CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)

Robert Adams; James Spriggs; Zachary Wambaugh

Project Number

S1101

Project Title

Men with a Lot of Mussels

Abstract

Objectives/Goals

Our goal is to explore the biodiversity of the Davenport Landing tide pools along a pre-established vertical transect. Our investigative question is: How will biodiversity of organisms change along the vertical transect as sea mussel population increases? Sea mussel population is predicted to rise due to decreased level of predation from the dwindling number of sea stars and sea otters, and should impact biodiversity along the rocky intertidal. We predict that the sea mussels will crowd out other organisms and decrease the biodiversity of the area.

Methods/Materials

1. Collect the abiotic factors of temperature and wind speed using an anemometer and thermometer.
2. Line tape through eye bolts, which descend perpendicular to the ocean.
3. Center quadrats over the transect tape every 3m at: 0m (A), 3m (B), 6m (C), 9m (D), 12m (E), 15m (F), 18m (G), and 21m (H).
4. Record Species abundance within each quadrat as instructed on the LiMPETS data sheet (see LiMPETS website for sheet and additional information). For algae, only the square(s) that contain the holdfast should be recorded. Count only living organisms, this may require some close investigation.

Results

Site	Biodiversity(1-4)	% mussel coverage
A	2.03778843	25.45%
B	2.16186264	80%
C	2.11935829	100%
D	1.85974718	92.36%
E	1.90388058	79.64%
F	2.33233991	42.55%
G	1.99515944	0%
H	1.99881546	0%

Conclusions/Discussion

We have found that there is an inversely proportional relationship between a site#s mussel presence and the site#s biodiversity, according to the Shannon Wiener index. At sites C and D where mussel presence increases, the biodiversity decreases, while at sites A, B, E and F, where mussel presence is lower, the biodiversity is higher. This shows an inversely proportional relationship between mussels and biodiversity along the vertical transect.

Summary Statement

The expansion of Sea Mussel abundance and its effect on the other noted creatures in the tidepools.

Help Received

Counting equiptment was given to us and we were taught how and were to collect data, but have been on our own for most of the project.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Kyle Aggarwal; Christopher Ray; Thomas Schmaeling

Project Number
S1102

Project Title
Oasis

Abstract

Objectives/Goals
The goal of this apparatus was to create a portable, cheap water filtration system that could be used in survival situations, in countries where access to filtered water is limited, during times of natural disaster, or even just on weekend camping trips.

Methods/Materials
The apparatus filters water through the use of a semi-permeable substance, which removes any large debris from the water sample. Following filtration, the bacteria are electrocuted by way of electric current from a 12 volt battery passing through copper plating.Nine tests were run using standing water to determine which materials, such as shirts, coffee filters, printer paper, etc., would make adequate filters while still allowing a considerable amount of water to run through the system based on the clarity of the water collected and the rate at which it passed through the filter. The apparatus itself was tested on two criteria: the clarity of the water and the results of several microbiological cultures.

Results
Over a fairly wide range of exposure times and ambient temperatures, exposure to cigarette smoke had no significant influence on the growth of wheatgrass. Studies on additional species of plants are warranted.

Conclusions/Discussion
Under all three experimental conditions, there was no significant difference in growth between plants exposed to smoke or not and between plants exposed to smoke in the day or at night. All p-values, as computed by a Mann-Whitney test, were less than 0.05.

Summary Statement
Increase in length of single-stalk wheatgrass plants were measured under identical conditions expect that one group was exposed to cigarette smoke during the day, one group during the night, and one group had no exposure. There were 18 plants per group. The experiment was repeated using different lengths of

Help Received
Grandfather provided microscope and expert advise.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
J. Alejandra Alvarez

Project Number
S1103

Project Title
Oily Hair!

Abstract

Objectives/Goals
The objective of my project was to see if hair , using hair booms which are nylon stockings stuffed with hair, are able to absorbs three different types of oil. Those three oils being cooking oil, motor oil, and used motor oil.

Methods/Materials
To test my objective I made hair booms, which are nylon stockings filled with hair. To make all the hair booms the same i weighed a pound of hair for each hair boom. Two hair booms were used per container. Totally 6 hair booms per experiment. I measured 1 liter of each type of oil (cooking oil, motor oil, and used motor oil) and added it to 10 liters of water (making it 1 part oil to 10 parts water). I let the oil sit in the water for one day before timing the amount of time it took for the hair booms to collect the oil. I repeated the experiment 5 times.

Results
My results showed that the hair booms took longer to absorb the cooking oil, averaging out to 8:03 minutes to absorb the oil. This time being the slowest, but even though it was the slowest the hair booms were still able to absorb the cooking oil. The average time that the hair booms absorbed the motor oil was 3:28 minutes and the average time for the used motor oil was 3:20 minutes. The hair booms absorbed the motor oil and used motor oil around the same time with a difference of only 8 seconds.

Conclusions/Discussion
The purpose of this project was to test if hair is able to absorb three different types of oil (cooking oil, motor oil, and used motor oil) using hair booms. Hair booms are nylon stockings filled with hair. My hypothesis stated that I thought the hair boom would pick up the motor oil and used motor oil a lot quicker than the cooking oil because cooking oil is a lot thinner than the other oils. I proved my hypothesis correct. The hair booms took about three times longer to pick up the cooking oil than the other two oils. My final conclusion is that hair is able to absorb three different types of oil even though it took longer for the cooking oil. If I were to repeat this experiment I would add more types of oils. Also I would test in salt water to see if there was any difference.

Summary Statement
My project's purpose is to see if hair is able to absorb three different types of oil; cooking oil, motor oil, and used motor oil.

Help Received

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Miranda Brater; Rachael Brater

Project Number
S1104

Project Title
Disperse!

Abstract

Objectives/Goals
If an environmentally safe dispersant can break apart an equal or greater amount of oil when compared to harmful dispersants, then a safer dispersant to animals and humans should be used during oil clean up.

Methods/Materials
The project began by creating a safe workspace with a large tarp,clean up rags, one gallon containers,garbage bags, and a plastic funnel. Disposable bowls were labeled for each trial and substance being used. A 1/2 cup of water and 2tbs of motor oil were added to each bowl. 1tsp of dispersant was added to each bowl and stirred. Pictures were taken of each bowl. An increased amount of dispersant was added to the next trials. Each bowl was stirred a second time and photographed. Each bowl was emptied into disposables and utensils were disposed in garbage bag. Oil dispersal was tested with more toxic substances: Liquid Tide scented detergent, Dawn scented dish soap, and graded Ivory bar soap, followed by less toxic substances: vinegar, baking soda, sodium carbonate, and borax.

Results
Dispersal was determined by a rating scale from 1 to 5, 1 being no dispersal and 5 being completely dispersed. Tide, trials 1-12 all showed a high rate of dispersal. The average dispersal on the scale using Tide was 5. Dawn dish soap exhibited an average rating of 4. All the more toxic substances averaged to 4. For less toxic dispersants: Shaved Ivory soap, oil dispersed at an average of 3. Vinegar earned an average of 3. Sodium bicarbonate, trials 1-6 rated between 2 and 3; with increased amounts of baking soda dispersal improved in trials 7-10, but decreased by trial 11. An average rating of a 2 was reported for sodium bicarbonate. The average dispersal for sodium carbonate was 4, with increased dispersal. With an average of 2, borax scarcely dispersed. The borax acted more as an absorbent rather than a dispersant. The average oil dispersal rate for all the less toxic dispersants was a 4.

Conclusions/Discussion
The hypothesis was generally supported. A more natural substance was found to disperse oil. Sodium carbonate was the most effective more natural dispersant. Tide was the most efficient toxic substance. When more of a dispersant was added, dispersal increased. The least efficient dispersal was borax. Although there are different viscosity levels in refined oil and crude oil, this experiment supports more environmentally friendly methods of oil dispersal.

Summary Statement
Our project is about finding a more natural substance used to disperse oil.

Help Received
Advice from science instructors at our school

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Christina Y. Cho

Project Number
S1105

Project Title
Fresh Water Galore: Greywater Recycling

Abstract

Objectives/Goals
Currently, California and many other places are experiencing fresh water shortage crisis. A major portion of this fresh water shortage comes from excess use of water in homes, especially from watering gardens and lawns. Greywater recycling is one method to reduce fresh water usage in homes. My objective was to find out whether greywater is efficient and economical.

