CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Aamna J. Abbasi

Project Number
J1101

Project Title
Why Mummify if You Can Say Goodbye? Comparing Biodegradation in Dry-tomb and Bioreactor Landfills by Measuring CO(2)

Abstract

Objectives/Goals
The objective is to use carbon dioxide measurements (an end product of bacterial degradation), to determine if the new Bioreactor landfill design could be a better option for the disposal of municipal trash than traditional dry-tomb landfills. To take things a step further, both traditional papers/plastics and biodegradable papers/plastics were compared in each landfill prototype.

Methods/Materials
I built two Bioreactors and two dry-tomb landfills, proportioning the trash the same way as in a real life municipal landfill. Each Bioreactor and Dry-tomb landfill set had either traditional papers/plastics or biodegradable papers/plastics. Using a Q-Trak instrument, I measured the carbon dioxide in each prototype through a resalable port over a period of six months. On a monthly basis, I added 30% of the field capacity of liquid to each Bioreactor in the form of leachate/storm-water.

Results
Through the experiment, I determined that the Bioreactor with biodegradable papers/plastics showed the highest average and total carbon dioxide concentrations over a period of six months. The dry-tomb landfill with biodegradable papers/plastics and the Bioreactor with traditional papers/plastics were fairly close in carbon dioxide levels. The dry-tomb landfill with traditional papers/plastics demonstrated the least amount of carbon dioxide.

Conclusions/Discussion
Based on my experiment, I concluded that on a small scale that Bioreactors are a viable option for municipal waste disposal; providing additional landfill space through accelerated decomposition, as an immediate solution to more effective waste management the use of biodegradable papers/plastics will provide a significant impact to the status quo landfill design.

Summary Statement
Comparison of Biodegradation in Dry-tomb and Bioreactor Landfills By Measuring CO2.

Help Received
My mother and father helped get various tools needed. Grandma gave encouragement. I love you Grandma, this one's for you!

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
J. Alejandra Alvarez

Project Number
J1102

Project Title
The Power to Recycle

Abstract

Objectives/Goals
The purpose of this project was to test the effects of recycling water on three different kinds of plants. For that purpose I used three different kinds of water: white water, gray water, and black water. My goal was to find out if plants could grow when watered with water that has already been used in a household. Water is one of the most important natural resources that is vital for our living, and at this time that water levels are going down we need to save as much water as possible. We have the power to recycle water!

Methods/Materials
I used three different kinds of seeds: tomato, sunflower, and bean. I planted each one of them four times in order to water them with white water, gray water from the laundry, gray water from the kitchen sink, and black water. I observed them for 21 days, and each day I recorded the temperature and height of the plant. I repeated the experiment once more to get a more accurate result.

Results
According to my data the tomato plant grew better with black water, the sunflower plant grew better when watered with white water, and the bean plant also grew better when watered with white water.Even though plants watered with gray water didn't grow the fastest, it is still a good way of recycling water.

Conclusions/Discussion
The purpose of my project was to find out if plants watered with reused water will grow. In my hypothesis I stated that I thought plants watered with kitchen sink gray water will grow perfectly fine because of the food bits that contains a lot of nutrients. I, also, thought that gray water coming from the laundry would also grow fine because laundry gray water that contains a low concentration of soap could actually help the plants grow. And finally, I thought that black water would kill the plants because it has a lot of bacteria. My hypothesis was half right and half wrong. Both gray waters did help the plants grow, but the plants watered with black water didn't die. If iwere to do this experiment again I would like to test different plants. Also I would like to test them with gray water coming from the bath and ad he bathroom sink, instead of the kitchen sinkand the laundry. I would also be able to have more time so I could analyze the fruit of the plant to see if it is edible when watered with gray and black water.

Summary Statement
The purpose of this project was to test the effects of recycling water on three different kinds of plants.

Help Received
Mother helped by buying materials

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Alan T. Begian

Project Number
J1103

Project Title
What Type of Energy Source Is Economical for Ocean Water Desalinization?

Abstract

Objectives/Goals
What type of energy source: natural gas, propane, electricity, and solar power are feasible to purify ocean water. The independent variables are; natural gas, propane, electricity and solar power. The dependent variables are; average ending salinity and how much water will purify in the least coastally way.

