hybrids have improved upon the CO emissions of both modern gas-powered cars and those manufactured prior the Clean Air Act of 1988. All cars emit the most CO when idling, because that is when fuel is least efficiently combusted, so the fact that hybrids emit nothing when idling is a huge advantage and drives down their city-driving average. As hybrids gain popularity, our air quality will only improve and we can look forward to fewer air-pollution-related ailments such as asthma and lung cancer.

Summary Statement

My project shows how much better carbon monoxide emissions in hybrids are than in gas-powered cars.

Help Received

Used father's cars; Friend helped with finances

CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s) Eleazar Gutierrez	**Project Number** **S0806**

Project Title
Paper vs. Plastic

Abstract

Objectives/Goals
My objective and goal of this project is for people to know or to have an idea who paper material or use plastic material and for them to find out which one will be better for our environment and our world.

Methods/Materials
My materials were three paper bags
three plastic bags
worms and dry grass

Results
my result was that pqper was better gor the environment

Conclusions/Discussion
my conclusion is that paper is better for the environment

Summary Statement
which is better for the environment paper or plastic?

Help Received
my science teacher helped me with my project

Name(s)

Shelby D. Hawkins

Project Number

S0807

Project Title

Do Carpets Affect Air Quality?

Abstract

Objectives/Goals
To see how different floor coverings affect the amount of particulates in the air.

Methods/Materials
Materials:
Digital disecting microscope w/built in camera
Computer
Ionic Breeze
Digital Camera
Scotch Tape
slides for microscope
Handy Tally Counter

Methods:
1).Run the Ionic Breeze Quadra in both the carpeted and non-carpeted classrooms for a total of 18 hours, varying student activity and no student activity.
2.)After running the machine for alloted time, remove the filtration plates from the Ionic Breeze analyze the particulates that collected by taking the scotch tape (3 cm long) placing on the filtration plate in 3 different locations (bottom, side, front) apply pressure to flatten out tape, peel of and stick on a clean microscope slide.
3.) For each slide count the number of particulates in the field of view using a hand tally counter. Randomly rotate the slide on the microscope 5 times, counting the number of particulates and record them.
4.) After randomly collecting 5 field of views average the 5 for each slide (side, bottom, and front).
5.) Clean the Ionic Breeze with a damp cloth and then place more tape on the Ionic Breeze filtration plates, repeating steps 3 and 4.
6.) Repeat the steps for the carpeted and non-carpeted, with students for 18 hours and without students for 18 hours.

Results
Overall the non-carpeted room had more particulates when compared to the carpeted room. However when students were in the carpeted room the amount of particulates increased by almost 50%. When the students were in the non-carpeted the amount of particulates increased less than 20%.

Summary Statement
Comparing the particulate levels in carpeted and non-carpeted classrooms with and without activity.

Help Received

Name(s)	Project Number
Megan M. Lee	**S0808**

Project Title
Ammonia: The Passed Gas, Part III

Abstract

Objectives/Goals

My project was to determine if manure from a horse (through a change in the animal's diet), can be used as effectively as steer manure when utilized as plant fertilizer. I believe that the altered horse manure will be as effective as steer manure when used as plant fertilizer.

Methods/Materials

After collecting manure samples from both horse and steer, mix each with three different types of soil into six pots as a 4:1 ratio (soil to manure). Mix each pot throughly and plant bean seeds. Over a three day period test the soil mixture for nitrogen, pH, and appropriate fertilizer levels in each sample. After the three day period expires, continue to log and measure the number of bean plants in each pot, as well as the plant height, and over all grow rate.

Results

After testing and growth measurement, the mixture of potting soil and horse manure produced the greatest number of bean plants as well as the tallest and largest bean production of any of the six samples.

Conclusions/Discussion

My conclusion is that it is possible, with alteration, that horse manure can be used as effectively as steer manure as a form of fertilizer.