Methods/Materials
For my project, greywater was used in the form of kitchen sink water. The heights of the sunflowers were measured with a ruler to test the efficiency of greywater. Three types of water were used to water the sunflowers: sink water, recycled sink water, and tap water. A home-made greywater recycling system was constructed using sand, gravel, and activated carbon to obtain the recycled sink water. Ten sunflowers of each type of water were watered for a period of 50 days. A water bill was used to determine the amount of water and monetary value that would be saved, assuming that 50% of indoor water would be saved.

Results
The final average heights of ten plants for tap water, recycled sink water, and sink water were 15.06 cm, 12.73 cm, and 9.68 cm respectively. Economically, we would be able to save 935 gallons and $2.55 per person per month if greywater recycling is applied.

Conclusions/Discussion
Greywater, recycled and non-recycled, had similar effects on plants as tap water. With the results, I can conclude that our society can use greywater in the lawns and gardens to reduce fresh water usage. Using greywater will also have great impacts on economy today.

Summary Statement
My project is about whether greywater is efficient and economical while constructing a homemade recycling system to reduce fresh water usage in homes.

Help Received
Father helped drill holes in the cans. Parents helped in supplying materials.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Justin J. Choe

Project Number
S1106

Project Title
Utilizing a Magnetic Field to Reclaim Nanoparticles in Water Treatment Process

Abstract

Objectives/Goals
A novel approach was proposed to test the viability of utilizing magnetic silver nanoparticles as a primary method for a water treatment plant#s disinfection process. The conventional methods are through contact with sodium hypochlorite or ozone, both of which yield potentially hazardous byproducts. The proposed magnetic silver nanoparticles could eliminate reliance on these current methods for disinfection. Most importantly, they will be retained and reused to prevent these nanoparticles from entering into the environment.

Methods/Materials
1:3 and 1:4 ratios of silver to iron by mass were produced as the nanoalloys to be tested. First, a control and control duplicate were taken by placing 1 mL of raw plant influent water from Anaheim#s Lenain Water Treatment Plant. Next, the 1:3 ratio was tested by placing those particles in plant influent water. 1 mL samples were taken at each of 10, 20 and 30 minutes. Two electromagnets were employed to collect the nanoparticles, and the water was pumped out. More plant influent water was added, and the process was repeated twice. The test for the 1:4 ratio was the same as the test for the 1:3 ratio. Lastly, to prove that the nanoparticles would escape to the environment without the magnets, the final test had the 1:4 ratio in plant influent water, but did not collect the particles between trials.

Results
Both the 1:3 and 1:4 ratios of silver to iron by mass yielded positive results. Bacterial colonies formed in all of my tests, though significantly less were counted in the tests utilizing nanoparticles. On average, the control had around 50 cfu#s, while the trials utilizing nanoparticles only had a few colonies of bacteria each.

Conclusions/Discussion
In conclusion, both ratios of nanoparticles worked effectively in eliminating bacteria. Also, electromagnets allowed the magnetic silver nanoparticles to be retained and reused. These conclusions display the possibility of eventually incorporating nanoparticles into conventional water disinfection processes.

Summary Statement
An environmentally sound approach for water disinfection was proposed by utilizing novel magnetic silver nanoparticles that could be retained and reused by an induced magnetic field.

Help Received
Mentored by Dr. Shaily Mahendra; Used City of Anaheim's Lenain Water Treatment Plant's Water Quality Lab; advised by Mr. Peter Starodub

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)

Thomas Chu; Adam Gramling; Keltan Lawler

Project Number

S1107

Project Title

The Extraction of Oil from Oceanic Areas Using Ferromagnetic Fluids

Abstract

Objectives/Goals

We plan to effectively harvest oil from an aquatic environment by synthesizing a ferrofluid. We will achieve this goal by synthesizing ferrofluid, a liquid that is magnetized in the presence of a strong magnetic field. Ferrofluid is a magnetic material and oil bonded together, so by placing a magnet near the ferrofluid, the magnet will attract the magnetic material and oil to the magnet, and the solution is extracted through this process.

Methods/Materials

We began our first step by making magnetite, a natural ferrimagnetic mineral in nature. To make magnetite, we added 10 mL of PCB etchant and 10 mL of distilled water into a beaker. We than added a steel wool to the solution. This made a solution called ferrous chloride. We filtered the solution, and added another 20 mL of PCB etchant to the solution. We added 150 mL of ammonia, and magnetite falls out of the solution. We heated the solution and coated the magnetite with oleic acid, a surfactant. A surfactant is used to lower surface tension, and it will stop the magnetite from clumping. Once the oleic acid bonds with the magnetite, oil is added to the solution. The oil represents the actual oil in oil spills. The magnetite will separate form the water and bond to the oil. There will be two solutions in the beaker, one solution is an aqueous solution of water and ammonia, the other solution is the ferrofluid.

Results

In our four experiments, we were only partially successful. Our first trial failed because we failed to create magnetite. In our second, third, and fourth experiments, we successfully made ferrofluid, but the solution was not extremely magnetic. Our second experiment was the best because half of the solution we made was strong ferrofluid.

Conclusions/Discussion

We discovered that many of our problems lies with the materials we used to make ferrofluid. The materials had to be new, and we had to work quickly so our substances would not go foul. We were only able to make weak ferrofluid, and we believe the ferrofluid is weak because the oleic acid did not coat the magnetite properly. The oleic acid coats the magnetite because it has a polar head and a non-polar head. Non-polar substances such as oil only attract to other non-polar substances. Water is a polar substance, so water and oil will not mix. The oleic acid's non-polar head should bond to the oil, and the polar tail should bond to the magnetite.

Summary Statement

Our project is focused on removing oil from oceanic areas by bonding magnetite to the oil and removing it as ferrofluid.

Help Received

Special thanks to Mrs. Messenger and Mr. Burns, my chemistry and physics teacher, for analyzing the problems we ran into.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)

Brennan Coulter; Cameron Coulter

Project Number

S1108

Project Title

The Potential for Plant Oils as a Substitute for Diesel Fuel

Abstract

Objectives/Goals

Our research objectives were to:
-Study the properties of the oil coming from both oil yielding trees and annual crops to confirm their potential as a fuel.
-Determine the performance characteristics of the oils as a direct substitute for diesel or as blended with diesel.
-Evaluate the overall environmental impact of the oils
-Evaluate the economics of the plant oils as compared to diesel.
-Research the potential supply of the various plant oils and potential to scale production.

Methods/Materials

The properties of twelve tree and vegetable oils, and blends of each with diesel were studied for properties as a fuel: viscosity, freeze/melt point, density, and blendability with diesel. Any fuels that failed these tests were not further tested; fuels not yet eliminated were evaluated for energy efficiency relative to diesel in a diesel generator. If an oil was within 10% efficiency of the diesel baseline it was then evaluated in terms of net energy production. If the oil had a net positive it's economics, potential to be scaled to production, and it's potential environmental effects were evaluated.

Results

From the property testing avocado(refined and unrefined), canola, corn, olive, peanut, soybean and diesel blends with avocado (refined and unrefined), corn, olive, peanut and soybean remained as viable candidates.
Performance Testing showed a baseline performance of 204 grams diesel consumed, which was converted to a base 27.0 mpg. Fuel efficiency of diesel was followed closely by peanut, olive, soy, corn, unrefined avocado, refined avocado, and canola. Blended fuels (90% diesel) were also tested with surprising results indicating soy and unrefined avocado performed equal to or better than pure diesel.
Several oils were found to require consumption of more energy in production than energy produced by the oils. As a result, all fuels other than avocado (refined and unrefined) and olive were eliminated.

Conclusions/Discussion

Based upon current economics of production, olive oil was eliminated as a candidate. However, avocado (both refined and unrefined) was found to be capable of production at a cost per mile competitive to diesel and capable of being produced on sufficient scale. Thus, avocado was found to meet all criteria to qualify as a substitute, and may provide US consumers a savings of $0.12/ gallon, as well as provide substantial

Summary Statement

The Potential for Plant Oils as a Substitute for Diesel Fuel

Help Received

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Julie A. Courtney

Project Number
S1109

Project Title
The Proof Is in the Roof

Abstract

Objectives/Goals
My objective was to discover which roof worked best in cooler temperatures and warmer temperatures and to determine whether the use of a plant roof could be a solution to the Urban Heat Island Effect.

Methods/Materials
I constructed four model buildings by placing different materials on four wooden boxes, all the same shape and size. I put black asphalt roofing material on the 1st box, grey on the 2nd, and white on the 3rd. On the 4th box, I put a wooden barrier on the edge of the top (to hold the soil) and then planted miniature cactus plants inside the barrier. I placed a thermometer in each box, put the boxes on a table outside in direct sunlight, and set another exterior thermometer outside to record the air temperature. Every day for twenty days in February at 7 a.m. and 3 p.m. I opened each box and quickly recorded the temperature of each thermometer, remembering to also record the exterior thermometer#s temperature. I then repeated this process again in March for eighteen additional days.

