CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Garnet A. Abrams

Project Number
J0801

Project Title
Mycofiltration: Does Straw with Mycelium Make a More Efficient Erosion Control Than Plain Straw Wattles?

Abstract

Objectives/Goals
The objective of this experiment was to find out if straw with mushroom mycelium growing in it will be a better erosion control by retaining road sediment runoff better than straw without.

Methods/Materials
I built a board 122 cm to imitate a road, with sides to contain all of the runoff. I spread 625 grams of soil over an 80 cm length of it and elevated one end to simulate a 5% grade. I then poured 8 liters of water, divided evenly into two watering cans, to replicate rain onto the soil. The water/soil ran unobstructed into a bucket at the end of the ramp in three of the tests. The water/soil ran through plain rice straw three times. The water/soil ran through rice straw inoculated with mushroom mycelium three times as well. I took a sample of the runoffs to find the Suspended Sediment Concentration (SSC). I used a vacuum filter to vacuum off most of the water in the samples, and then dried each filter with its soil sample in a 105º C oven for ninety minutes. The filters with soil were weighed; the weight of the filter then subtracted to find out how much soil was in each sample. The weight (mg) of soil was then divided by the amount of water/soil from the sample (L), to calculate the SSC.

Results
In the tests with no barrier, all 625 grams of soil washed down the ramp with 8 liters of water, so the SSC was 78,125 mg/L. The SSC average was 5,006 mg/L for the tests using plain rice straw, blocking 94% of the sediment. The SSC average for the straw with mycelium was 2,536 mg/L, blocking 97% of the sediment.

Conclusions/Discussion
The results of this experiment agreed with my hypothesis. The mycelium did work better, as I had thought it would, but the difference was not as significant as I had expected.
For this experiment to be applied to the real-world, I would see if straw wattles inoculated with mushroom mycelium are a feasible improvement to plain rice straw wattles. To do this experiment again, I would inoculate straw wattles with mushroom mycelium and use them on the sides of dirt roads as plain rice straw wattles are currently being used.
I felt I needed to do this model to obtain background information before doing it on a full scale.

Summary Statement
My project explored the possibility of increasing the efficiency of rice straw wattles used for erosion control by inoculating them with mushroom spores, creating a mycelium network to further increase their efficiency.

Help Received
Consultation and direction from Scientists from PALCO, Scotia, CA and Shawn Magnuson, President, Humboldt Bay Mycological Society. David Summerlin, Consultant, Fungi Perfecti, Olympia, WA, for supplies & advice. Doug Svendsen, for help building the ramp. My parents for support and transportation.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Sarkis Bornazyan

Project Number
J0802

Project Title
Solar Energy Trap

Abstract

Objectives/Goals
My project is to determine if the solar energy can be trapped for our future needs. Based on my research, it was hypothesized that if a vertical salinity gradient layer is created in a body of water, isolated with fresh water layer from the top, the density increasing with the depth, and the lamplight exposure time of the water surface progressing, then the temperature of the bottom high density layer will increase and exceed that of the top layer by trapping thermal energy.

Methods/Materials
A vertical salinity gradient and no salinity gradient (the control) cases, created in a container, were experimented, each in three different trials. In both cases the container was exposed to halogen lamplight. The temperature of the bottom and top layers of each case was measured as a function of the light exposure time. The mean differences in temperature between the bottom and top were calculated and the results were compared between the two cases.

Results
In the salinity gradient case, the temperature of the bottom layer exceeded the top by at least 5 °C, while in the no salinity gradient case the bottom did not exceed the top.

Conclusions/Discussion
In the vertical salinity gradient case thermal energy was trapped in the bottom layer, since there was no convection in the gradient layer. In the no salinity gradient case the bottom layer could not trap energy, because the entire structure was convective. The data fully supported the hypothesis. These findings agreed with the information found in the literature and the El Paso Solar Pond research project results. Hence, this project suggests that the renewable energy source such as solar, can be effectively stored in the solar pond-like conditions for our future needs.

Summary Statement
By creating middle insulating salinity gradient layer in a body of water, it was shown that the solar energy could be trapped in the bottom high-density layer for future needs.

Help Received
Consulting; Transportation to obtain necessary materials and literature.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)

Yanosh D. Cerovcevic

Project Number

J0803

Project Title

PEM Fuel Cell and Hydrogen: Pollution Free Energy Source of Today

Abstract

Objectives/Goals

Pollution is the greatest threat to our environment and health. The goal of this project is to find a good and an efficient way as an alternative of using fossil and nuclear fuels; also to create and store renewable energy and in the process produce less, or no pollution at all. The fuel being tested is hydrogen, the most abundant element in the universe.

Methods/Materials

A solar panel was used and reversible PEM Hydrogen Fuel Cell, to produce hydrogen and oxygen from distilled water. In a reversed process, these gases were forced through the fuel cell catalyst producing electricity. Experiments were recorded with a camera to have more accurate hydrogen volume readings, as well as time, voltage and current. Results were transferred to spreadsheets for computations and graphs were created. As a final test, a modified electric model car was powered with produced electricity.

Results

Voltage, current, hydrogen volume and time were measured. It took an average of 6min and 8sec to convert 11mL of hydrogen from the water using solar energy. Average current was 0.189A and voltage was 1.85V. In reverse process, 11mL of hydrogen created average voltage 0.57V and 0.421A current for 3min and 4sec with 1ohm load. Experiments were repeated with a 60W lamp. Solar energy proved to be better energy source, producing same volume of hydrogen for shorter period of time. In same time average efficiency (34%) was higher than using a 60W lamp (28%). The only byproducts created in the process were water and heat.

Conclusions/Discussion

Hydrogen as a fuel and PEM Fuel Cell are in combination much better energy source than most commonly used fossil and nuclear fuels. If electricity used to create hydrogen is produced from solar, wind or hydro energy source, energy created in a fuel cell is renewable, produces no pollution and have high efficiency rate. Because the only output of a fuel cell is water, the fuel cell used in conjunction with an electrolyzer (reversible fuel cell) is a true closed system, returning the water back to its source. Fuel cells do not have the efficiency limitations or the pollutant output of conventional power generators, because hydrogen and oxygen are converted into water, rather then combusted, as in internal combustion engines.

Summary Statement

The goal of this project is to find a good and an efficient way as an alternative of using fossil and nuclear fuels; also to create and store renewable energy and in the process produce less, or no pollution at all.

Help Received

My father purchased material and helped wire components.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Rebecca A. Chan

Project Number
J0804

Project Title
Effects of Perchlorate and Turmeric on Daphnia Heart Rate

Abstract

Objectives/Goals
Perchlorate contamination in the Colorado River is a pollution problem that has been recently identified. The objective of this project was to evaluate whether perchlorate salts would increase the heart rate of Daphnia magna and, if so, could turmeric, an antioxidant, reverse this effect?