Summary Statement

This project is to determine whether horse manure through diet alteration can be utilized as effectively as steer manure, thus leading horse farms to the opportunity of marketing and selling manure vs. paying for it to be hauled away.

Help Received

I used my horse for the test hores, and steer from the Beef Unit of Cal Poly San Luis Obispo. My grandparents for continued use of their home, and my mother for driving me and my project to where i needed to be.

Name(s)

Catherine Lo; Marielle Ona

Project Number

S0809

Project Title

Toxic Rocket Fuel in a Healthy Diet: A Field Study of Perchlorate Concentrate in Lettuce Grown in California

Abstract

Objectives/Goals

The purpose of this field study is to show that the lettuces grew in California are contaminated with perchlorate since the water that used to cultivate these lettuces is also contaminated by perchlorate. This field study will inform the public of how big the perchlorate contamination problem is.

Methods/Materials

Different types of lettuce heads are purchased from different stores. The lettuce heads are put into the freezer to rupture the plant cell wall. The frozen lettuce head is blended in a blender for about two to three minutes with double distilled water. This lettuce solution is put into two separate centrifuge tubes. The centrifuge tubes are put on the shaker over night to dismantle plant cell. Next day, the centrifuge tubes are put into the centrifuge for an hour with 30,000 revolution/ minute and force of gravity of $104739 * g$. After an hour, filter the lettuce solution using filter paper with pore size of 22μm. Filter the solution again through SPE Cartridges. The SPE Cartridges are first condition with methanol and double distilled water. Discard the first twenty-two drops of lettuce solution from the cartridges and filter the rest of the solution into plastic tubes. Add standard solution into each plastic tube. Use a pipette to add 1mL of the sample into a glass tube. Run the samples through ICMS (Ion Chromatography Mass Spectrometer).

Results

Red leaf and Romaine lettuce heads had the most perchlorate concentration. Lettuce heads that were purchased from Albertsons have the highest concentration of perchlorate. The organic Romain Hearts that were purchased from Trader Joe's have perchlorate concentration too.

Conclusions/Discussion

The lettuce heads that were purchased from Albertson#s were grown Salinas, California, which means that the water source that use to water these lettuce heads is contaminated with perchlorate. The organic Romaine hearts are supposed to be chemical free, but since it is water by the perchlorate-contaminated water, it is also contaminated by perchlorate. It is important for human not to consume any perchlorate contaminated food because it may disrupt adult's metabolism, and for pregnant women, perchlorate might cause the child to have behavioral problems, a lower IQ, development, loss of hearing and speech, or defects in motor skills.

Summary Statement

Many water sources in California are use to cultivate many different lettuce, and these lettuce heads accumulate different amounts of perchlorate since it is water by contaminated water.

Help Received

Angie Seyfferth from Dr. Parker's lab at UCR.

Name(s)	Project Number
David Marash-Whitman	**S0810**

Project Title

Heavy Metal Trafficking: Rhizofiltration Efficacy of Elodea canadensis in Copper Contaminated Effluents

Abstract

Objectives/Goals
The goal of this project was to determine the viability of 'green cleaning' using rhizofiltration by looking at the efficiency of an aquatic plant such as elodea canadensis in the removal of copper from polluted effluents across a broad range of contamination levels, and determining and range in which it is useful.

Methods/Materials
To assess copper absorption over time, extracted 10 ml samples from beakers with water at 0(control),0.5,1.0,5,10,50,100 ppm initial copper contamination level and elodea canadensis plantings. Measured copper levels using an ion specific meter at one day intervals for 6 days. Also determined final copper content in plant matter by ashing plant material, mixing with nitric acid and diluting accordingly, measuring copper with ion meter, and calculating total copper content using derived equations.