Results
The temperature recordings at 7:00 a.m. in February proved that the plant roof box was warmest, followed by the black, grey, then white. The temperature recordings at 7:00 a.m. in March indicated that the black roof box was warmest, followed by the plant, grey, then white. The overall averages for the 3:00 p.m. temperature recordings in both February and March showed that the plant roof box was coolest followed by the white, grey, then black.

Conclusions/Discussion
For the most part, my hypothesis that the eco-friendly green roof would be warmest in cool temperatures and coolest in warm temperatures was accurate. This experiment proves that the green roof provides the best of both worlds! The only problem that appeared in my initial experiment was that the afternoon temperature wasn't always hot. Since the plant roof insulates in cool temperatures, the plant roof insulated the wooden box in both the morning and afternoon on cold days. Since the afternoon temperatures during the initial test period varied widely, the cooler days increased the average 3:00 p.m. temperature calculation of the plant roof. In order to truly to discover if the plant roof would be as efficient or better at cooling a building than a white roof, I had another testing period in March and evaluated the data according to ranges of temperature instead of the time of day for true results.

Summary Statement
My project tested the capability of insulation and cooling of the green plant roof vs. the traditional black, grey, and white asphalt roofing materials.

Help Received
My parents drove me to retrieve all of the materials and paid for them. My dad assisted me in constructing the boxes.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Catherine T. Dang

Project Number
S1110

Project Title
Investigating Air Pollution Patterns in Southern California Using Isotope and Elemental Analysis of Lichen

Abstract

Objectives/Goals
To utilize the isotope and element signatures of lichen tissue to identify air pollution patterns across Southern California.

Methods/Materials
Some of the lichen samples were accessed from lichen archives across a Southern California gradient while some were collected from field sampling. Place lichen samples in a large cylindrical airtight container connected to the Flexi Dry MP freeze dryer. Maintain the freeze dryer temperature to be less than -80º C and pressure less than 40 millibars. The microbalance, Sartorius ME 5, was used to weight 2.00-3.00 mg of lichen into 3.5mm x 5mm tin capsules. Exact weights were recorded. The samples were placed oin the Delta V Advantage isotope ratio mass spectrometer. The Isodat 2.4 software was used to report data. SigmaStat was used to test correlation between elements and nitrogen and ammonia deposition values.

Results
The strongest correlations relating to deposition was the %N in lichen tissue ratio in the lichen tissue and the dry ammonia deposition with an R2 value of 0.3467. Another strong correlation was between the total wet deposition with the ä13C # and the total wet deposition with an R2 value of 0.5625. As I was organizing the results I also noticed that the element against the isotope correlations were also fairly strong such as the %N vs. ä15N #, %N vs. ä13C #, %C vs. ä15N #, %C vs. ä13C #, and ä13C # vs. C/N

Conclusions/Discussion
The strongest correlations that were found between the sites across Southern California have nitrogen isotopic signatures that reflect nitrogen composition in lichen tissue. The correlation between %N and dry ammonia suggest that lichen in mountain areas with more dry ammonia deposition have less nitrogen in their bodes. This finding suggests that ammonia hurts the lichen. Thus, the analysis of isotope and elemental analysis of lichen tissue can be used as indicators for anthropogenic inputs of ammonia to the environment.

Summary Statement
My project investigates air pollution patterns in Southern California using istope and elemental analysis of lichen.

Help Received
Used lab equipment at University of California, Riverside under the supervision of Dr. James Sickman; Dr. Sarah Jovan and Mr. Kerry Knudsen gave me lichen archives

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)

Kayane K. Dingilian

Project Number

S1111

Project Title

The Effect of Size and Structure of Various Chlorine Compounds on Their Ability to Adsorb to Sand

Abstract

Objectives/Goals

The objective of this experiment was to analyze the effects of the size and structure of various chlorine compounds on their ability to adsorb to sand.

Methods/Materials

The following materials were used in this experiment: NaOCl, LiOCl, Ca(OCl)2, C3N3O3Cl3, and C5H6O2N2Cl2 - the disinfectants. Also electric balance, graduated cylinders with sizes 10 mL and 25 mL, squirt bottle, test tubes, centrifuge, small jars, chlorine paper, and LaMotte Chlorine titration kit. First, 10 mL of a 1250 ppm chlorine compound solution was mixed with 5 g sand and separated. The chlorine concentration was measured, and 8 mL of water was mixed with the sand to remove the chlorine and then was separated. At the end of each rinse, the chlorine concentration was taken, and rinses continued until the reading became 0. Six trials were conducted for each compound; for five of the six trials, chlorine paper was used to measure the concentration of the effluent solution of each rinse. The concentration of chlorine in the solutions in the sixth trials were measured using titration.

Results

For this experiment, 5 trials were conducted for each of the 5 chemicals. It took NaOCI 5 rinses, LiOCl 7 rinses, Ca(OCl)2 6 rinses, C3N3O3Cl3 4 rinses, and C5H6O2N2Cl2 5 rinses to reach 0 ppm. Each solution began in the low to low-mid 1000s and continued until the values reached 0. Standard deviation was also calculated, and low values indicated the values were consistent.

Conclusions/Discussion

Based on the data gathered, the hypothesis was supported connecting the size and structure of the chlorine donors on their ability to adsorb to sand. The first part of the hypothesis addressed the relationship between ionic and molecular compounds, predicting that ionic compounds would take longer to come out of solution than molecular compounds. The second part of the hypothesis addressed the trend within the ionic compounds, theorizing that the smaller the compound, the longer it would adsorb to the sand due to increased electronegativity of the cation and greater attraction to its anion. The third part of the hypothesis brought forth the relationship between the two molecular compounds, with the prediction that the compound with more nonpolar behavior would adsorb better to the sand. This part of the hypothesis was also supported. Soil reclamation and mine acid neutralization are examples of applications of this experiment.

Summary Statement

This project studies how chlorinated compounds adsorb onto sand, the results of which can help reduce water pollution, clean up mines, and reclaim soil.

Help Received

Borrowed centrifuge and its test tubes from Mr. Antrim and borrowed other glassware from Father.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)

Trevor J. Fobel

Project Number

S1112

Project Title

Growing Green: A Study of the Effects of Chemical Fertilizers on the Biofuel-Producing Algae Dunaliella salina

Abstract

Objectives/Goals

If chemical fertilizers that simulate runoff are applied to the biofuel algae Dunaliella salina, growth will be accelerated.

Methods/Materials

A culturing station and light stand were assembled. Cultures were inoculated with approx. 1 mL of algae solution. 10 mg of each fertilizer was dissolved in 250mL of solution to synthesize the experimental mediums. One solution contained 7 ppm of dissolved nitrogen (labeled solution N), the other 7 ppm each of nitrogen, potassium and phosphorous (labeled solution NPK). A third group was the control. Point counts were conducted during the 1 week growing period. Average growth rates were used to compensate for variances in the initial algae populations of the individual cultures. Cell totals and growth percentages were determined and the variances analyzed.

Results

After 1 week of growth all test groups exhibited exponential growth. A daily point count was calculated to yield growth %s for the three test groups. Daily growth rates, total growth averages and differences in %s were documented. The NPK yielded the most dramatic increases in the 1 week growth period, maintaining an ave. growth rate of 166.9% per day. The control group experienced the second highest increases in growth, averaging 88.47% daily. The N group experienced the lowest increases, at 81.45% per day. Growth of the NPK test experienced significantly retarded initial growth compared to the other test groups, but accelerated within 24hrs. The control exhibited a large starting growth %, but never exceeded the NPK group; the growth % of the control varied widely in comparison to the other test groups.

Conclusions/Discussion

The data indicated that the presence of some fertilizers will cause a dramatic growth increase in Dunaliella salina cultures. Dunaliella salina is tolerant to fertilizers and excels under appropriate conditions. The algae require the presence of equally proportioned fertilizers to experience this large growth. The presence of a solution containing only dissolved nitrogen is slightly detrimental to the growth of Dunaliella salina. Within a solution containing approx. 7ppm each of nitrogen, potassium and phosphorus, the algae thrives. Because of Dunaliella salina#s ability to thrive in solution containing fertilizer, the question is: May Dunaliella salina be used for the purposes of bioremediation while simultaneously being harvested and processed into #algae-fuel#?

Summary Statement

Studying the effects of simulated chemical fertiizer runoff on the biofuel algae Dunaliella salina.