Methods/Materials
Daphnia magna were exposed to three different concentrations of perchlorate solutions, 0.001 M, 0.01 M, and 0.1 M. In each test solution, the Daphnia were removed from the culture using a plastic disposable pipette. They were placed on a cavity slide and viewed under a 40X magnification video microscope. The time for 100 heart beats (contractions) was recorded using a stopwatch. This count was repeated twice for each result.

Results
An increase in heart rate was demonstrated upon exposure of Daphnia to perchlorate solutions. In spring water (the control), Daphnia heart rate averaged 215 beats per minute. In 0.001M perchlorate, the average heart rate was 221 bpm after 1 minute; 217 bpm after 15 minutes, and 215 bpm at 30 minutes. In 0.01M perchlorate, the average heart rate increased from 247 to 274 bpm after one minute, 297 beats after 15 minutes and 289 beats at 30 minutes. In 0.1M perchlorate the average Daphnia heart rate after 1 minute increased to 383 bpm, and to 403 bpm after 15 minutes.
Addition of the antioxidant turmeric to Daphnia that had been exposed to 0.01M perchlorate for 15 minutes lowered the average heart rate from 369 to 331 bpm within 1 minute; the heart rate continued to decrease to 114 bpm after fifteen minutes.
When Daphnia were exposed to a solution containing both 0.01M perchlorate and turmeric, the average heart rate dropped from 381 bpm to 269 bpm in just 1 minute. After 15 minutes the heart rate had dropped to 181 bpm.

Conclusions/Discussion
This study demonstrated an increase in heart rate in Daphnia magna upon short-term exposure to the oxidant contaminant perchlorate in water. The results also showed a dramatic reversal of this increase with the addition of the antioxidant turmeric. In the event of a toxic exposure to high perchlorate levels, turmeric may represent a natural, economic, and readily available antidote. These tests should be repeated to confirm the results.

Summary Statement
My project studies the short-term effects of perchlorate and turmeric on the heart rate of Daphnia magna.

Help Received
My teacher, Ms. Hunker, gave me wonderful advice. My father, Dr. Chan, helped me with the experiments.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Joshua J. Compton

Project Number
J0805

Project Title
The Effectiveness of Ridgetop Fuelbreaks in Modifying Wildfire Behavior on Moderate and Steep Forested Slopes

Abstract

Objectives/Goals
The objective is to determine the effects of ridgetop fuelbreaks (created by altering vegetation on the ridgetop) on the spread of wildfires, in a forested stand, on moderate (35%) and steep (65%) slopes.

Methods/Materials
Two models (1/150th scale) were constructed using soil mounds with 35% slopes. Wire mesh was placed on the slope to establish a fixed grid pattern. Pine branches, alder twigs, chemise brush, pine shavings, and moss were placed on the mounds in a predetermined pattern. Vegetation was altered on the ridgetop fuelbreak model. A space heater was used to simulate fire weather. The vegetation was ignited and results mapped out corresponding to trees, snags, brush, and surface fuels consumed, partially consumed, and not consumed. This experiment was repeated three times. Two models (1/150th scale) were also constructed using soil mounds with 65% slopes, and the experiments repeated three times.

Results
Complete consumption of trees, snags, brush, and surface fuels was greatest in the control stands, ranging from 50.6% to 63.9%. The ridgetop fuelbreaks on the steep slopes were more effective than on moderate slopes, with complete consumption of trees, snags, brush, and surface fuels ranging from 43.9% to 49.2%.

Conclusions/Discussion
Ridgetop fuelbreaks on moderate and steep slopes were effective in suppressing the wildfires. However, the ridgetop fuelbreaks on the steep slopes were more effective than on moderate slopes which is contrary to background research conducted. The consumption of vegetation was significantly reduced when the wildfires reached the ridgetop fuelbreaks. Ridgetop fuelbreaks can be an effective tool in fire management. The use of ridgetop fuelbreaks in high fire risk areas can reduce the consumption of fuels, thereby suppressing wildfires and allowing firefighters to take control.

Summary Statement
My project is about evaluating the effectiveness of ridgetop fuelbreaks on wildfire behavior, on moderate and steep slopes, using a model forested landscape.

Help Received
Father helped construct soil mounds, gather and place vegetation. Mother helped organize log book and display board.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Gabriel Contreras; Jacob Gowan; Joe Knedler-Defrenne

Project Number
J0806

Project Title
Flood Control

Abstract

Objectives/Goals
The goal is to find out which material is the most efective in preventing flooding.

Methods/Materials
Sandbags and a variety of materials were used in tis experiment.

Results
Clay heldback the most water bwhile gravel and grass hay held back the least.

Conclusions/Discussion
Clay works the best for preventing flooding. Gravel and grass hay work the worst for preventing flooding.

Summary Statement
This projects purpose is to discover which material works the best in sandbags to prevent flooding.

Help Received

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Taya S. Crayk-Bonde

Project Number
J0807

Project Title
Which Microorganism Works Best in Bioremediation, Bacteria or Mold?

Abstract

Objectives/Goals
THIS EXPERIMENT STUDIED THE QUESTION OF WHICH MICROORGANISM, MOLD OR BACTERIA WOULD DO BETTER IN THE BIOREMEDIATION PROCESS, BY REDUCING, ELIMINATING OR CONTAINING CONTAMINANTS SUCH AS OIL IN AN OIL SPILL.

Methods/Materials
FIRST, AN AGAR WAS MADE TO GROW BACTERIA ON BY MIXING KNOX GELATINE WITH A SOUP BOULLION CUBE AND WATER AND BRINGING THEM TO A BOIL. THIS MIXTURE WAS POURED INTO STERILE PETRI DISHES AND ALLOWED TO SET INTO A GEL. A SALIVA SAMPLE WAS TAKEN FROM MY PET CAT AND PLACED ON THE MEDIUM FOR THE BACTERIA TO GROW ON. THE BACTERIA WAS GROWN FOR 10 DAYS. THEN, MOLD (PENICILLIUM) WAS GROWN BY PUTTING LEMON WEDGES, DUST AND WATER INTO SEALED BAGGIES AND PLACING THEM INTO
A SEALED CONTAINER FOR 10 DAYS. THE MOLD AND THE BACTERIA WERE THEN HARVESTED TO BE PLACED INTO 6 READIED "SIMULATED OIL SPILLS". THERE WAS TWO CONTAINERS THAT WERE AGITATED 3 TIMES A DAY - THEY WERE (LIKE THE WAVES), THERE WERE TWO CONTAINERS THAT WERE STILL - (LIKE A LAKE), AND THERE WERE TWO THAT HAD SAND AND WERE (LIKE A BEACH). NUTRIENT FERTILIZER WAS ADDED TO SPEED UP THE PROCESS. THE RESULTS WERE DOCUMENTED DAILY OVER A 10 DAY PERIOD, AND PHOTOGRAPHS WERE TAKEN.