Methods/Materials
For solar energy, use an umbrella and cover the inside with foil. Then get two bottles, connected with a tube. Fasten ice packs to one of the bottles, place the other in the center of the umbrella. Pour the water inside the bottle in the umbrella. Measure the amount of water that evaporates and condenses on each day for four days. Empty the collected water from the condenser and measure the amount of purified water. Finally, repeat the process twice.
For natural gas, and propane energy sources use a stainless steel pot as an evaporator. Connect the pot to a plastic bottle using a tube. The ocean water in the pot is evaporated by natural gas or propane and condensed by ice packs. Record natural gas and propane consumptions. Measure the amount of purified water and repeat the process twice.
For electrical source, use an electrical water heater to evaporate the ocean water and ice packs to condensate it. Record the electricity consumption. Measure the amount of purified water and repeat the process twice.

Conclusions/Discussion
We discovered that even though the solar energy was the least expensive process to purify ocean water, the most economical process was the natural gas.

Summary Statement
To find out which type of energy source would purify water in the most economical way.

Help Received
Father helped me with the construction of the apparatus, and gave me the information needed.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Glenn M.A. Billman

Project Number
J1104

Project Title
Reduce, Reuse, Recycle: Gray Water

Abstract

Objectives/Goals
The goal of my project was to see what common gray water can be used safely on plants so people can reduce the amount of water wasted.

Methods/Materials
I did this by watering twenty plants equally with five to twenty ml. of water (depending on their dryness) using five different waters (tap[the control], water from boiling spaghetti, water from boiling sausages, water with "environmentally friendly" dish soap, and water with bio-degradable soap) and measuring them weekly. I repeated this process for twenty-three days.

Results
Kirkland Signature dish soap had the most successful growth with an overall growth average of 59%, followed by tap water with 31% growth, then spaghetti water with 24% growth, then sausage water at 21% average growth. The last was bio-degradable soap water with an average of 18% growth.

Conclusions/Discussion
The results indicate that the dish soap was best when I hypothesized it to be the worst. I predicted tap water would be third best, it was second. I was sure that spaghetti and sausage water would be about the same (which they were) and better than the tap water (which they weren#t). Bio-degradable was the worst for plants when I had predicted it to be about the same as water.
From this I summarized that dish soap, at least Kirkland brand, is somewhat environmentally friendly and the best for watering plants, tap water second, spaghetti water third, sausage water fourth, and bio-degradable last.

Summary Statement
My project is about the effects of different types of common kitchen grey water on violas in relation to their height and health.

Help Received
My parents gave limited assistance with watering and measuring; I attended three mentoring sessions where different scientists briefly talked about my ideas and methods with me. My parents also proof-read my paper and my dad showed me how to do my first graph on Excel.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Kennedy J. Bingham

Project Number
J1105

Project Title
Thirsty

Abstract

Objectives/Goals
My objective is to determine which type of water purification system is most effective; carbon filtration or UV purification.

Methods/Materials
Experimental Procedures
1. Get water from El Estero Pond and NPS Pond.
2. Test untreated water sources for iron, copper, nitrites, nitrates, ph, alkalinity, hardness, chlorine, and visual bacteria.
3. Test water sources after treating with carbon filter.
4. Test water sources after treating with ultra-violet light.

Materials List:
- Water quality test kit by PRO-LAB (3)
- Bacteria in water test kit by PRO-LAB (3)
- Water from NPS Pond (1(32oz.))
- Water from El Estero Pond (1(32oz.))
- Pen / pencil (1)
- Science journal
- UV Purifier (1)
- Carbon filter(1)
- Water Containers (2)
- Cups (2)
- Microscope (1)
- Dropper (1)
- Slides (6)
- Sample containers (6)

Results
My results are represented graphically in detail on my board.

Conclusions/Discussion
I believe that UV purifiers are the best way to go for purifying potentially dangerous water. Carbon filters are for filtering metals and water in industrial areas. UV lights are for killing bacteria. So, it depends on the water source; lakes or river versus industrial area.

Summary Statement
My purpose is to discover whether carbon filtration or UV purification of water is most effective.