Help Received

Father helped assemble growing station; Chemistry teacher advised on stoichimetric calculations; Mother helped format data tables

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Richa S. Gandhi

Project Number
S1113

Project Title
The Impact of Toxins on Mytilus edulis (Bay Mussel) and Artemia (Brine Shrimp)

Abstract

Objectives/Goals
This research tests the impact of toxins on the filtering abilities of bay mussels and the growth of brine shrimp.The bay mussel feeds on phytoplankton and does so by filtering plankton rich water directly from their environments. Because of the invertebrates# close proximity to the shoreline, it is often used as an early indicator for ecologists and biologists to determine any foreign or toxic substances in the water.

Methods/Materials
I tested the filtering abilities of the bay mussels by applying several human byproducts (laundry detergent, motor oil, and dishwasher fluid), to see how the pollutants would affect the bay mussels# filtering abilities. I measured the bay mussels by taking samples of the water with a fluorometer every half hour for two hours. The fluorometer determined the amount of plankton contained in a set container. My results concluded that substances such as dishwashing soap and motor oil are not efficiently filtered by mussels because they kill and dissolve the plankton in the water. Without being able to eat plankton, the mussels cease to filter the water and die in large numbers. In order to see its impact on brine shrimp placed one tablespoon of brine shrimp eggs in twelve 250mL beakers. I then, placed the beakers with the brine shrimp in a temperature controlled device. Later, samples were taken from each beaker and were examined under a microscope to see how the detergent affected the growth of brine shrimp.

Results
This research indicates that all three human waste products are detrimental to the bay mussels and brine shrimp. Also, due to the process of bioaccumulation, as one moves higher in the food chain, the concentration of each substance increases as well. Furthermore, these compounds are detrimental to both the filter feeders and the plankton they eat. The motor oil and dishwashing soap caused the phytoplankton to dissolve. Without phytoplankton, filter feeders will stop filtering toxic wastes found in the ocean water. Excess amounts of dissolved phytoplankton and increased amounts of algae caused by the build up of phosphates from cleaning agents will cause dead zones in the ocean. Also by expelling these particles in their feces, filter feeders accelerate sedimentation. This research project proves that human waste products could be devastating not only to mussel and shrimp farms, but also to the overall health of the marine ecosystem.

Summary Statement
This project is about the the impact of common toxins found in the ocean on the health of marine organisms.

Help Received
I conducted this research at CSU Northridge under the supervision of Dr. Kubler.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)

Geena Garabedian; Taylor Wright

Project Number

S1114

Project Title

Healing a Wounded Earth: Getting the Salt Out

Abstract

Objectives/Goals

Salt accumulation in agricultural soils is threatening world-wide crop production. We believe a new approach in high saline soils using a natural chemical source Humate molecule will reduce salts in experimental saline soils as measured by Electrical Conductivity, EC, in mS/cm.

Methods/Materials

High saline salt soils occur when large amounts of salt (ions) accumulate in the root zone. Over 800 million acres of farmland worldwide is affected by saline-induced soils by farming activities. Crop losses result and leaching salts out has been the common method.

We tested a new natural source chemical humate compound that when added into irrigation water, encapsulates the salts. Controls of soil with 500 ppm salt and no humate were compared with experimental soil with 500ppm salt and humate using a Hach 40d electrical conductivity (EC) tester.

Results

Treated soils showed a lower EC value and therefore less salt after treatment. Salts in experimentals were reduced from 500ppm to 300ppm.

Conclusions/Discussion

Humate applications may be a promising new method for chemically treating high saline cropland thus improving farm food supply and economic profits.

Summary Statement

We tested a new chemical compound to reduce harmful high salt in agricultural farmlands which may help significantly improve crop yields over time.

Help Received

Mark Dodd, Farm Advisor

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)

Zack Gold; Jesse Gomer; Winston Lee

Project Number

S1115

Project Title

Santa Monica Beach Pollution: High School Designed and Implemented Water Quality Monitoring Program

Abstract

Objectives/Goals

Our objective was to test the water quality in terms of the number of colony forming units(cfu) of Enterococcus bacteria per 100 milliliters of seawater at three different sites within the Santa Monica Bay area and to inform the public of potentially poor water quality. Specifically we tested two null hypotheses: (1) There is no significant difference in water quality during dry and rainy weather, (2) There is no difference among our three sites (two with a storm drain and one without a storm drain) in terms of water quality.

Methods/Materials

We followed the standard Idexx protocol in testing for Enterococcus bacteria, with the exception that we took three replicates per site as opposed to one replicate per site so as to evaluate inter-replicate variability. Specifically we collected three ocean samples per site, processed and incubated the samples in a lab, and after 24 hours we determined the number of cfu/100mL by counting the number of Quanti-tray wells that fluoresced under UV light.

Results

Based on the results from our Two Proportion Z and Cai Squared tests we found significantly poorer water quality during the wet seasons, and that the site without a storm drain was not significantly cleaner than the sites with a storm drain.

Conclusions/Discussion

In conclusion, during the wet seasons we observed a large amount of runoff water entering the ocean which appears to be the direct cause of poor water quality. This large volume of runoff in the ocean combined with currents appear to affect other non-storm drain beaches down the coastline. Based on the high inter-replicate variability seen in our data, our results suggest other researchers who take only one sample have a 37.5% chance of reporting a false negative.

Summary Statement

Our main focus is to monitor the ocean water for fecal indicator bacteria and inform the public of our results to raise awareness.

Help Received

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Matthew P. Goldklang

Project Number
S1116

Project Title
Red Tide Sensitivity to Ocean Acidification

Abstract

Objectives/Goals
The goal of this project was to develop a tank in which I could study the effects of ocean acidification on the dinoflagellate L. polyedra, and then study the effects of ocean acidification on this species.

Methods/Materials
Materials: Tank Development: Omega mass flow controllers, manifold, computer, LabView, Li-cor Li-820 CO2 analyzer, Qubit O2 analyzer, Liqui-cel, sterile filtered seawater.
Lingulodinium polyedra Culture. Equipment: microwave, steam sterilization bags, portable hand lamp, temperature controller, electronic thermometer, pH meter, Bunsen burner, aluminum foil, photomicroscope, microscope, hemocytometer. Equipment Purchased Sterile: cotton wool, gloves, pipettes, droppers, laboratory glassware, media bottles.
Procedures: Tank Development: A tank program was developed using LabView, a computer programming system, to produce gas compositions for future ocean acidification projections. L.polyedra Culture: L. polyedra was serially cultured. Its growth curve was characterized. Then, it was cultured at varying carbon dioxide levels. Cell counts were done on a hemocytometer. Dry mass was taken and size and shape were observed under a photomicroscope.

Results
Tank Development: The tank had a sustainable gas output with minimal variability as shown with a R2 value of 0.9577. The input CO2 levels matched relatively well with the output data and met the specification.
Lingulodinium polyedra Study: There was an increase in growth rate of L. polyedra, incubated with and without media, when cultured at higher CO2 levels. The overall increase in organic matter production was 32%. Along with an increase in dry mass production, L. polyedra underwent a size increase and morphological change at 1453 ppm CO2. The increase in size ranged on average between 10-30 µm and was statistically significant (T-test $p<0.05$).

Conclusions/Discussion
Tank Development: A tank was successfully developed that reproducibly models ocean acidification and its future implications with CO2. The tank will be used for future experimentation on the effects of ocean acidification.
Lingulodinium polyedra Study: The species demonstrated a significant change in growth rate under higher CO2 conditions. Along with an increase in growth rate, L.polyedra demonstrated a statistically significant increase in mass and size, and change in cell structure, under elevated CO2 levels.

Summary Statement
The effect of ocean acidification on L. polyedra.

Help Received
Used lab equipment at Scripps Institution of Oceanography

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Gabriel J. Guerra

Project Number
S1117

Project Title
Dude, There's a Garden on Your Roof: Rooftop Gardens and Their Effects

Abstract

Objectives/Goals
The objective is to determine how houses with rooftop gardens can be modernized to incorporate additional green practices, such as energy and water conservation, in order to implement a lessened impact on the environment.

Methods/Materials
A Google Sketchup model was developed to complement the prospective foam core model that the tests will be taken on. Temperature tests are to be the main focus of the experiments as temperature has the greatest impact on the homeowner and the environment by producing distinct differences between dark colored roofs and vegetative roofs. Tests will be completed with a heat lamp at increment distances to resemble the effects of the sun, and will internally and externally test the temperature of the house when equipped with a basic dark roof, and internally and externally test the temperature of the house when equipped with a vegetative roof.