Results
Greatest copper reduction (85-90%) for initial copper concentrations between 1 -10 ppm, more limited reduction (70%) for 0.5 ppm and for higher concentrations of 50 and 100 ppm (55- 60%). Plant morphology and water turbidity indicated health of the plants at higher concentrations deteriorated halfway into the runs. Results from ashing plantings and measuring the final copper content showed increase in total copper absorbed with increasing initial contamination levels, tapering off as concentrations got very high (50,100 ppm). Measurements for total copper absorbed in ashed plants was within 30% of the total copper calculated to have been removed based on reduction in contamination levels in the water samples.

Conclusions/Discussion
Contrary to published speculations and my hypothesis, results proved elodea canadensis a very effective hyperaccumulator across a broader range of copper pollution levels (0.5 - 100 ppm) than expected. Lesser effectiveness at very low dose indicated that contamination concentrations of 0.5 ppm may be lower than a threshold for the plant#s hyperaccumulation activity to be in full effect or too close to accuracy limitations of the ionmeter used. More limited rhizofiltration efficiency coupled with faster plant deterioration and greater water turbidity at high copper doses after 4 days, was probably due to the negative effect on the plants of more copper accumulated in each plant than it could handle. This can be addressed by cycling out plants as they reach maximum (copper) holding capacity.

Summary Statement

This research showed that rhizofiltation using aquatic plants such as elodea canadensis is a promising solution to addressing copper contamination in our creeks and bay.

Help Received

Mother and grandmother helped with pasting the board, Mrs. Cahn showed me how to do the ashing, Cheri Donelly of West Valley Clean Water Program and LabPro staff were information resources

Name(s)

    Nina S. Raj

Project Number

S0811

Project Title

Mind in the Gutter: The Effects of Various Natural Filters on Urban Runoff Water

Abstract

Objectives/Goals

My experiment was an attempt to test the effectiveness of various natural filters on urban runoff water. I may propose my findings to the Save the Bay Organization, and ask them to line the roads of Marin with the most effective filter. The filters I used were redwood bark, orchid bark, pebbles, charcoal, soil, and peat moss. My control was the unfiltered water. Pollutants I tested for included lead, bacteria, chlorine, nitrates, nitrites, pesticides, hardness, pH, and turbidity.

Methods/Materials

I sent away for test kits that tested for my pollutants and borrowed test kits from the science teachers at Tamalpais High School in order to test for turbidity as well. I created the filters by cutting squares of mesh wire, and duct-taping them into plastic flower trays. I spread 1 1/2 inches of each material into the bottom of the trays. I collected runoff water from various locations and let the water sit for 72 hours so that bacteria could form. I polluted the water with pesticides, drain cleaner, and mice remover. I let the water sit for 30 minutes to let the pollutants dissolve and disperse. I stirred the solution to disturb the levels in the water, and tested for all pollutants. I then poured five cups of this control water into a watering can. I placed another plastic container under the filter and slowly doused the material with the water. After letting the water drip through, I took the filter off and gently swirled the filtered water around the container, and then poured it back into the watering can. I repeated this process. I filled the six equally-sized containers with the filtered water. I tested for each of the different pollutants twice.

Results

I found that the most effective filters were the redwood bark and the charcoal. They worked best in filtering out nitrates, nitrites, pesticides, and chlorine.

Conclusions/Discussion

I believe that the most effective filters were the redwood bark and the charcoal because they had the largest surface area for chemical bonding. The results supported my original hypothesis, which was that if the water was poured through the redwood bark, the water would be cleaner than any of the other samples. I predicted that because redwood bark has natural filtering properties such as a large surface area for pollutants to bind to, plus the wood will naturally absorb water, reducing amounts of other chemicals.

Summary Statement

My experiment tested the effectiveness of various natural filters on the cleanliness of urban runoff water.

Help Received

Mother helped type report; Sister and friend helped design poster/advise project; used lab equipment at Tamalpais High School.

Name(s)

Armando Ruezga

Project Number

S0812

Project Title

Mix It Up: The Sequel

Abstract

Objectives/Goals

The Project at hand is based on the extensive pollution caused by the burning of oil-gasoline mixtures in two-stroke engines. The main focus is on motorcycles that utilize this type of engine. Three different premix oils competed in a test to find which burned cleanest. The oils consisted of Maxima#s Super-M, Maxima#s Formula K-2, and Pro Honda#s HP2.