Help Received
My dad helped me get the samples of water, buy the testing kits, & run the experiment. My siblings helped with the ideas. A classmate helped me identify the bacteria. My teacher let me use his microscope & slides, and dropper.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Oliver Chen

Project Number
J1106

Project Title
Ozonification

Abstract

Objectives/Goals
- Is it possible to build a Tesla coil at home using readily available materials? Can the ozone gas created by the Tesla coil be used to purify water? How efficient and effective is cleaning water with ozone gas created by a Tesla coil?

Methods/Materials
-Materials
Neon Sign Transformer, 10 ft. of 600 volt stranded copper wire,2 ft. of bare copper wire,20 ft. of 3/4 in. pvc piping,6 3/4 in pvc elbows,6 3/4 in. pvc tees,5 gal. bucket,3 gal. of water,800g. of table salt,500 ft. of 24 gauge enameled copper magnet wire,Two 3 in. nylon screws,6 nylon hex nuts,1 ft. of 1 in. vinyl tubing,1 in. pvc cap,Small fish tank air pump,Tungsten spark gap,
Volt meter,One 9 volt battery,16 prepared nutrient agar plates,16 sterile cotton swabs.
-Methods
Measure out approximately 100 mL samples of Tap water, Filtered Water, Pond water(collected from a local park), Rain Water(collected in a beaker), River Water(collected from the Lake forest O'Neil Creek) and Distilled water,
Place the 100 mL sample of tap water in a medium size beaker or measuring cup,Inoculate a plate by using a simple zigzag streak pattern,Measure and record the amount of electricity in the water with a volt meter,After 10 minutes,turn off the transformer and pump,Inoculate another plate the same way,
Measure the amount of electricity in the water with a volt meter,Turn on the pump and Transformer for 20 min,Measure the voltage with the 9 volt battery and voltmeter,Compare the three voltages of tap water and tap water after the purification for 10 and 20 minutes,Compare the agar plates after 24 hours in incubation by counting the number of bacterial colonies,And record the results,
Repeat for the rest of the 100 ml water samples.

Results
Results were that water purified by ozone had a lower voltage. It also had a lower bacterial count indicating that this method of purifying water by ozone is effective at removing bacteria from water.

Conclusions/Discussion
It is possible to build a Tesla coil at home using readily available materials. The ozone gas created can be used to purify water. Purifying water through contact with ozone can purify water as effectively as conventional methods such as filtering. I concluded that ozone is an effective way to treat water for bacteria and other organisms.

Summary Statement
To purify water with ozone created by a Tesla coil.

Help Received
Father helped get materials.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Nicolo R. Daug

Project Number
J1107

Project Title
The Effect of Water Temperature on a Sorbent's Ability to Clean Up Oil in an Oil Spill

Abstract

Objectives/Goals
The objective of this project was to determine if water temperature affects how much oil a sorbent can absorb in an oil spill and to find out what temperature of water the sorbent would be most effective in--tropical, temperate, or arctic.

Methods/Materials
2.75 liters of water (28-30°C for tropical, 18-20°C for temperate, 2-4°C for arctic) was poured into a pan which was placed in a water bath to regulate temperature. 300ml of motor oil was poured into the water to simulate an oil spill. A 14x14cm polypropylene pad was placed into the middle of the pan to absorb oil for 15 minutes and the soaked pad was weighed to find out how much oil was absorbed. Ten trials were done for each water temperature and the average weight of oil absorbed was compared.

Results
The pad absorbed the most oil in the tropical setup (70.4g), followed by temperate (60.6g), and lastly arctic (51.8g). In the arctic setup, the pad absorbed 15% less oil than the temperate and 26% less than the tropical.

Conclusions/Discussion
My conclusion is that the sorbent was most effective in absorbing oil in the highest temperature water (tropical) and least effective in the lowest temperature water (arctic). The results suggest that in a marine oil spill, water temperature is an important factor to consider when choosing the method for cleaning up the spill.

Summary Statement
This project was done to determine if water temperature affects a sorbent's ability to clean up oil in the event of an oil spill.

Help Received
My mother helped me get all the materials I needed and my teacher lent me a Celsius water thermometer.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Douglas R. Dean

Project Number
J1108

Project Title
Are Natural Products As Effective in Cleaning Oil Spills As Commercial Products?