Results
The temperature of the house with the dark colored roof was much warmer internally and externally, whereas the house with the vegetative roof was much cooler internally and externally. The external temperature of the house with the dark roof was up to eight degrees warmer than the actual temperature of the lamp, and the external temperature of the house with the vegetative roof was up to five degrees cooler than the actual temperature of the lamp. The internal temperature of the house with the vegetative roof was seven degrees cooler than the internal temperature of the house with the dark colored roof.

Conclusions/Discussion
Houses incorporating rooftop gardens, solar energy, and rain-water collecting systems do not only benefit the homeowner through decreased heating and cooling bills, but also through the ability to grow his/her own food at home and to save on fuel or pricey agricultural products. These houses also benefit the environment by reducing storm-water runoff, ridding the air of pollutants, and reusing materials and resources.

Summary Statement
The focus of my project is to primarily emphasize the importance of designing modern houses that incorporate rooftop gardens and other eco-friendly practices while examining the benefits of such houses.

Help Received
Mrs. Herrington assisted me in development of project, Mrs. Sumter let me borrow her heat lamp, Mr. Avila assisted in the design process, John Smith assisted in the design process, Juan Gonzalez assisted in the design process

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Iryna Ivasyk

Project Number
S1118

Project Title
Analysis of the Energy Production Potential of the Tijuana River

Abstract

Objectives/Goals
Diseases such as malaria and diarrhea are among the leading causes of death for the indigenous people of developing countries. Many of such diseases are spread primarily through contaminated water as a result of the high expanses of water treatment. The ultimate purpose of this project is to study biological fuel cells as well as wastewater qualities, and their potential integration into providing the electricity needed for a water treatment plant to function.

Methods/Materials
The primary purpose of this experiment was to test the Tijuana River water to see its potential application in wastewater treatment. Containers were built to hold the anode and cathode which will be submerged in wastewater and water respectively. The current was measured on three incidences using two different samples as well as a control which only used water.

Results
The fluctuations present in the data for the biological fuel cell as opposed to the unanimous measurement of the water powered cell presents the idea the hypothesis was not proven correct because the wrong type of fuel cell was used. The salinity, PH and DO were also monitored and unexpected results demonstrated an odd relationship between the concentration of the solution and how PH changes.

Conclusions/Discussion
The data reveal that the current seems to increase slightly over time for the containers but does not reach a specific point. This continuous change is what makes the current difficult to quantify specifically and the hypothesis difficult to prove or disprove. Although the difference is so negligible between water and wastewater that the hypothesis cannot be proven, another hypothesis originated as a result. a difference between the water from the Tijuana River and the current it conducts and regular water with salt ions in it. The PH did not surpass the hypothesized barrier created by the first trial. This observation of the same phenomena leads me to believe that my hypothesis of the pH that the bacteria create for themselves might have valid roots. Hopefully, after further considerations of other fuel cell designs, one will be able to create the necessary output of electricity to begin incorporating it into the wastewater treatment plant its self.

Summary Statement
A biological fuel cell was built and run using water and mudd samples from the Tijuana river to create electricity; the central focus was to study biological fuel cells as an alternative energy sourse for wastewater treatement plant.

Help Received
I would like to thank Ms. Wendy Slijk for supervising my project and giving me ideas about where to continue. I would also like to thank Andrey Misyutin for helping me obtain samples for the project and Canyon Crest Academy QUEST program for providing an environment for me to create my project.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Anush Ginosyan; Shaunt Kevork

Project Number
S1119

Project Title
Removing Nitrates from Water using Redox Reactions

Abstract

Objectives/Goals

The purpose of our investigation was to remove nitrate ions from water. Nitrate ions are common pollutants found in water bodies and wastewater due to the use of inorganic fertilizers and discharge of animal waste. In doing so, we also hoped to generate electricity to make the process environmentally sustainable. Using a redox reaction in a galvanic cell, we were able to reduce nitrates in a potassium nitrate solution to dinitrogen tetroxide gas. The release of this gas caused the volume of the solution to decrease, obeying the law of conservation of mass. Another byproduct of this redox reaction was the formation of hydroxide ions, causing the solution to turn basic. After days of observing, the voltmeters read an average voltage of nearly 1.0 V, further proving that nitrate was being reduced. Such results proved that the reaction took place. The results of the test using a nitrate testing kit eliminated any possible doubt remaining. Ultimately, the success of the experiment shed light onto a brand new method of removing nitrates from fresh water. The generation of electricity was a bonus, which will allow for a sustainable method of water pollution remediation. This method will prove to be vital in the coming years as more and more water sources will become polluted due to human activities.

Summary Statement

The purpose of our project was to discover a self sustaining, viable technique of removing nitrates from polluted water, while at the same time generating a voltage with the potential to produce electricity when used on a large scale.

Help Received

Teacher supervised experiment in school laboratory

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)

Rose L. Leopold; Ella R. Madsen

Project Number

S1120

Project Title

Sandy Beaches: Pleasure or Pollutant? Year 4, An Analysis of Kelp as a Possible Source of Beach Sand Contamination

Abstract

Objectives/Goals

We tested as a continuation of the previous 4 years to see if decaying kelp at the high tide line could be a source of sand contamination causing many California beaches to be closed frequently. We collected fresh kelp and let it sit on sterilized and unsterilized sand for a 2-week period to see if the kelp added coliform bacteria to the sand as it decayed.

Methods/Materials

We built an incubator from a Styrofoam cooler and a light bulb. We collected fresh kelp from the ocean and sterilized half of it by steaming. We collected sand from the high tide line and sterilized half of it by baking it (the sterilized kelp and sand were our controls). We tested for coliform bacteria by following the state regulations using materials such as distilled water, pipettes, sterilized jars, an iron, Quanti-Trays and bacteria reagent. We then put the sealed Quanti-Trays into the incubator for 18-22 hours.

Results

Sterilization processes did not work. We tried sterilizing by using permanganate, but it did not work so we tried heating the kelp, but that did not work. The steaming method sterilized the kelp initially, but something contaminated all our samples and we had to throw our control data away. Our sterilization method for the sand worked initially, but later the sand became contaminated and we had to throw away our data. We do not know how the sand and kelp got contaminated. We also saw spikes of bacteria that increased and then decreased as time went on in our tests of sterilized kelp & unsterilized sand as well as sterilized sand & unsterilized kelp. Our test of unsterilized sand & unsterilized kelp had the least bacteria overall, surprisingly.

Conclusions/Discussion

We cannot make a reasonable conclusion with the data that we have. Our controls did not work so we have nothing to compare our data to. Also, we are confused as to why the bacteria levels in some tests increased on average and then decreased. We have a few theories as to why this is happening. Perhaps there is some sort of competition happening or maybe there are different types of coliform that we cannot distinguish between living in the sand (maybe aerobic vs. anaerobic) and we did not homogenize our mixtures enough. We modified our methods of testing when we saw they did not work (eg. Sterilization of kelp) and then we would start over. We are continuing to test and modify our project so that we can better understand what is going on.

Summary Statement

We tested the decaying kelp along the high tide line in order to see if it adds coliform bacteria to the sand.

Help Received

Iddex Company for donating our supplies, Darrel Steely for helping analyze our data, Adina Paytan for helping us create question and testing methods

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Anne C. Maher

Project Number
S1121

Project Title
The Worst Pollutant for Plants

Abstract

Objectives/Goals
To discover which of the given pollutants (car soap, car oil, smog, and acid rain) is most harmful to the life of plants. I believe this will be car oil.

Methods/Materials
Thirty-nine Cherry Belle radishes, thirteen pots, soil, acid water, motor oil, car soap, three plastic bags, three paper plates, duct tape, and a notebook were used. Three pots, three plants in each pot, were used for each pollutant. There was also one control that was given no pollutants. Each of the three pots was given twice the amount of pollutants as the last pot. For instance, the three smog plants recieved one hour, two hours, and four hours of smog each day. Soap and oil recieved 1/2 teaspoon, one teaspoon, and two teaspoons. Acid rain recieved 1/8 cup, 1/4 cup, and 1/2 cup. This continued every day for four weeks.

Results
The soap was the most deadly pollutant, killing the plants most quickly. Oil came next, then smog, than acid rain. Oil plants recieved black blotches on the leaves before dying. Smog did not grow well, suffered discoloration and loss of leaves before dying. Acid rain had discoloration for a while and then flourished and were the first to grow a radish.

Conclusions/Discussion
Soap is by far the most harmful pollutant of the ones used; killing usually within a week. This may be because the soap rubbed off the cuticle of the leaves and dehydrated it, alone with poisening it. The oil probably entered into the leaves pores and caused the blotching. The lack of sunlight most likely prevented photosynthesis in smog plants and caused the lack of growth and discoloration. The lemon juice used to make acid rain may be what caused them to flourish.