 A hypothesis was developed with the aid of simple observations and past results. The Super-M is designed to be a #smokeless# and #environmentally friendly# formula. It also burned cleanest during last year#s experiment. The HP2 formula is specially produced to provide high performance and limited engine wear and therefore has little regard for the environment. It placed last in a previous test. Formula K-2 is also designed for performance, but do to its possession of some ingredients found in Super-M, it was concluded that it would be the median oil. Therefore, if Maxima#s Super-M is utilized in two-stroke engines rather than Maxima#s Formula K-2 and Honda#s HP2, then the lowest output of pollutants among the three oils will be achieved.
Materials:

Methods/Materials

Materials: 1. Honda HP2 Premix oil; 2. Maxima Super-M Premix Oil; 3. Maxima Formula K-2 Premix oil; 4. Three Gasoline reservoirs; 5. Funnel; 6. 1.5 gallons premium gasoline (91 octane); 7. 2002 Honda CR125R; 8. SMOG test device; 9. Thermostat; 10. Logbook; 11. Pencil/Pen;
Procedure: 1. Mix all oils with petroleum in appropriate ratios. 2. Insert HP2 fuel into motorcycle reservoir. 3. Instigate combustion, insert smog device into silencer, and test 2X. 4. Turn engine off and drain fuel from bike#s tank and carburetor. 5. Repeat steps 2-4 with Super-M and again with Formula K-2. 6. Record all data in logbook.
Test conditions were as follows: temperature-55 degrees Fahrenheit, elevation-479 ft, air screw- 2 turns right, needle-clip on top (fifth) groove, choke-off, mix ratio- 3 ounces per gallon.

Results

Results: Maxima's Formula K-2 came in first, Maxima's Super-M was second, and Honda's HP2 came in last.

Conclusions/Discussion

Therefore, Maxima's Formula K-2 is in fact a cleaner burning oil than Super-M and HP2. The fact that a lubricant formulated to burn rapidly and improve throttle response will burn cleaner failed to be considered. It is for its ability to burn more completely that Maxima#s Formula K-2 placed first during the

Summary Statement

An attempt to find which of three premix oils burns cleanest in a two-stroke engine.

Help Received

Mr. White of A.H.S. auto tech provided smog test Machine.

Name(s)	Project Number
Matthew S. Shepherd	**S0813**

Project Title

Optimization of Biomass Conversion: Pilot Study Evaluation of the Use of Low-Grade Steam to Reform Methane

Abstract

Objectives/Goals

My project assessed the opportunity to reduce greenhouse gas emissions by producing transport-grade hydrogen fuel through low-grade steam reformation of methane off-gas produced during anaerobic digestion of municipal wastewater. In the common industrial process for hydrogen production, carbon-hydrogen bonds of methane are broken in the presence of steam, generating hydrogen gas. I postulated that if steam reformation were an equilibrium-driven replacement reaction, then it would go to completion in the presence of excess steam according to Le Chatelier's principle.

Methods/Materials

I constructed a continuous process reaction chamber using ice chests, PVC and galvanized steel piping, metal mesh screens, crushed ice, and a home steam cleaner. I also built a frame and cone to hold the catalyst. I used methane, hydrogen, a propane torch, aluminum oxide, Drano, a home pressure cooker, and pH paper.

Results

Both continuous-process investigations at atmospheric pressure and pressurized batch pilot studies demonstrated that Le Chatelier's principle does not apply to the reaction since low-grade steam, even in excess, did not produce the intermediate carbocation necessary for hydrogen generation. Additional experimentation was conducted in the presence of aluminum oxide to see if a catalyzed reaction would proceed without high pressure or superheated steam.