Results
THE THREE CONTAINERS THAT HAD MOLD INTRODUCED DID NOT SEEM TO HAVE ANY EFFECT ON ELIMINATING, REDUCING OR DEGRADING THE "SIMULATED OIL SPILLS". THE CONTAINER WITH BACTERIA AND THE AGITATED WATER - (LIKE THE WAVES), ALSO HAD NO APPARENT CHANGES OTHER THAN COLOR. THE CONTAINER THAT HAD BACTERIA INTRODUCED THAT WAS THE STILL WATER - (LIKE A LAKE), HAD A MODERATE AMOUNT OF DEGRADATION OF OIL, MORE THAN 1/2. ALSO THE SAND AND WATER - (LIKE A BEACH), HAD THE MOST REDUCTION OF OIL, ALMOST 3/4.

Conclusions/Discussion
I CONCLUDED THAT THE BACTERIA WAS A MORE EFFECTIVE MICROORGANISM IN BIOREMEDIATION THAN THE MOLD IN THIS EXPERIMENT.

Summary Statement
THIS EXPERIMENT IS ABOUT FINDING OUT WHICH MICROORGANISM IS BETTER IN BIOREMEDIATION - BACTERIA OR MOLD?

Help Received
MY MOTHER TOOK THE PHOTOGRAPHS OF ME.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Taras B. Dreszer

Project Number
J0808

Project Title
Hydrogen Factory in a Bottle: Getting Hydrogen from Organic Waste and Anaerobic Bacteria

Abstract

Objectives/Goals
I am trying to produce hydrogen as a clean energy source. The two current methods to obtain hydrogen are either expensive or pollute. Can I get hydrogen from anaerobic bacteria and organic waste? Hypothesis: It is possible to obtain hydrogen from organic waste using anaerobic bacteria.

Methods/Materials
In this experiment I baked dirt to isolate heat resistant spores of anaerobic bacteria. I then chopped and boiled corn stalk and combined it with the dirt in a bottle, removing oxygen. From this I collected biogas, and attempted to isolate hydrogen by having it leak from a balloon. Finally, I used a mass spectrometer to determine if I had produced and isolated hydrogen.

Results
I got a total of 109 ml. of biogas, but only 1.5 ml of gas escaped the balloon. With the mass spectrometer, I proved that this was almost pure hydrogen.

Conclusions/Discussion
I believe that I have proven my hypothesis, but my methods have also proven to be inefficient. Although I did not prove that you could run a hydrogen economy on organic waste I did learn a great deal.

Summary Statement
I obtained hydrogen from organic waste using anaerobic bacteria.

Help Received
Father helped with set up, take down and transportation; Kirk Gilmore provided access to a Mass Spectometer.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Dillon Cole Flournoy

Project Number
J0809

Project Title
Solar Disinfection of Water

Abstract

Objectives/Goals
My project was to determine whether or not there would be fewer bacterial colonies in contaminated water after being exposed to sunlight. I wanted to find and easy and inexpensive way for people in developing countries to disinfect their water.

Methods/Materials
I collected nine samples from three different water sources. Samples of the contaminated water were spread on auger plates and put in an incubator for thirty-six hours. The contaminated water was then exposed to the sun for five hours. After sun exposure, more samples were spread on new auger plates and put in an incubator for thirty-six hours. Bacterial colonies on the auger plates, from before and after sun exposure, were then counted and compared.

Results
After counting and comparing the bacterial colonies on the auger plates from before and after sun exposure, I found that there was 45-50% fewer bacterial colonies in the contaminated water that had been exposed to the sun.

Conclusions/Discussion
After researching my topic, I thought that there would be at least a 90% kill of bacteria in the contaminated water. I may have had a better outcome if I had left the contaminated water in the sun longer, had a less cloudy day or extracted all of the air from the bottles. I think this experiment will work with some changes and will provide an easy and inexpensive way for people to disinfect contaminated water.

Summary Statement
My project was to disinfect contaminated water by exposing the water to the sun's U.V. rays.

Help Received
Dr. Catania and the Modoc Veterinary Center for the use of their incubator. My mother for driving me around so that I could collect supplies, deliver samples of water, and for taking me to the Veterinary Center.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Ryan M. Fox

Project Number
J0810

Project Title
The Removal of Toxic Chemicals from Contaminated Filter Materials: An Extended Study

Abstract

Objectives/Goals
The Goal of my project is to properly remove and dispose of the Toxic chemical Malathion from my filter Media.

Methods/Materials
Remove the Malathion trapped inside my filter materials using the processes Photolysis or sunlight, Thermal Reaction or heat, and Chemical Reaction to then break apart the Malathion compound in to separate non-hazardous molecules.

MATERAILS
Almond, Walnut, and Pistachio shells, Activated Carbon, Filter rack, pH strips, cups, water, pans, 4 filters, Malathion, Crickets, Stop Watch, Milk Cartons, Blender, spray bottle, screen, Phosphorus tester, Sulfide tester, grill, thermometer, and stove.

Results
I was able to break up and remove the Malathion compound on some of my filters. Photolysis or sunlight was the best process for removing the Malathion, the Chemical reaction was the least successful. I removed the Malathion from the Activated Carbon using heat and the Walnut shells using Photolysis. The Chemical reaction did not appear to remove the Malathion.

Conclusions/Discussion
Malathion can be removed from contaminated water by natural filter materials such as Walnut Shells, Pistachio Shells and Almond shells. The trapped Malathion can be broken down into non-hazardous molecules such as hydrogen sulfide and phosphourus oxide. These molecules can be released back into the enviroment.

Summary Statement
Remove and safely dispose of the toxic malathion in my filter media.

Help Received
Dad; Revise writing, helping with interview, and getting materials

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Tamar J. Freeland

Project Number
J0811

Project Title
Toil With Oil

Abstract

Objectives/Goals
I believe that medium textured human hair will adsorb the most oil because it is not too coarse, but not too fine and thin.

Methods/Materials
First I collected different types of hair. I then put a consistant weight of hair into a piece of mylon and weighed it. Next I put the hairball into a beaker of oil and water and let it sit rot three minutes. When the time was up, I immediatly took the hairball out of the liquid and calculated the percent of oil adsorbed. Materials; Human hair, donkey hair, horse hair, mule hair, cow hair, goat hair, dog hair, 250 ML beaker, vegetable oil, water, scale, nylons, and calculator.

Results
All of the hair, excluding meduim textured human hair adsorbed 60% or more of the oil. None of the hair adsorbed any measurable water. Donkey hair adsorbed the most oil, adsorbing 96%, and medium human hair the least, adsorbing 47%.

Conclusions/Discussion
I believe that animal hair adsorbed more oil than human hair because of it's light weight. The lighter it was, the more hair went into a nylon, hence, more surface area, so more oil was adsorbed. As for the results of the human hair, I believe it had to do with texture. I did this project because I am interested in ways to promote a healthy environment.

Summary Statement
My project deals with adsorbing oil with different types of hair to see what kind of hair adsorbs the most.