Summary Statement
The worst pollutant for radish plants out of acid rain, smog, soap, and car oil.

Help Received
Father helped with idea; mother bought supplies.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Naomi S. Menezes

Project Number
S1122

Project Title
The Effect of Urea on Archaea Microbes' Consumption of Gasoline

Abstract

Objectives/Goals
This purpose was to find a way to increase the rate that bacteria bio-remediate an area polluted with gasoline. Oil spills put 37 million gallons of oil in the ocean each year and some bacteria can consume it.It was hypothesized that the Archaea microbes mixed with 1.5 grams of urea would consume the most gas over an hour.

Methods/Materials
Materials used: beaker, graduated cylinders, stir plate, funnel, separation flask
First 20 mL of water, 2 grams of bacteria, and either 0, 0.5, 1 or 1.5 grams of urea were mixed and put on a stir plate for 30 minutes. Then 20 mL of gasoline was added to this mixture for an hour. The mixture was then separated with a seperatory funnel. The amount of gasoline separated was recorded and the amount of bacteria and water was recorded. This procedure was repeated five times for each amount of urea.

Results
For zero grams of urea an average of 1.3 mL of gasoline was consumed with a 0.4 mL deviation and a 1.1% deviation. 0.5 grams of urea had an average of 0.6 mL of gas consumed, a 0.8 mL deviation and a 1.0% deviation. For 1.0 grams of urea 3.3 milliliters was the average gas consumed with 0.7 mL average deviation and 0.9% deviation. The 1.5 gram of urea trial#s average amount of gas consumed was 3.7 mL with a 1.1 mL average deviation and a 1.0% deviation.

Conclusions/Discussion
The hypothesis that the 1.5 grams of urea trials would consume most of the bacteria was supported. The 1.5 grams of urea trials had an average of 3.7 mL of gasoline consumed with a 1.1 mL average deviation and a 1.0% deviation. This was higher than the other three averages. When comparing 0.5 grams of urea trials and the 0 grams of urea trials the hypothesis was not supported. The 0.5 grams of urea trial had an average consumption of 0.6 mL while the zero grams of urea trials had an average of 1.3 mL of gasoline consumed. This data suggests that 0.5 grams of urea was not enough to stimulate the bacterial consumption of the oil. There is no pattern when adding more urea to the bacteria mixture, there is not a steady increase, only more gasoline was consumed. When comparing the bacteria and water, in order of increasing gasoline consumption, the data shows that more gasoline consumed yields more bacteria and water. Future research for this experiment could be to test the amount of urea or nitrogen to be added to an ocean environment to stimulate the oil consuming bacteria.

Summary Statement
800 ENVIRONMENTAL SCIENCE/ ECOLOGY

Help Received
My science teacher helped with the experimental design

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Maretta Oganesyan

Project Number
S1123

Project Title
Using Magnetic Particles to Remove Lead Ions from Water

Abstract

Objectives/Goals
Lead is a potent neurotoxin that does not break down in the environment and is very hard to clean up. It is extremely harmful to the nervous system, especially in small children. This project was designed to remove lead ions from an aqueous solution using negatively charged magnetic particles # specifically iron filings. I hypothesized that if the surfaces of the iron filings are chemically manipulated to acquire a negative charge, then the positively charged lead ions (Pb2+) can become attached to the surface of these magnetic particles and can thus be removed from solution using an external magnetic field.

Methods/Materials
For this experiment I used beakers, 15 mL vials, iron filings, .5 M Sodium Chloride, .5 M Ammonium Hydroxide, 1 M Sodium Hydroxide, and .5 M Lead (II) Nitrate, Distilled Water, an electronic scale with weighting paper, magnets, masking tape, pipettes, and graduated cylinders.
After treating the iron filings with the different base solutions for 24 hours I added 4 mL of lead (II) nitrate and left them in contact for different amount of time. I would then remove the lead and add NaCl to form Lead (II) Chloride.

Results
As the reaction time between the contact of the lead solution and the iron filings increased so did the amount of lead removed. After 4 hours of contact time however, there was no significant removal of lead.

Conclusions/Discussion
In conclusion the results of my experiment supported the idea of using an external magnetic field to remove lead ions from the solution. Furthermore the efficiency of this project depends on the amount of reaction time between the iron filings and the lead ions. According to my results a reaction time of 4-6 hours is sufficient to remove 1 M lead ions concentration from the solution. However, I believe if the amount of magnetic particles is greater the reaction time could be shorter. The reason why I chose to use magnetic particles to remove lead ions was to test for a way to remove lead ions from water. People mainly concentrate on lead solids and their removal using filters to remove them, but lead solid is not the only kind of lead that pollutes the waters. Industries such as those in metallurgy are known to dump acidic solution of lead into water, effectively preventing lead from becoming solids. This method could be used in industries to remove the lead ions and prevent the pollution of waters in homes and the environment

Summary Statement
My project was about the removal of lead ions from an aqueous solution using a method other than filtration, one that

Help Received
AP Environmental Science teacher supplied lab equipment and information on chemicals.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Corlin L. Palmer

Project Number
S1124

Project Title
The Utilization of Palm Waste for the Production of Charcoal

Abstract

Objectives/Goals
Hundreds of tons of palm leaves are sent to our overfilled landfills every day, while forests are being depleted to produce charcoal. The purpose of this project is to solve both of those problems. Based on my research on charcoal, I believe that commercial and homemade production methods can be adapted in order to efficiently make charcoal out of palm waste.

Methods/Materials
To do this, I will gather palm waste, chop it up into small bits, and burn them in a barbecue. While burning, I will cut off the oxygen supply to the burning charcoal and let them smolder and turn into char. I will then blend the charred palm into a fine powder and mix it with starch and water to hold the briquette together. After drying the briquettes in an oven, they will be ready to burn in a barbecue.

Results
After some trial and error, I was able to make nicely sized briquettes out of palm charcoal. In the comparison of my charcoal to the Kingsford brand charcoal, the palm charcoal outperformed its competitor in a few tests, but was undeniably a bit worse than its commercial rival.

Conclusions/Discussion
I believe with the right machinery and enough time to perfect its creation, the palm charcoal could ultimately be superior to current commercial charcoal, being produced at a lower cost while saving the environment at the same time.

Summary Statement
By making charcoal out of palm waste, many environmental problems could be solved.

Help Received
Mother helped with arranging and gluing the board.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)

McKenzie Pantana; Brooke Snyder

Project Number

S1125

Project Title

Think About It, Take a Second

Abstract

Objectives/Goals

Plastic bags are found littering parks and street corners, while millions of trees are cut down in order to produce paper bags. The objective of this project was to test which grocery bag (paper, plastic, cotton, or polyester) after being thrown away is most environmentally friendly. IF plastic, paper, cotton, and polyester grocery bags are placed in controlled environments, THEN paper will decompose the fastest.

Methods/Materials

Phase 1: Forty 4x4 inch pieces of plastic, paper, polyester, and cotton grocery bags were placed in bins filled with: mulch, water, salt water, or leaves, while also stapling 10 of each bag onto wooden posts exposed to sunlight. Each bin was uncovered allowing weather such as rain, snow, heat, and wind to effect the environment. After 7 weeks each bag was measured for surface area changes. Phase 2: Twenty 4x4 inch pieces of paper, plastic, cotton, and polyester bags were placed in Tupperware containers filled with: tap water, salt water, mulch, soil with yeast, or soil with salt and yeast, in an incubator at 30°C. After 3 weeks these samples were removed and measured. Phase 3: a survey was conducted outside the Edwards Air Force Base Commissary, 150 participants were asked 2 questions regarding grocery bags.

Results

75% of the paper bag pieces in mulch and leaves had changes in surface area by roughly 1 centimeter. While, the cotton grocery samples differed by less than 1 centimeter. The plastic and polyester pieces showed no change in all five environments. After Phase II in the incubator, the paper in potting soil with yeast decomposed completely, while cotton in the same environment broke down into small pieces. The surveys showed 51% of the 150 participants thought cotton grocery bags are best for the environment. 28% percent stated that paper bags are best, 9% believe plastic is best, and 12% stated polyester grocery bags are best for the environment.

Conclusions/Discussion

Overall, the data did support the hypothesis. The results showed that the paper pieces decompose most effectively. Paper in potting soil with yeast at 30°C decomposed in the least amount of time. Therefore, paper grocery bags will decompose the fastest leaving less trash littering the Earth. The survey shows that although individuals believe cotton bags are best for the environment; these bags are not being used as often as plastic bags due to convenience issues.