Abstract

Objectives/Goals
The objective is to determine if natural products are as effective in cleaning oil spills as commercial products. My goal is to reduce needless pollution at an oil spill by using eco-efficient products and reducing waste.

Methods/Materials
I used the same amount of measured samples of cotton, coconut husks, wood chips, and commercial absorbents (selectSorb and PY pads) and submerged them into an oil water mixture for a timed period. Oil and water levels were measured and documented. Each test was completed three times for accuracy.

Results
Cotton (control) absorbed an average of 55% of the oil. Commercial product, Sham-Wow, absorbed 52%,and PY Pads and wood chips absorbed 42% of the oil.

Conclusions/Discussion
The cotton (control) absorbed the highest amount of oil due to the manipulation of fibers in manufacturing for absorbency. Commercial products were more effective in cleaning up the oil than the other natural products tested. My goal and future project is to recycle the cotton used in the oil spill and reuse it due to its efficiency and absorbency. I would like to create a simple washing drum machine to spin off the oil collected on the cloth at an oil spill site and then reuse the cloth rags again for clean up.

Summary Statement
Testing the efficiency of oil absorbency on commercial and natural products.

Help Received
My mother drove me to pick up all my supplies, paid for them and helped with printing my report. My dad took photos of the experiments, assisted with safety and the disposal of the oil.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)

Paul Epperson; Steven Wang

Project Number

J1109

Project Title

Engineering an Energy Efficient Solar Powered Water Desalination Apparatus

Abstract

Objectives/Goals

The objective was to generate a direct current using solar cells to power an apparatus that desalinates enough water for an average person's use.

Methods/Materials

Four different apparatuses were designed and constructed. The apparatuses were powered by a solar module that we constructed which provided a peak power of 45.1 watts. Using this power, these apparatuses attempted to desalinate 35-ppt saltwater (sea water equivalent) through distillation. Apparatus A heated water with engine enamel coated resistors and condensed steam onto thin film plastic wrap. Apparatus B used rubber coated resistors and condensed steam into a tube connected to a beaker. Apparatus C used a test tube that isolated the resistors from the saltwater and also used a condensing tube. Apparatus D used a copper tube filled with heat transfer fluid that isolated the resistors from the saltwater and also used a condensing tube.

Results

Apparatus A and B were unable to desalinate water due to resistors causing electrolysis and then corroding. Apparatus C was not air tight and let steam leak out. Apparatus D was able to distill 170 ml of water in 6.5 hours at 61% efficiency.

Conclusions/Discussion

Apparatus D was able to desalinate 170 ml of water in 6.5 hours and was the most successful apparatus. The cost is approximately $100. However, a person needs about 2 liters of potable water everyday to be healthy. In order for this design to provide enough water for a person's daily use, at 61% efficiency it must be powered by approximately 500 watts and the heating reservoir would have to be increased to hold 6 to 7 Liters. These changes would result in a product that costs approximately $550.

Summary Statement

We engineered a solar powered apparatus that desalinated saltwater to provide drinking water.

Help Received

Parent used dangerous equipment (table saw; propane torch). Equipment was borrowed from school.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Daniel J. Feeny

Project Number
J1110

Project Title
Can Silicon Spheres Save Our Sphere?

Abstract

Objectives/Goals
This experiment investigates Dr. Field's ICE911 idea to slow the warming of the Arctic glaciers by studying the effect of 0.7-3mm silicon spheres floating on the surface of water - how the size and the clustering of the spheres effects the evaporation and temperature of the water. (Dr. Field's idea is to float small silicon spheres all around the polar ice caps and by increasing the surface area there will be more evaporation, lowering the temperature of the water and preventing the ice from melting.)

Methods/Materials
Seven modified evaporating tanks were built so that two different sized silicon spheres and different amounts of coverage by the spheres on the surface of the water could be investigated at the same time. Evaporation was measured after 24 hours and temperature data was taken several times a day. The experiment ran for five days in order to compare daily evaporation and temperature trends between the 7 tanks. The experiment was run a second time with modifications to get more accurate data: temperature data logger, replacement of sinking spheres, and improved location.