Conclusions/Discussion

Experimental investigations with pure methane and steam demonstrated that the reaction was so endothermic that the reaction was not reversible and hence not subject to the Le Chatelier principle because low temperature steam did not successfully reform methane. Additional experimentation conducted in the presence of aluminum-oxide in a pressure cooker to see if it could catalyze the reaction and get it to proceed at relatively low temperatures was unsuccessful.

Summary Statement

This pilot study was designed to evaluate the efficacy of biomass conversion using low-grade steam to reform methane.

Help Received

Ted Cruz of AirGas supplied lecture bottles of methane and hydrogen for experimentation. My parents critiqued my board layout and reviewed my batch and process experimental designs to reduce the likelihood of having a boiler explosion.

Name(s)

Jennifer So; Monica So

Project Number

S0814

Project Title

Application of Magnetic Flux and Electric Field to the Recycling and Deodorization of Seawater

Abstract

Objectives/Goals

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

Methods/Materials

To experiment, build 2 models, each consisting of a basin with an untreated seawater source, a 5# plastic soda bottle tunnel perforated with a 9x9 matrix of 1mm-diameter holes on opposing sides of each soda bottle segment, a condensation container, and tubes to allow effective flow of condensation out of the systems. Place an electrode into each system and apply a 115-V power supply. Add a magnet stand to the circumference of one model. The control model will lack a magnet stand and electrodes. Initiate vaporization with a water heater placed into the untreated seawater source for ten days. Each day, measure the temperature & observe the external conditions of the models. Analyze the CO2, salt concentration, chloride content, resistance, & iron content of the untreated seawater before and then the final condensation after the electromagnetic process.

Results

After the electromagnetic treatment, carbon dioxide levels dropped from 2,568 ppm to 69 ppm, salt concentration reduced from 875,000 ppm to 640 ppm. No chloride ions could be detected by the silver nitrate test. The resistance increased from 7.3 kilo-ohms to 85.6 kilo-ohms. The iron content dropped from 310 ppm to 5.62 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

Our 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, chloride, salts, concentration, and 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

Our 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.

Name(s)

Amanda Turk; Rachel Yuengert

Project Number

S0815

Project Title

The Styrofoam Solution

Abstract

Objectives/Goals

Expanded polystyrene (EPS), commonly referred to as Styrofoam, is a non-biodegradable plastic that is difficult to recycle by standard methods. As such, rapidly growing amounts of EPS waste in landfills are a serious threat to the environment. We decided to investigate possible methods of controlling this form of pollution.

Methods/Materials

We selected 12 solvents having a similar molecular structure to that of the styrene monomer, which should, therefore, dissolve polystyrene. Food-grade, craft-grade, and industrial grade EPS samples were individually added to 100mL of each solvent for a period of ten minutes. The initial and final masses of both the solvent and the EPS were recorded, as well as qualitative observations

Results

All but three solvents caused the EPS to progress along the same continuum of physical change during the dissolution process, although at varying rates. The results regarding percent mass change showed that the EPS absorbed large amounts of solvent over the course of dissolution. Xylene (the quickest), lemon oil, turpentine, and camphor oil completely dissolved all grades of EPS. The exceptions to the above patterns were water (the control, which had no effect on EPS), acetone, and diluted acetone. There was a large, unexplained discrepancy between the initial and final masses of their solutions, and large bubbles appeared when EPS was in contact with these solvents.

Conclusions/Discussion

EPS can be effectively and quickly dissolved by at least four solvents, two of which are entirely natural. The completely effective solvents contained, or were themselves, high aromatic hydrocarbons. However, based upon our observations of a #dissolution continuum# it is highly probable that all of the tested solvents would have been effective if allotted more time; thus, low aromatic and aliphatic hydrocarbons may also be effective. The mass discrepancy in acetone solutions, when coupled with experimental observations, strongly points to the release of invisible vapor during a chemical reaction between the EPS and the acetone.

The results of this study are extremely valuable in that they indicate an efficient, natural solution for the mounting problem of EPS pollution: distillation of an EPS solution so that the plastic may be reclaimed and recycled.