Summary Statement

This project tested which kind of grocery bag once thrown away will stay in the Earth's environment for the least amount of time.

Help Received

Debbie Lewis supplied this project with an incubator.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)

Marci F. Rosenberg

Project Number

S1126

Project Title

Effect of Neustonic Microplastic Debris on the Pelagic Insect Halobates sericeus

Abstract

Objectives/Goals

The North Pacific Central Gyre (NPCG) is a key area of interest for investigating the effects of plastic debris on the lives of marine organisms because much of this debris is concentrated in gyres throughout the world's oceans. This study provides the first assessment of the impact of plastic debris on marine invertebrates, targeting the neustonic marine insect Halobates sericeus. This species was chosen because it utilizes floating material, including surface-level plastic, as a substrate to lay eggs.

Methods/Materials

A total of 45 historical (1972/1973) and 45 recent (2009) samples from the NPCG were sorted and analyzed with a dissecting microscope. Plastic and H. sericeus were thoroughly sorted and counted, with the H. sericeus being further classified into five age groups: juvenile, adult male, adult female, newly molted, and molts of organisms.

Results

Although the data showed that both the abundance of plastic and H. sericeus in the NPCG has significantly increased over the last forty years, the concentration of plastic debris grew faster over this time period. Data from 1972/1973 indicated that there was no correlation between the abundances of H. sericeus and plastic. However, the 2009 samples showed a significant positive correlation ($p < .0001$, $R^2 = 0.3353$).

Conclusions/Discussion

Further research is necessary to determine the specific nature of the interaction between plastic debris and H. sericeus in the NPCG, though this research does suggest the possibility of a true biological relationship between the two.

Summary Statement

I looked at the impact of surface level microplastic marine debris on the population levels of a unique oceanic insect, Halobates sericeus.

Help Received

Used lab equipment at Scripps Institution of Oceanography under the supervision of my mentor, Miriam Goldstein; Consulted with Dr. Lanna Cheng about the general biology of Halobates

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Hilarie Sit

Project Number
S1127

Project Title
Veggie Fruity Paper: To Investigate an Alternative Way to Utilize Agricultural Wastes

Abstract

Objectives/Goals
To examine the process of making paper from agricultural wastes, such as orange peel and corn stover, and to investigate the energy requirements for paper production from these materials as compared to the paper made from pine wood and then to determine biodegradability of the resulting papers.

Methods/Materials
The basic setup of this experiment was to create pulp from each material by using electric blender and heating stove, and then to determine the energy needed for the processes by measuring the time required in the specific power rating electric appliances. Pulp from each agricultural waste was made into papers by using hand-made process and dried under room temperature. For biodegradability testing, five equally weighted pieces of paper made from each type of agricultural wastes were put into soil and then the weight from each type of paper was measured weekly for 5 weeks.

Results
In this experiment, the energy required to make paper from pine wood was 2590KJ; from orange peel, 964KJ; from pummelo peel, 978KJ; from corn stover, 1636KJ; from cauliflower stem, 658KJ. In biodegradability testing for pine wood paper, there was 0.65g remaining after 5 weeks in soil; for orange peel paper, 0.11g; for pummelo peel paper, 0.05g; for corn stover paper, 0.46g; whereas cauliflower stem paper virtually disappeared in soil in 4 weeks.

Conclusions/Discussion
Making paper from agricultural wastes actually requires less energy and the products requires less time to biodegrade than that from pine wood. This experiment helps us realize that the traditional way of paper production may not be the best, and paper production can be a viable and sound alternative option for utilizing agricultural wastes such as orange peel and corn stover, and that may also help to reduce landfill overload and the amount of trees being cut down.

Summary Statement
This project investigates paper making as an alternative way to utilize agricultural wastes such as orange peel and corn stover.

Help Received
Dr. Oliver and Mrs. Raco gave me advices and guidance needed; parents helped me with the supplies.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)

Dillon Szyper; Anthony Toledo

Project Number

S1128

Project Title

Reducing Gaseous Emissions in Dairy Cattle Excreta using Lipids

Abstract

Objectives/Goals

Our goal is to reduce the amount of gaseous emissions released by cattle into the atmosphere by adding lipids to their feed and also to their fecsl mstter.

Methods/Materials

In the pilot study the bulls were fed corn silage ad libitum. For the first treatment, ½ liter of vegetable oil was mixed directly into the corn silage daily and fed for 15 days. The fecal matter produced was placed into a 70 ml test tube, filled completely to the rim. The balloon was stretched over the open the end of the test tube until secured. The circumference of the balloon was measured with the tape measure at 1, 6, and 24 hours, and the data was recorded. For the second variable, these steps were repeated adding canola oil to the corn silage and fed. As a control, fecal matter was collected from a bull fed only corn silage with no lipid additive.

In the secondary experiment, the same materials were used with the exception that 250 ml Erlenmeyer flasks replaced the test tubes. For the variable, a 5% mixture of #2 yellow grease and the liquid waste slurry were combined and filled to the rim of the flask. A balloon was then placed over the rim of the flask to collect any gases emitted. As a control, the liquid slurry with no lipid additive was filled to the rim of the flask and a balloon placed over, to collect any released gases.

Results

In the pilot study where lipids were mixed with corn silage and gases were collected from the feces, after 24 hours the vegetable oil variable measured 1.78 cm, the canola oil variable measured 10.16 cm, and the control measured 12.7 cm. The vegetable oil had an overall decrease in emissions of 86% when compared to the control with no lipid additive.

In the secondary experiment lipids were added directly to dairy lagoon waste water. The control had a gas collection measurement of 5.5 cm and the lagoon slurry with lipid additive had a measurement of .85 cm. This experiment resulted in an 85% reduction in gaseous emissions.

Conclusions/Discussion

The findings of this experiment help to demonstrate the potential benefits of lipid additives and that gaseous emissions can be significantly reduced using lipids in the form of vegetable oil and #2 yellow grease. This potential solution to rid waste of harmful gases produced by cattle has positive implications for U.S. dairy producers, agriculture and the environment.

Summary Statement

Reducing harmful gases from dairy cattle waste by adding lipids to their feed and lagoon slurry.

Help Received

Advice and information gathered from some experts who study in this field.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Akhil Tanwar; David Wang

Project Number
S1129

Project Title
Vermicomposting! Make Composting Productive and Cost Efficient!

Abstract

Objectives/Goals
The main objective of our project is to test that increase in temperature, increase in moisture level and adding egg shells can eventually increase the reproductive rate of worms in a worm compost system.

Methods/Materials
We created four worm bins to test these three factors. Three of the bins were designed to test the three variables, and the last bin is the control bin. Every week, we counted the number of worms in each bin five times and recorded our data for 6 weeks.

Results
In our experiment we saw that the worms reproduced quickly in the bin with egg shells. Worms also reproduced steadily in the bin with temperature control. However, in the moisture bin, worms did not reproduce and the worm population decreased at the end of the 6th week.

Conclusions/Discussion
Calcium in the egg shells may have helped stimulate worm reproduction and survival by making the bin more alkaline. We also saw some growth in the bin with the high temperature bin. The mean temperature for the high temperature bin during the 6 week period was 21.8 degree Celsius. The other bins were kept outside where the temperature was around 17.7 degree Celsius, which means that worm#s reproduction is favored at higher temperatures. Because 15-25 °C is the most favorable temperature range for worm growth, I believe that worms tend to be more active at higher temperature.The moisture bin did not experience any population growth and the population declined in this bin. Too much moisture is bad for the red worms because they will suffocate and die in the presence of excessive amount of moisture.

Summary Statement
We conducted this experiment to determine what conditions can increase the worm reproduction rate.

Help Received
Friend helped us gather information; AP environmental teacher informed us about us about the benefits of composting; another friend helped revise the research paper.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)

Kimberly M. Vaz

Project Number

S1130

Project Title

Optimal, Automatic Hydration System for Household Water Conservation

Abstract

Objectives/Goals

While a lot of attention has been given to conserving water through techniques such as the use of low flush toilets, not enough attention has been given to tackle the largest source of household water usage, which is that of watering household lawns. The technology used for irrigation in the backyard requires a great deal of intervention by the consumer to ensure that lawns are not under watered in summer or over watered in winter. This project aims to provide a tremendous reduction in household water consumption through an easy-to-use, easy-to-install, automatic sprinkler system which delivers an optimal amount of water necessary for the backyard.

Methods/Materials

I wanted to program a micro controller with the function to check the resistance, and thereby the moisture levels, in my back yard soil. To test my code, I ran tests on my computer using a simulated circuit board to indicate the glow of an LED light.