Results
Spheres reduced the temperature of the water but not by evaporation as Dr. Field predicted. Instead the spheres dampened evaporation, yet the water still cooled (probably due to the albedo effect). The experiments showed evaporation decreased linearly with increasing surface coverage, and the larger spheres had slightly more evaporation than the smaller spheres. 100% coverage by the spheres reduced the temperature of the water by 4C. The size of the spheres did not affect the temperature curve. A white plastic sheet covering the surface did not reduce the temperature, but raised it by 5C. Also, the silicon spheres did not remain buoyant as Dr. Field assumed in her design. Up to 50% of the spheres sank within six days. The smaller spheres sank twice as fast as the larger spheres and the spheres sank more quickly in salt water than fresh water.

Conclusions/Discussion
Dr. Field#s floating silicon spheres will reduce the temperature of the water next to the glaciers. She can use smaller sized spheres to minimize the amount of material needed and therefore reduce the cost for her idea. However, Dr. Field will need to find another type of silicon sphere that is more buoyant.

Summary Statement
To investigate Dr. Field#s ICE911 idea to slow the warming of the Arctic glaciers by studying the effect of 0.7-3mm silicon spheres floating on the surface of water on evaporation and temperature.

Help Received
A graduate student at Stanford looked over my proposal and suggested I narrow down the scope. He told me how to get climate data from the Y2E2 building at Stanford and suggested I use data loggers from PGE to get more accurate temperature data.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Jake A. Forrester

Project Number
J1111

Project Title
From Garbage to Energy: Can Heat Generated in Composting be Reclaimed to Heat Domestic Water?

Abstract

Objectives/Goals
The hypothesis for this project was: If water is circulated through a heat exchanger coil embedded in a compost pile, then the temperature of the water exiting the coil will be significantly warmer than the temperature of the water entering the coil. The problem was: Can water be heated by circulating it through a heat exchanger coil embedded in a compost pile?

Methods/Materials
A compost pile was started and maintained by adding materials, moisture and air. Once the temperature of the pile reached above 100 degrees Fahrenheit, testing was started. Five tests plus one control test were conducted. Water was pumped from an insulated container through a copper coil heat exchanger embedded in the hot compost pile. The water was circulated for 48 minutes. Entering and exiting temperatures were measured every two minutes.

Results
In all tests, there were significant increases in the water temperature during the first 12 to 16 minutes. After that time, the water temperature continued to increase, but at a slower and steadier rate. The accumulated heat gains for the tests were: 28.0 27.6, 24.2, 24.0, and 32.4 degrees Fahrenheit. The control test calculations determined that 10.1 degrees of the results were contributed from heat generated by the water pump with the difference generated by the hot compost pile.

Conclusions/Discussion
Overall, the testing was successful because it proved that heat energy can be reclaimed from composting. In addition, many pounds of materials were kept out of landfills and compost material was generated for use as fertilizer. Although the experiment was successful, it is probably not practical for residential purposes because of the large amount of composting material needed to generate significant amounts of heat.

Summary Statement
This project tests whether or not the heat generated in composting can be used as an energy source to heat residential water.

Help Received
Mom helped type report, set up display board. Dad helped build compost bins, build heat exchanger, execute tests. Brother taught me about Newton's Law of Cooling, calculated the constant for the formula. Science teacher discussed ideas/questions, reviewed work each week.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Camille M. Furby

Project Number
J1112

Project Title
Recycling Paper Products

Abstract

Objectives/Goals

Each type of paper: newspaper, copy paper and magazine paper was shredded into 2 cm. pieces and blended into paper pulp and then tested them for strength and quality. I did this because 40% of our landfill space is made up of paper and I wanted to try to reduce that amount by finding an efficient way to use certain types of paper for different uses.

Methods/Materials

Materials: blender, 3 ten gallon plastic tubs, stirring stick, shredded paper (newspaper, magazine, and copy paper), mold and deckle, sponge, absorbent cloth, candle wax, quarters, water dropper and water.
Procedures:

1. Shredded each type of paper and let them soak in 3 gallon plastic tubs.
2. Separately blended each type to an oatmeal consistency.
3. Placed paper into separate bins.
4. Stirred up each type of paper and carefully placed the mold and deckle into the pulp.
5. Covered the top of the screen evenly with pulp.
6. Removed the mold and deckle, placed it on an absorbent cloth and let dry.
7. Couched the paper, removing all excess water.
8. Removed the paper from the screen, and left it completely dry.
9. Tested it for strength and quality.