Summary Statement

A study of the effectiveness of various hydrocarbon solvents in the dissolution of expanded polystyrene waste for reclamation.

Help Received

Used lab equipment at La Reina High School under the supervision of Mrs. Adrienne Reeves and Mrs. Marilyn Usher

Name(s)

Devesh M. Vashishtha

Project Title

Soil Microbes in Southern California : A Source of Global Warming?

Abstract

Objectives/Goals

The objective of this experiment was to understand the role of soil microbes in global warming. Few studies have been done on carbon released as a result of microbial activity in soils, and even fewer have looked at the amount of carbon released at elevated temperatures.

Methods/Materials

MATERIALS

Materials used included a Low Temperature Illuminated Incubator for storing soil samples, 5-ml, 1-ml, and 200-ìL micropipettes for diluting solutions, and Biolog plates for assessing reactivity.

METHODS

Soils from three different locations (mountain, beach, and urban) were collected and stored at a temperature of 4 degrees C to inhibit microbial activity. The soils were then sieved and placed into 48 labeled bottles, and 24 were kept at the control temperature of 10.0 degrees C whereas 24 were kept at the variable temperature of 21.6 degrees C. The soil samples were suspended in saline solution in a ratio of 1g to 10 liters in a sterile manner. The suspensions were then placed into 9 Ecolog plates in which each well contained an organic compound. Then the plates were covered and placed at room temperature for 1 week for the reactions to take place. Appearance of purple color indicated a positive well.

Results

When all three soil types were compared, higher temperature significantly increased the number of positive wells. (P = 0.013) At the elevated temperature, the average number of positive wells was 4.83, compared to an average of 2.25 wells at the control temperature. Within each soil type, variation between different samples was insignificant (P = 0.417). At both control and higher temperatures, beach soils were the most effective as decomposers, followed by the urban soils, followed by the mountain soils.

Conclusions/Discussion

This data suggests that as global warming continues to occur, soil microbes will decompose organic matter at a higher rate, releasing more CO_2. Thus soil microbes are an important factor that should be taken into consideration in models of global warming.

Summary Statement

This project analyzed the effects of elevated temperatures on the decomposing ability of microbes in Southern Californian soils and their role in global warming.

Help Received

Used lab equipment at UCI under the supervision of Professor Kathleen Treseder; Mother helped glue together board

Name(s)

Nisha R. Wadhwa

Project Title

The LD50 Level of Cadmium on Baccharis salicifolia

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, and identified the median lethal dose (LD 50 Level) of cadmium on saplings of the species, as well as the accumulation and distribution of cadmium in the plant tissues. The experiment was designed to indicate the possible success of mulefat in large-scale phytoremediation projects.

Methods/Materials
The LD50 level was determined by planting nine groups of saplings of mule fat in various cadmium concentration levels. Cadmium was applied via solutions of water and cadmium sulfate. 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
Mortality data showed that the median lethal dose of cadmium on mule fat was around 225 mg Cd/ kg soil. Observations indicate that after this point, the plant becomes significantly affected by the cadmium and is unable to grow normally. Accumulation data show that increased cadmium content in the soil causes increased cadmium uptake by mule fat. The leaf tissues contained the highest levels of cadmium.

Conclusions/Discussion
Mule fat, when compared to other plant species used in similar studies, is able to efficiently uptake high amounts of cadmium in a relatively short period of time. This study suggests that mule fat is a feasible and effective candidate for large-scale cadmium cleanup project.

Summary Statement

This study was designed to determine if Baccharis Salicifolia, or mule fat, is an eligible candidate for a cadmium-clean up project.

Help Received

Katie Brandt, a graduate student at California State University Dominguez Hills, supervised me in the greenhouse and the lab at the university facilities. My parents provided transportation and Mr. Starodub assisting in guiding me throughout the entire process.