Help Received
My dad helped me find a way to do my experiment and payed for equipment, and my science and math teacher gave me guidance and help along the way.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Everett "Rett" Frost

Project Number
J0812

Project Title
Turning Up the Heat: Optimizing a Portable, Low Cost Solar Oven Design

Abstract

Objectives/Goals
The objective is to explore the most cost effective, portable, box style solar oven that could be used in underdeveloped countries to pasteurize water or sterilize food.

My hypothesis was the 36 in cube oven, covered oven with mirror walls and a tall stand would be the most effective oven.

Methods/Materials
I tested three sizes of ovens, two reflective materials, covered and uncovered ovens and two different stand heights. I build the oven and placed a 15 gram water sample in the oven. I measured the temperature of the water sample every 15 minutes during the 90 minute testing period. I tested the ovens side-by-side so that I could eliminate some of the independent variables like angle of sun, wind, quality of sun, etc.

Results
The mirror material out performed the aluminum material. The 18 in cube oven out performed the large ovens. The covered ovens out performed the uncovered and the lower stand height was only slightly better. After adjusting for the cost of the reflecting material, the aluminum foil was the superior performer.

Conclusions/Discussion
Results did not support the hypothesis. The best performer was the 18 in cube, covered oven. This portable, low cost oven could offer underdeveloped countries a realistic solution to cooking food, or pasteurizing water.

Summary Statement
Optimizing a Portable, Low Cost Solar Oven Design

Help Received
Chase Brutten, a friend helped me take numerous temperature readings. I borrowed a light meter and digital camera.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Leslie S. Gray

Project Number
J0813

Project Title
What Effect Does Aeration Have on Algae in Pond Water?

Abstract

Objectives/Goals
The purpose of my project was to see if injecting air cleans the algae in pond water. I predicted that injecting air into pond water would reduce the amount of algae.

Methods/Materials
Four ten gallon tubs were filled with 4 gallons of pond water collected from the same area in the pond. Fillamentous algae was also collected from this same area. The algae was squeezed and strained to remove as much water as possible. 200 grams of algae was weighed and placed in each of the four tubs. 2 watt Aquarium pumps were placed in 3 of the tubs (the 4th was the control with no aeration). Each pump was placed on an automatic timer to run twice a day. Each pump ran daily for different amounts of time totalling: 90 min., 120 min., 150 min. On days 5, 10 & 15 the algae was strained and weighed from all four tubs.

Results
The algae was reduced 51%, 44%, and 38% in the tubs receiving aeration of 150 minutes, 120 minutes and 90 minutes respectively. The algae in the tub receiving no aeration (the control) did not change over the 15 day experiment.

Conclusions/Discussion
It was my thinking that aeration would put oxygen in the water, therefore keeping it fresher and free of algae. While aeration did clean up the water it was not for the reason I thought (according to my resource Mr. Young). The bubbles created agitation which is what killed the algae. Algae actually needs oxygen to grow. So I was giving it a necessary part of its reproduction needs. But the aeration/agitation had an overriding affect.

Summary Statement
I was testing the effects of aerating pond water to see if it would reduce the algae in the pond water.

Help Received
My Mom helped typed the report; Mr. Gong helped me design the Procedural Flow Chart.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
William B. Hance

Project Number
J0814

Project Title
Can Your Household Trash Make a Backyard Splash?

Abstract

Objectives/Goals
My main objective throughout this experiment was to try and discover if normal household waste products could be put back to use in our environment somehow. I was eager to observe exactly which household waste product could act as the most effective waste fertilizer and help promote the growth of the English Primrose and Quinalt Strawberry plants the most.

Methods/Materials
While planting the primroses and strawberries, I used instruments and supplements such as potting soil, the waste fertilizers, and 10 cm plastic pots. During my test, I planted 25 mL of each waste product 3.25 cm below the soil of each English Primrose and Quinalt Strawberry plant. Every five days, I recorded a very thorough log of writing and quantitative measurements. I spaced my measurements every five days to give the plants enough room to grow healthily and to fully show the results of each household waste fertilizer.

Results
Overall, the used coffee grounds promoted the growth of both the English Primrose and Quinalt Strawberry plants the most. In the primroses, the plants grew to an average height of 20.2 cm from an average height of 14.3 cm in the beginning of the experiment. The strawberries grew to an average height of 15.1 cm from an average height of 10.1 cm. There was a 24% higher growth rate in the primrose plant fertilized with coffee grounds and a 10% higher growth rate in the strawberry plant fertilized with coffee grounds than the waste fertilized primrose and strawberry plant with the next highest growth rate.

Conclusions/Discussion
I have concluded that the coffee grounds were the most effective form of waste fertilizer for both the plants used in my experiment. I have also concluded that all of the waste fertilizers helped the plants grow to their full potential, and that they helped provide nutrients and essential elements that normal potting soil could not provide. Overall, I have concluded that my experiment was a great success, and that it was one of the most fun and fulfilling experiments I have ever performed.

Summary Statement
My science fair experiment is about the use of household waste products to help enhance growth in plants.

Help Received
Mother helped glue board.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Theresa J. Hannig

Project Number
J0815

Project Title
From Your John to the School Lawn: Is Recycled Water Really Safe?

Abstract

Objectives/Goals
Purpose: Does watering with recycled water affect the safety of school lawns?

Hypothesis: I think that watering with recycled water does not affect the safety of school lawns.

Methods/Materials
I grew three patches of lawn in three separate miniature greenhouses using plastic boxes, chicken wire, and clear plastic trash bags. I watered one with recycled water, one with distilled water, and the other container with tap water. I measured their growth rate and compared the appearances of the grass patches in each container. I collected water runoff samples and tested each for pathogens, nutrients, and other characteristics.

Results
The recycled water patch grew faster, looked better, had a lower pathogen level, and higher nutrient level than the tap or distilled water patches. None of the runoff samples had residual chlorine.

Conclusions/Discussion
Conclusion: My hypothesis is partially correct. The recycled water did not affect the lawn in a bad way, but instead affected it in good way. The lawn that was watered with recycled water grew the fastest, had the lowest pathogen levels, one of the best appearances, and the highest nutrient level. Recycled water is extremely safe and actually better for irrigation use than other sources because its residual chlorination kills pathogens and its residual nutrients from our waste created healthier grass.

Practical Application: Recycled water could be used as a new local water source. By recycling wastewater, instead of discharging it into the marine environment we can conserve tap water and decrease water contamination.

Summary Statement
I tested the effect of recycled water on the safety of school lawns and found that recycled water improves grass growth and health without increasing pathogen levels.