In practice, I had intended to wire my board to two metal nails underground and check the resistance on these nails, however, I wasn't able to do so due to the fact that soil is very saline and would have corroded the nails and produced inaccurate readings. Thus, I created a soil probe by inserting two metal nails into gypsum plaster. The gypsum profoundly exemplified the amounts of water absorbed. I connected my soil probe to the micro controller using multiple wires, and a PVC pipe underground.

Results

After effectively programming the micro controller that checked the resistance in the soil probe, I was able to receive analog resistance values and the micro controller was able to send out digital commands. These digital commands signaled the sprinkler control timer to either complete its task if moisture levels were low, or disable it if adequate moisture existed. I used rain sensor inputs on modern sprinkler timers (which are connected to a rain gauge), to turn off the sprinkler timer if it was raining.

Conclusions/Discussion

My invention is practical for a number of reasons. Unlike other automatic sprinkler systems, which require a great deal of time and money to install, my system is simple and very inexpensive. My smart water system has the potential to save the residents of California and the rest of the United States millions of dollars in water as well as care for the environment by not over-watering or under-watering plant specimens in the backyard.

Summary Statement

My project is the creation of a water-saving, low-cost, easy to use, easy to install automated sprinkler system that delivers the optimal amount of water required for lawns and plants.

Help Received

Micro controller recommended by colleague of father.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Daniel Waizman; Amanda Zhang

Project Number
S1131

Project Title
Effects of Soil Salinity on Native Vegetation in the San Dieguito Lagoon

Abstract

Objectives/Goals
There have been several problems with restoring native vegetation to the San Dieguito Lagoon. We believed that the salinity of the soil had an effect on the type of growth within Disposal Site 32 (an area of attempted re-vegetation). The first plot we observed contained mostly the species Suaeda Taxifolia, while the second plot contained a mixture of Atriplex Lentiformis.

Methods/Materials
To find out if salinity was the culprit we took samples from the two different plots of and compared the salinity of the topsoil as well as soil six inches down. We used a conductivity probe to determine the salinity.

Results
The salinity of the topsoil was less than that of the salinity six inches down in both respective plots, which is expected. Our analysis indicated that the topsoil salinities are equal in both plots, while the salinity at six inches is different. Moreover, the salinity is greater in plot one with the Suaeda Taxifolia than the second plot with Atriplex.

Conclusions/Discussion
We can affirm that salinity varies within one disposal site, and that this variability affects the type plant growth by creating different environments in which the seeds must germinate.

Summary Statement
Our project suggests that even slight changes in salinity in soil affects the growth of plants in lagoons.

Help Received
Dr. Hany Elwany from Coastal Environments assisted us with background information.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Jessica J. Wu-Woods

Project Number
S1132

Project Title
Comparison of Three Methods to Rapidly Detect E. coli in Water

Abstract

Objectives/Goals
Fecal contamination of drinking and recreational water is a serious problem. This contamination is determined by measuring the presence of coliform bacteria, such as Escherichia coli. Current established methods to detect these bacteria take 18-48 hours, therefore a reliable rapid test is needed. My project has focused on evaluating three methods to rapidly test for E. coli in water.

Methods/Materials
Laboratory reagents, PCR machine, DNA gel box, antibody based lateral flow strips, metabolite based lateral flow strips. Bacterial strains. There were three strains of bacteria used in this experiment.

Results
In the first experiment, a dilution series was tested in order to confirm that the metabolite strips worked correctly. It was concluded that these strips could be used to detect different concentrations of ligand. In the next experiment we tested the idea that a small change in ligand concentration would cause a visible change on the test lines. This produced a positive result. The last experiment was the most important where we tested different E. coli concentrations. The experiment included all three rapid detection methods. Both the metabolite-based strips and the PCR-based method could detect low concentrations of bacteria.

Conclusions/Discussion
PCR was the most sensitive and best for detecting E. coli based on this data. However the metabolite strip show promise as a quick and expensive alternative to the PCR. The antibody strips failed to detect E. coli except at very high concentrations.

Summary Statement
Determining the best method to rapidly test for E. coli in water.

Help Received
I used lab equipment under the supervision of Dr. Woods at Inscent, inc.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Kenneth Xu

Project Number
S1133

Project Title
Phytoremediation with Aquatic Plants: A Study on Ecological Cleanup of Heavy Metals from Water with Duckweed

Abstract

Objectives/Goals
Heavy metal contamination is a major issue in the world, especially in developing countries that lack resources for sophisticated water purification systems. This experiment investigated the potential of duckweed species Lemna Minor in removing the heavy metal copper from water. The purpose of this project was to present an inexpensive, simple, yet efficient solution to cleaning up heavy metal contamination around the world, which could save many lives. It was predicted that duckweed would remove at least 50% of copper from water regardless of concentration.

Methods/Materials
There were three testing sessions, each testing four solutions with copper concentrations of 0, 3, 6, and 10 parts per million (ppm). 1 gram of duckweed was added to each solution and a CHEMets copper testing kit was used to analyze the concentration of copper at 0, 6, 12, and 24 hours. A lighting system was constructed for testing.

Results
Only duckweed in the 3 ppm solution satisfied the prediction by removing 50% of the copper in the solution over 24 hours. Duckweed removed 50, 42, and 27% of copper for the 3, 6, and 10 ppm solutions after 24 hours. Duckweed in the 10 ppm solution removed the highest amount of copper (0.405 mg), while duckweed in the 3 ppm solution removed the highest percentage of copper (50%).

Conclusions/Discussion
Copper reduction rates far above 50% were observed in solutions of 6 ppm and above in the first twelve hours. However, by the end of the testing session copper levels in the water rose drastically. This was concluded to be due to the short retention time that duckweed for high concentrations of copper. Moreover, it was observed that in concentrations above 6 ppm, duckweed colonies tended to stagnate and die. As a result, it is concluded duckweed (Lemna Minor) is an excellent hyperaccumulator of copper, and works best at concentrations not exceeding 3 ppm.

Summary Statement
Investigating the use of duckweed in removing heavy metal pollutants from water.

Help Received
Professor Elizabeth Pilon-Smits of Colorado State University gave advice, parents paid for materials and supervised the experiment

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)

Chung Jui Yu

Project Number

S1134

Project Title

Mapping the Time-Averaged Distribution of Combustion-Derived Air Pollutants in the San Francisco Bay Area

Abstract

Objectives/Goals

Urban air pollution is an ongoing and complicated problem for both residents and policy makers. One particular class of organic air pollutants known as polycyclic aromatic hydrocarbons (PAHs) and their derivatives are well-studied carcinogens that have been associated with numerous health problems. The purpose of this study was to: 1) provide insight to the interaction of PAHs with tree leaves; 2) develop a method to quantitatively measure the concentration of PAHs in widely distributed tree leaves in the Bay Area; 3) generate maps of the pollutant distribution and compare my results with those done in past studies.

Methods/Materials

Shade leaves of Quercus agrifolia and Sequoia sempervirens were sampled throughout the Bay Area. PAHs and other plant material extracted using dichloromethane (DCM) and concentrated using the rotary evaporator. Short column silica gel chromatography was employed to isolate the PAHs from the plant material, and samples were analyzed using the gas-chromatography mass spectrometry (GCMS) for quantitative analysis. The program ARCGIS was used to generate the maps of my data.

Results

From my microcosm, there is a relationship between the initial accumulation rate and the vapor air concentration of the PAHs in the various substrates, which provides a foundation towards the understanding of PAH accumulation based on its vapor pressure in the atmosphere. Comparing redwood and oak PAH concentrations, differing accumulation patterns suggest species specific factors that influence the uptake of PAHs. A study done on PAH concentrations of redwood and oak in the same locality reveal the numerous factors influencing accumulation of PAHs and a relationship is generated to eliminate these factors. This relationship was used to convert oak concentrations into redwood equivalents and was integrated into redwood maps of the Bay Area. The magnitude of the signals corresponds to their proximity to pollutant sources. Differing distributions of the PAHs can be observed.

Conclusions/Discussion

Tree leaves demonstrate the capability to monitor PAHs in the atmosphere and map the heterogeneity of the PAH distributions over a given area. Further research towards the development of equilibrium models can provide a more accurate representation of regional air pollutant concentrations. This study provides the foundation for the application of leaves as inexpensive high-resolution air pollutant monitors.

Summary Statement

A study on the interaction of PAHs with leaf wax and the potential for leaves to monitor the distribution of air pollutants in the Bay Area.

Help Received

Used lab equipment at Stanford University under the supervision of Dr. David A. Zinniker and Professor Michael J. Moldowan.