Name(s)	Project Number
Jennifer Y. Wang	**S0818**

Project Title

Can Antacid Tablets Improve Soil Damaged by Acid Rain?

Abstract

Objectives/Goals
The objective is to determine if the antacid TUMS helps the plant spinach growing in soil affected by acid rain recreated by drain cleaner containing 93% virgin sulfuric acid.

Methods/Materials
Four spinach plants are planted in four pots filled with soil. One pot contained soil affected by acid rain, one pot contained soil affected by acid rain and antacids, one pot contained soil affected by antacids and one pot contained unaffected soil. Over time, It was recorded how much each plant grew.

Results
Spinach growing in soil affected by acid rain grew the most, but also looked shriveled and unhealthy. The spinach growing in soil affected by acid rain and antacid, turned out healthier with smooth, green leaves.

Conclusions/Discussion
My theory is that spinach growing in acid rain grew the most in size because the soil it was growing in had a soil pH in the range of spinach#s soil pH preference. Spinach has a pH preference of 6.0 to 6.5. When sulfuric acid was added to the soil of a pH of 7.0, the pH fell into that range of pH preference. Seeing that the effects of acid rain did not show up in the pot with acid rain and antacids, antacids clearly eliminated the effects of acid rain.

Summary Statement

Plant growth in soil affected by acid rain is a problem, but maybe it can be solved by a simple solution.

Help Received

Name(s)

Paul A. Westhart

Project Number

S0819

Project Title

The Effect of Eisenia fetida (Compost Worm) in Enhancing the Bioremediation of Oil-Contaminated Soil

Abstract

Objectives/Goals

The objective of my experiment is to test and analyze the effect of Eisenia fetida (compost worm) in enhancing and promoting the natural bioremediation of hydrocarbons by increasing the metabolic activity of degrading microorganisms in oil contaminated soil.

Methods/Materials

Prepare 18 pots each containing 1 kg of soil, plant fertilizer and dead leaves. Add Eisenia fetida earthworms to select samples to promote the bioremediation of hydrocarbons. Add Pseudomonas putida bacteria to select samples because of its known efficiency in degrading hydrocarbons. The test substrate is oil-contaminated soil (4000 mg/kg oil concentration). Separate the containers in six sets as follows:

Set -1: uncontaminated soil (control)

Set -2: oil contaminated soil (control)

Set- 3: oil contaminated soil + 15 earthworms

Set- 4: oil contaminated soil + Pseudomonas putida bacteria

Set- 5: oil contaminated soil + 15 earthworms + Pseudomonas putida bacteria

Set- 6: oil contaminated soil + 15 earthworms + Pseudomonas putida + alfalfa plants.

Measure the pH of the soil and perform bacterial population counts at distinct intervals during the experiment. Determine the final hydrocarbon concentration of the samples using analysis method EPA 413.2. Conduct a seed development test during week 6 to assess the presence of hydrocarbons (some seeds are sensitive to hydrocarbons in soil).

Results

The results show a difference in oil degradation. The best results were found in Sets 5 and 6. Evidence of oil degradation was a decrease in pH, increases in the bacterial count, higher rates of seed development and lower levels of oil concentration as measured by chemical analysis method (EPA- 413.2). No significant degradation of hydrocarbons was found in the control samples.

Conclusions/Discussion

The data supports my hypothesis that the presence of earthworms enhances oil bioremediation in soil by increasing the metabolic activity of microorganisms. After 60 days of experimentation, there was a greater reduction in oil concentration in the samples containing Pseudomonas bacteria, plants and earthworms compared to samples without earthworms. The greater reduction of oil concentration can be explained by the burrowing activity of the earthworms which increases the level of oxygen and disburses the nutrients available for degrading microorganisms.

Summary Statement

My project tests the effect of Eisenia fetida (compost worm) on promoting the bioremediation of oil-contaminated soil.

Help Received

My parents helped me to obtain the materials needed for my project. Mr. Richard Fosyth of Sierra Analytical tested the oil concentration of my samples without charge.