Help Received
My parents gave me lots of helpful suggestions. Ken Kaufman at South Bayside System Authority (SBSA) gave information and suggestions. Calleen Wilcox-Hanlon, Water Quality Specialist at the SBSA, did the lab testing. Kathy Suter, the lab director at the SBSA, explained the pathogen test.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Meg E. Haupt

Project Number
J0816

Project Title
Percolation Purification: Cleaning Our Wastewater

Abstract

Objectives/Goals
My statement of the problem is, Which material (sand, charcoal, or gravel) will best filter waste from creek water? My hypothesis was that the charcoal would work best at filtering creek water because it is used in aquariums for filtration of water.

Methods/Materials
I used sand, charcoal, and gravel, and filtered local creek water through the materials. I then tested the water for the COD (chemical oxygen demand), turbidity (cloudiness), and suspended solids, at the local Dublin San Ramon Wastewater Treatment Plant, to see which one worked best.

Results
When running my procedure I ran a duplicate sample of each material thereby running the experiment twice. I then ranked each material for each test 1-6, with 1 being the best, and added up the total score for both samples on all three tests and compared the final scores. Gravel=16, Charcoal=18, and Sand=29.

Conclusions/Discussion
The results of my experiment did not support my hypothesis regarding charcoal. The material that worked best at filtering waste from creek water was gravel. The next was charcoal, and last was sand. I did notice visually that when filtering creek water through charcoal sample #1, there was a considerable amount of charcoal dust in the filtered water. I believe this is due to the fact that the sample for charcoal #1 was lower in the container of charcoal than charcoal sample #2, and so it was dustier. I rinsed both samples in equal amounts of pure water to get rid of the dust. If I had to do this experiment over again I would have mixed the charcoal in the container before taking the samples to better ensure not getting charcoal dust. If you compare the charcoal samples individually, you will see that the charcoal #2 out performed gravel.
The results of my experiment show that gravel would be a practical, natural, and effective material to place along waterway banks to help reduce water pollution.

Summary Statement
I did my project to see which material (sand, charcoal, or gravel) would best filter waste from creek water.

Help Received
I used lab equipment and test materials at the Dublin San Ramon Wastewater Treatment Plant under the supervision of Flordeliza Misra, Environmental Services Administrator.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Michele K. Jenkins

Project Number
J0817

Project Title
Determining the Effects Polymers Have in Reducing the Toxicity of Contaminated Soil

Abstract

Objectives/Goals
The objective of my project is to determine the efficacy of water-absorbing polymers in absorbing liquid contaminants in soil.

Methods/Materials
Diazinon, used motor oil, and gasoline were used as the variables in my trials with living organisms (crickets). Glyphosate and a salt solution were the variables in the germination rate tests (radish seeds). I contaminated 5 identical individual soil samples made from sand and potting soil with each of the variable, then took more soil samples for the testing. Prior to this, I took the pH of each of the contaminants for data purposes. I then contaminated the soil with a set amount of contaminant, and tested the toxicity level of each (ie. Timing the cricket's death rate and plant's germination rate). After the data was collected, I added water and polymers to the soil from which the samples originated, and a 48 hour absorption period ensued. After that, I retested all of the trials, then collected and compared the corresponding results.

Results
The polymers reduced the toxicity of the contaminants in each of the cases, excluding the motor oil. In the cricket trials, the gasoline's pre-test average compared to the post-test average had increased the insect's longevity rate by 6:894 minutes. In the diazinon's averaged trials, the longevity was increased by 5:99. In the germination trials, the germination rate was reduced in the glyphosate by 43 1/3 hours, and in the salt solution's by 10 2/3 hours.

Conclusions/Discussion
When the data is analyzed in my project, it can be concluded that polymers can reduce soil toxicity when contaminated with a water-based solution. Because of this, I have also proved that polymers also have a positive effect on the environment when used under these circumstances. Unfortunately, the polymers have no effect on the motor oil, seeing as they did not absorb any of it, even though its fumes were not toxic to the insect.

Summary Statement
My project studies the effects of polymer crystals in absorbing contaminants from soil.

Help Received
Mother typed Introduction, Grandmother taped board, Aunt helped with research, Uncle provided oil and pesticide

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Alex M. Koppel

Project Number
J0818

Project Title
In Hot Water

Abstract

Objectives/Goals
Is it practical to build a solar water heater that would contribute energy to a home at lower cost than buying energy from the power grid?

Methods/Materials
I built a solar water heater with a length of tubing within a wooden frame and covered with Plexiglas. This heater was connected to a water reservoir which contained a small electric pump. Over several days I measured the increase in temperature of the water as the heater sat in the sun.

I then calculated the heat generated, and compared it to the cost of purchasing the same amount of energy from Pacific Gas & Electric.

Results
Even in January, I was able to generate a gain of around 50 Watts of heat per hour. The cost of the solar heater was less expensive than buying the same power from PG & E over a 1 1/2 year period.

Conclusions/Discussion
It is straightforward to build a solar water heater that contributes energy to a home, at less cost than purchasing the power from the electric power utility, with a payback period under two years. It would be straightforward to build a larger heater that is of practical use and could be connected to a home.

Summary Statement
My project demonstrated that it is straightforward to build a solar water heater for a home.

Help Received
My father helped me build the apparatus, and gave me advice on how to compare the cost of my heater with the cost of purchasing electric power.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Magda T. Langiewicz

Project Number
J0819

Project Title
How to Eliminate the Energy Crisis in California

Abstract

Objectives/Goals
My objective was to prove that the energy crisis in California could be solved by use of energy efficient lighting in each household.

Methods/Materials
I've created a survey asking how many light bulbs on average there are within a household, the type of lighting used, number of hours used, and the wattage of each bulb.
I've calculated the energy usage used for lighting per day, month, and year.
By analyzing a data I've estimated how much energy could be saved by use of energy efficient lighting.
I have estimated how much energy we would save if we replace one, three, five incandescent bulbs or 50%, 75% and 100% of incandescent bulbs with fluorescent bulbs.

Results
My results were that the average energy usage for lighting per household is 2.426 MWh. The average incandescent light bulb energy usage is 2.233 MWh, and the average fluorescent energy usage is 0.193 MWh. The total energy saved per household is 0.773 MWh and the average wattage of an incandescent bulb is 60 Watts. The average number of incandescent bulbs is 40, the average number of fluorescent bulbs is 8 in each household, so the average total number of bulbs is 48 and the average hours the light is on through the year is 1224.2 hours.
Changing three bulbs in each household in San Diego County would preserve the amount of energy produced by the San Diego Kearney Power Plant. On the other hand, changing five light bulbs in each household throughout the state would preserve more energy than the capacity of the Diablo Canyon; the largest nuclear power plant in California.

Conclusions/Discussion
The statistical analysis of my data shows that if we were to convert all or many of our incandescent light bulbs to fluorescent lighting we would be able to reduce or even eliminate energy shortage through the San Diego county and the state.
My project has encouraged people to be more concerned about energy usage, its shortage and methods of preserving it.

Summary Statement
My project shows how to reduce the energy shortage in California by using energy efficient lighting, "smart lighting".

Help Received
100 survey participants provided information about energy usage for lighting within their household and my father for guiding me through my project.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Kelsey M. McClure

Project Number
J0820

Project Title
Will Biodegradable Plastic Spoons Decompose in Common Environments?

Abstract

Objectives/Goals
By performing this experiment, I hoped to find out in what types of environments wheat-based and corn-based biodegradable plastic spoons might or might not decompose. I also tried to incorporate the question: 'Do the spoons biodegrade in common environments in an amount of time reasonable enough to warrant the higher cost per utensil?'. I believed that such a question, once answered, would motivate people to spend a little more now to help preserve our natural resources and environment for the future.

Methods/Materials
To conduct the experiment, I set up four environments and placed five of each type of spoon in them. The three types of spoons were wheat-based, corn-based, and petroleum-based plastic (for a control. The environments in which the spoons were placed included household worm-enhanced compost, air (outside exposed to the elements), freshwater, and SF bay water. After removing the spoons from their respective environments at 33 days, I gave them all a uniform rinse. The spoons were left to dry overnight. They were inspected for signs of pitting, mold, or other decay. They were then placed on a balance, with the five exposed spoons of one type from the same environment weighed against five unexposed spoons of the same type.

Results
Of the three types of spoons tested, only the wheat-based spoons showed signs of decomposition. The wheat-based spoons in the compost lost weight and showed obvious signs of decay. The wheat-based spoons in air, freshwater, and bay water all gained slight amounts of weight due to moisture absorption from the damp environments, as well as showed signs of early biodegradation. No changes occurred with the corn-based spoons or petroleum-based spoons throughout the experiment.

Conclusions/Discussion
The wheat-based spoons showed considerable amounts of biodegradation. In my hypothesis, I stated that both types of biodegradable plastic spoons would show the most signs of decomposition in the compost because of the biologically active environment it provided. However, the corn-based spoons had no weight difference between the unexposed and exposed ones in any of the environments due to their more specific biodegradation requirements. The wheat-based spoons began to decompose in every environment, making them the clear choice for consumers willing to pay the extra pennies to conserve our natural resources, and minimize the impact on our landfills.

Summary Statement
The purpose of my project was to determine if biodegradable plastic utensils will decompose in common environments in an amount of time reasonable enough to justify their additional cost.

Help Received
I received help in the form of transportation while purchasing and collecting materials. My father helped me construct an enclosure to keep my spoons safe from animals while they lay in the compost.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Claire E. McKinley

Project Number
J0821

Project Title
But Not a Drop to Drink! Third World Water Purification

Abstract

Objectives/Goals
The objective was to find a method of purifying water which was simple, effective and inexpensive, and so could be used in a third world country. Four methods were tested: chlorination, boiling, solar (UV) disinfection, and solar heat disinfection (the AquaPak).

Methods/Materials
The materials obtained were empty water bottles, unopened water bottles, secondary effluent, 1 bottle of Clorox bleach, 1 AquaPak, 1 stainless steel pot and 1 eyedropper. The empty bottles were cleaned and filled with a mixture of secondary effluent and bottled water in a ratio of one to ten, respectively. Two drops of bleach were added to six samples. Water for another six samples was boiled for thirty minutes. Six samples were placed in direct sunlight for six hours. Another six samples were poured into the AquaPak and placed in the sun, and at least one sample was refrigerated, serving as the control. This entire process was repeated three times.

Results
The samples were subjected to a heterotrophic plate count. The control plates averaged 168.4 colonies. With chlorination, the plates averaged 4.8 colonies. Chlorination was the most effective method in eliminating the bacteria. The next most effective method was boiling, which averaged 5.9 colonies per plate. The third most effective method, according to the results, appeared to be the AquaPak, which averaged 19 colonies per plate. The least effective method in this experiment was solar (UV) disinfection, which averaged 110.3 colonies per plate.

Conclusions/Discussion
Chlorination was effective in eliminating bacteria and is an inexpensive method of purifying water. It is also less subject to inadvertent contamination than the other methods, since it#s able to eliminate bacteria after its addition to the water. Although boiling is also very effective, it#s possible that water can be contaminated after it is boiled. Boiling should have eliminated all bacterial colonies in this experiment, and its failure to do so suggests inadvertent contamination. Also, boiling is easily the most expensive method tested, and cost is an extremely important consideration in the third world. The AquaPak eliminated most of the bacteria, and it was also very inexpensive. However, the AquaPak did not eliminate as many bacterial colonies as boiling or chlorination. In this experiment, solar (UV) disinfection was an ineffective method of water purification.

Summary Statement
The objective was to find a method of purifying water which was simple, effective and inexpensive, and so could be used in a third world country; four methods were tested.

Help Received
My mother drove me to San Elijo Water Reclimation Facility - the lab where I tested my samples. Suzanne Mosko (a chemist at the lab) provided me with secondary effluent and taught me how to do a heterotrophic plate count. My science teacher, Mrs. Hunker, edited my abstract and my report.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Nikki Mercado

Project Number
J0822

Project Title
Purification of Water through Solar Energy

Abstract

Objectives/Goals
Many peaple live without clean water. Governments recommend that people boil water, but they do not do that for the following reasons: 1)people don't believe in the germ theory of disease, 2)they think the fuel is too limited or costly, 3)people think the heat and smoke are unpleasant. My goal is to introduce to these people that they can purify their water without the bad heat, smoke, or cost.

Methods/Materials
To set up my project I made a solar cooker out of aluminum foil, cardboard, black painted can, and a soda bottle. I also used other water purifiers like a black pan, copper pot in a basket of leaves, heated by Fresnel lense, and a regular black can in a soda bottle. Since the solar cooker turned out to be the best water purifier, I pored the contaminated water into the black painted can of the solar cooker. I then put that can inside the soda bottle by cutting the top half. I put that bottle on the cardboard wrapped in aluminum foil. Next, I placed this solar cooker outside in the sun, checking on it every 15 minutes to see if it had moved or what temperature it was by looking at the thermometer I had placed in the can. As soon as the thermometer reached a temperature of 150 degrees Fahrenheit, I waited 6 more minutes to make sure it stayed at that temperature. Then, I took the black can out of the soda bottle. Into one of my sample bottles, I pored the water and the testing chemical. I put the sample bottle in the incubator I made out of cardboard box and a light bulb and let it sit there for 24 hours. I, of course, put the water in the incubator before I put it in the solar cooker to make sure it was truely contaminated water. As soon as it was 24 hours, I checked the water sample to see if the chemical made it yellow or clear (if it is yellow the water has bacteria in it, but if it is clear, it does not).

Results
The water turned out clear.

Conclusions/Discussion
In conclusion, I know now for sure that water can be purified using solar energy at a temperature less than boiling, as I stated in my hypothesis. But I feel this area of research needs to be recognized by more people. I think more testing is needed for final results to this experiment. So, I hope, by my investigation, I am able to educate these people that can not afford purified water to realize that boiling is not the only way. I want to help these people by finding a new way to purify their water through solar energy.

Summary Statement
I purified water at a lower temperature than boiling, using solar energy as my heating source.

Help Received
Used water purification chemical equipment under supervision of my grandfather (he knew how to use it)

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Laura B. Mitchell

Project Number
J0823

Project Title
Oil Spill Cleanup: Beyond the Major Methods

Abstract

Objectives/Goals
The purpose of this project is to explore methods of cleaning oil spills other than the major methods used (burning, biotechnology, and the use of biological agents). After learning about these methods, I also want to determine which one is the most effective.

Methods/Materials
I modeled all the methods and the oil spill itself on a small scale by using common household objects. An #ocean# was created by mixing two cups of water with regular sea salt, and then placing the mixture in a glass Pyrex container. I then poured some motor oil into the container, and placed plastic tubing # representing a boom # around the spill. I modeled four methods in the following ways:
SPONGE: place a normal household sponge into area of spill
SAND: pour half of bag of sand into area of spill
DETERGENT: pour small amount of liquid laundry soap into spill area
SKIMMING: use fat skimmer to filter oil out of water

Results
All of the techniques tested were somewhat effective. Respectively, they removed about this much of the oil: sponge # 35-40%, sand # 99%, detergent # 60%, skimming # 99%.

Conclusions/Discussion
I concluded that simple cleanup methods work reasonably well, and the most effective are the use of sand and skimming. These procedures could be used in a situation where a more complicated cleanup was not possible, and would be successful.

Summary Statement
I am testing how well small, alternative techniques clean up oil spills.

Help Received
Father helped with board layout

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Phaivanh Phonxaylinkham

Project Number
J0824

Project Title
Comparing How Pesticide Will Penetrate through Different Ash and Soil Combinations

Abstract

Objectives/Goals
The purpose of my science project is to compare how pesticide will penetrate through different ash and soil combinations. I want to know if slash and burn techniques are beneficial by doing this experiment.

Methods/Materials
I used soil, 5 different types of wood ash(lemon,grapefruit,cherry,grape,and orange),pesticide,crickets, cardboard rolls, ducktape, dropper, mallet,match, measuring cups, containers, razor, and a timer. Before i started my experiment, I had to tape 2 cardboard rolls together and make two slits with the razor on top of the plastic containers so that the roll can fit into the slits, but before I put to roll into the slits, I had to pock two pinholes on the bottom of the rolls. Then after I did that i began my project.

Results
The results of my experiment showed that the grapfruit ash mixed with soil was the best into allowing the pesticide to penetrate through it faster to kill an average of 4.25 crickets within a 20 minute time limit. The control (just soil) did the least effect into killing to crickets. The average amount for the control was zero. The orange and cherry wood ash came 2nd best with an average of 2 crickets dead within a 20 minute time limit. The grape and lemon wood ash came in 2nd to last into killing an average of 1 cricket within a 20 minute time limit.

Conclusions/Discussion
After completing my project I found my hypothesis incorrect. It stated that the grapefruit wood ash will make the pesticide penetrate through it slower than the orange wood ash within a 20 minute time limit.

The grapefruit ash did the best and the control did the very least. The cherry wood ash and the orange wood ash came in 2nd best. The lemon and grape wood ash came in 2nd to last. I observed that some of the different types of ash was probably thicker than each other.

I learned that different types of wood can make a difference in thickness or softness. When having ash in soil, it loosens it up and the pesticide penetrates through it faster. From my research I foung that wood ash can actually help the soil.

In conclusion people who farm can try adding wood ash to their lands. It could raise the alkalinity in the soil and it wouldn't take so long for insects to die after pesticide is sprayed on. YOu can getr rid of the pest in a quicker manner, which means you won't have as much damage to your crops.

Summary Statement
My project is to find out if slash and burn techniques are beneficial.

Help Received
My science teacher revised my introduction and made sure I did all my papers required to be on the board; my father supervised my during my experiment.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Elizabeth M. Raymond

Project Number
J0825

Project Title
Getting the Bugs (and Other Things) Out of Water

Abstract

Objectives/Goals
My objective is to determine the best method of purifying water. I believe that the distillation method will work the best to remove both chemical and biological contaminants.

Methods/Materials
Obtain untreated lake water, and test it for the presence of chemical and biological contaminants using commerical water testing kits. Then purify the water using 9 different methods; coffee, foam, fiber and activated carbon filters, bleach, chlorine and iodine tablets, boiling and distillation. Then test each sample of purified water for chemical and biological contamints using the water testing kits.

Results
Distillation method worked the best, removing all contaminants. Boiling removed all bacteria and iron. Activated carbon removed some bacteria and iron. Chlorine, bleach, and iodine removed all bacteria but no chemical contaminants. Coffee filter removed some bacteria and no chemical contaminants. Foam and fiber filters added more bacteria into the water and removed no chemical contaminants.

Conclusions/Discussion
My hypothesis was correct being that the distillation method was more effective at removing the contaminants than the other methods. From doing this experiment I proved that different methods of water purification are more effective than others, and it is important to choose the correct method because some methods hardly work at all.

Summary Statement
Given the importance of water, my project was designed to figure out which method of water purification is most efficient in removing harmful substances such as chemcial and biological contaminants.

Help Received
Science teacher Mrs. Dwyer oversaw each step of project as class assignment; Dad helped with purchasing materials, transportation, and assisted with the experiments.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Jennifer C. So

Project Number
J0826

Project Title
Separation of Impurities from Water, Phase IV: Utilizing Natural Condensation and Electrolysis

Abstract

Objectives/Goals
The goals to this water recycling project is reduce the amount of impurities from water,& find the most efficient water recycling process.

Methods/Materials
Build a cylinder-cone shaped condenser,attached to a jar of impure water. 2 tubes should stick out opposite one another & into an airtight compartment to allow for water collection. Then whole structure is placed into a black box of sand & rocks (heat source). Model is placed outside to allow energy changes to stimulate production of water droplets. After collecting 250mL of water,it goes through the process of electrolysis (direct electrical copper charged plates) to lessen the impurities.

Results
The kilo-ohm resistance increased, indicating water with less impurities. This process was 48% efficient. After the electrolysis process with the direct electrical copper charged plates, the original water samples# resistance was higher & current was lower, indicating more ionization going on between the plates.

Conclusions/Discussion
My hypothesis was correct because the water was cleaner in terms of a decrease in amount of impurities. For condensation process,surface area for the evaporation of vapor and condensation of water droplets needed to be greater for the water condensation and evaporation to occur. The distance between the water surface and the condensation body had to be shorter. The last important problem that I encountered was water droplet transportation. To resolve this problem, I had to develop specialized, slanted structures to allow droplets to flow out from the recycling system and into confined jars. For the electrolysis, the amount of time that I took to measure the resistance would be an affect because the longer the water sits, the higher the resistance and less impurity it contains. i.e.,I measured the test container first & then the reference container. This would mean the reference container#s resistance would be a lot higher than test container because of the timing factor. To solve to problem I would use 2 ohm-meters, instead. Moreover, the voltage of the 12-volt battery might have lower electricity storage after different times in the experiment. This would affect the resistance being measure because then it#d be unequal for every time the water is measured for resistance. To resolve, I would apply regulated power supply.

Summary Statement
By using natural condensation and the electrolysis, cleaner water will be produced than without using the two techniques.

Help Received
My dad was the one who recommended me to do this project. My science teacher showed me the formats of writing and how to research on the information, I needed. I would like to thank my mom and my science teacher for obtaining materials for my science prjt

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Drew K. Spence

Project Number
J0827

Project Title
Do Low-Flow Toilets Actually Conserve Water?

Abstract

Objectives/Goals
The 1995 National Energy Policy Act required that low-flow toilets be installed in all new housing to reduce water usage. Consumers report however, that these toilets require multiple flushings and question the effectiveness of their water savings. I tested high-flow and low-flow toilets to see which one is more effective in conserving water and in meeting consumer acceptance.

Methods/Materials
A low-flow "Mansfield" 1.6 gallon (6.8 liter) toilet and a Standard 1975 3.8 gallon (16.1) toilet were used. A toilet paper usage survey was conducted and it revealed that on average 7 sheets of 2-ply toilet paper were used for liquid waste and 18 sheets of 2-ply toilet paper for solid waste. The experiment consisted of 10 flushes each of solid matter and liquid matter in each type of toilet. The average stool weight in western urbanized society is under 150 gm per day (Goodhart, Shills 1980). Volume of the stool was also taken into consideration and so two Hostess Ho-Ho-Ho#s weighing 56.7 gm and having a volume of 106 cubic cm were used to represent the solid matter. One drop of green food coloring was used to represent the liquid waste. Sheets of toilet paper were added as determined from the toilet paper survey. If a toilet became plugged it was plunged and cleared before the experiment resumed.

Results
Results of my experiment revealed that the low-flow toilet required the same number of flushings with "Liquid Matter" and twice the number of flushings on average with "Solid Matter". The toilet plugged with "Solid Matter" 40% of the time and required plunging. Converting number of flushings to volume of water used revealed that on average high-flow toilets used 9.3 liters more water with "Liquid Matter" and 3.13 liters more water with "Solid Matter" than the low-flow.

Conclusions/Discussion
Despite the multiple flushings required, the low-flow toilet used 58% less water with "Liquid Matter" and 16% less water with "Solid Matter" than the high-flow toilet. Consumer complaints that the low-flow toilet offers less water savings than it#s name implies may stem from the perception that more water is being used because more flushings are required. The increased incidence of toilet "pluggings" with low-flow toilets was supported by this project. For many consumers, avoiding a plugged toilet may be more important than saving water.

Summary Statement
This project compares the number of flushings required with low-flow and high-flow toilets to determine if low-flow toilets acutally conserve water.

Help Received
My mother purchased the items on my materials list. I used the low-flow toilet in my family's home and the "high-flow" toilet in my grandmother's home. My father took the photographs of me conducting the experiment and helped me to make certain the toilet was clear when it became plugged.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Finn Horve Sukkestad

Project Number
J0828

Project Title
River Bank Erosion: Rip Rap Records

Abstract

Objectives/Goals
The purpose of this project is to find out which rip-rap material is best at preventing water erosion. The three barriers tested were wood rip-rap, rock rip-rap, and a plant rip-rap.

Methods/Materials
In the experiment, a trench represented the river cavity and sand was embedded into its banks with the help of coffee filters. The barriers were then placed around the mounds of sand and a hose provided the rushing water. In the three trials, measurements of the remaining sand were taken on a small weight scale and then recorded.

Results
The results indicated more than what was in question. It was discovered that barriers do, in fact, prevent water erosion but, more importantly, that the material used as a barrier is not as important as the way that that barrier is built.

Conclusions/Discussion
That is, an arch-shaped barrier of wood, rock, or plant will prevent erosion at the same rate.

Summary Statement
This project is about the best methods for preventing water erosion on the banks of our Earth.

Help Received
JoEy watched while I recorded all measurements to make sure they were accurate; Mamma helped type report ; Pappa showed me how to make the graph results on the computer.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)

Yu (Joy) Sun

Project Number

J0899

Project Title

Dead Spots in the Ocean: HNLC Areas' Restriction to Phytoplankton's Uptake of CO(2)

Abstract

Objectives/Goals

A current solutions to global warming is to fertilize HNLC (High Nutrient Low Chlorophyll) ocean areas lacking iron with iron to increase CO2 absorption from phytoplankton. However, besides iron, some HNLC areas also lack silicate. The objective of this project is to determine if the absence of silicate or iron has a greater restriction to diatoms# uptake of CO2. I also want to determine if fertilizing HNLC areas with iron to decrease the rising levels of CO2 in the atmosphere is really the best solution, as opposed to fertilizing it with silicate, another needed but lacked nutrient.

Methods/Materials

Thalassiosira weissfloggi, a common diatom, was chosen to be used for the experiment. They were inserted into three different environments modeling after each of the two different HNLC areas and the standard culture that diatoms live in. After CO2 was inserted into the air tight vials, the Gas Chromatography was used to monitor the absorption of CO2 over time. The pH level was also tested at the beginning and end of the experiment to observe the CO2 uptake. To study the growth in diatoms, a cell count was conducted at the beginning and end of the experiment as well.

Results

Based on the results from the Gas Chromatography, diatoms in the culture without silicate had the least amount of CO2 absorption, at 7µl less than the standard culture. The results of the pH measurements corresponded with the Gas Chromatography results. Diatoms in the vials without iron were found to have the least cell growth, with a difference of approximately 6,800 cells/µl less than the standard culture.

Conclusions/Discussion

After the research and experiment, it is reasonable to presume that fertilizing the ocean with iron might not be the best choice. From the results, one can conclude that iron in the ocean doesn#t cause diatoms to have additional CO2 absorption but population increase instead. The extra phytoplankton would absorb more CO2 if it didn#t trigger zooplankton, a predator of phytoplankton, growth as well. The population increase in both of the organisms eventually evens out, because the extra zooplankton would consume the extra phytoplankton. On the other hand, the lack of silicate causes diatoms to have a decrease in CO2 uptake, so with the silicate stimulation, there will be more CO2 uptake without more population. Silicate fertilization also only triggers diatom growth and would not result in unwanted consequences.

Summary Statement

HNLC areas lacking silicate has a greater restriction to diatom#s uptake of CO2 than areas without iron, thus fertilizing the ocean with silicate is a wiser decision.

Help Received

Used Gas Chromatography and pH meter at the Department of Chemistry at UCSB under the supervision of Dr. Shouli Sun; Use the Hemacytometer and Microscope at the Department of Marine Biology at UCSB under the supervision of Mr. Mark Demarest; Mom helped with transportation.