Strength: I dropped 10 drops of water in the center of the paper and began to stack quarters on the wet area. The point of this was to see how many quarters it took for the paper to break.
Quality: I took a candle, dripping even amounts of wax on the paper. When it hardened, I tried to peel the wax from the paper . If the wax separated, without tearing the paper, it showed that the paper was not too thin and would be good for drawing or writing.

Results

I found that magazine paper proved to be the strongest. This is because magazine paper is made with a clear Chinese coating called Kaolin, which didn't dissolve during my recycling process, and made the paper strong. For the best in quality, newspaper was best because the texture was smooth and writing/printing would be easier.

Conclusions/Discussion

I concluded that magazine paper proved to be the strongest and newspaper proved to be the best in quality. I realized how hard it was to make paper, how many trees we use to make paper, and what kind

Summary Statement

My science fair project is about recycling paper and finding which types of paper would be best suited for different purposes so we can try to reduce paper waste.

Help Received

My grandfather helped me build the mold and deckle for making my paper, my science teacher explained to me how to do the project, and my mother helped me test my paper.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)

Connor Golden; Caleb Richards

Project Number

J1113

Project Title

What Is the Effect of Cover Crops on the pH in the Vineyard Soil?

Abstract

Objectives/Goals

Cover crops affect soil pH and the ranch soils we chose as our control variable had a variety of cover crops planted, so we tested our hypothesis by sampling soil to see how different cover crops affected the soil pH. We collected four samples from six locations and hydrated each sample with water to make a saturated paste. The resulting data did not agree with our initial hypothesis and it gave us a lot to think about.

Methods/Materials

Our project followed six basic steps. We collected four 400gm soil from six different ranch locations. Then we weighed and measured the samples to ensure consistency before we mixed 50ml of water into a test container to make a paste. We were then able to test the pH of each sample using an Active Air Two-Way meter with two prongs: moist and pH. Once we wrote down the results we used Excel software to plot the data and we created a graph to display on our board.

Results

Initially, we just took one sample from six locations and found that we didn#t have enough data to make a good conclusion. So we went back out to the six locations and collected four samples so we would have more data to support and verify the results.

At first we thought that the forest sample, one of our controls, would be the most acidic but it turned out to be very neutral. This makes sense because the trees have been dropping organic matter for hundreds of years. Cover crop is just adding organic matter for one season.

The Zinfandel vineyard had the lowest pH average and the forest sample tested neutral, 7.0, every time.

Conclusions/Discussion

It is evident from the data collected that there is a clear correlation between the native cover and planted cover crops and the resulting soil pH of the site. We concluded that our hypothesis, the seven seed mix would show a noticeable difference in pH, was incorrect. There was insufficient variation between the three cover crop samples and little variation between the cover corps and the control locations.

Summary Statement

We investigated the effect of cover crops on the pH of soils in vineyards.

Help Received

Dads helped us gather samples and moms helped put the display board together.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Sean S. Haas

Project Number
J1114

Project Title
Reverse Osmosis through Centrifugal Force

Abstract

Objectives/Goals
The past two years I created several different solar powered apparatuses that purified and desalinized water through distillation. In continuing my interest in clean water, this year I created a centrifuge to purify water using reverse osmosis. This device could be utilized for contaminated water, salt water, or possibly even in space. Using a centrifuge instead of an electric pump may be a viable and more cost effective means of purifying water in emergency situations like the devastating earthquake in Haiti or when contaminated water is the only water available.

Methods/Materials
A centrifuge was created using a salad spinner.Inside the centrifuge was a basket covered in one of four variables,nylon fabric,tarp,finely woven plastic fabric and .22 Micron filter.These acted as semipermeable membranes. The centrifuge and the contaminated water were my controls; the membranes were my variables.Water was placed in the basket and the centrifuge was assembled and spun, forcing the water through the membrane to help purify it.To test for the water's purity, a sample of the water was taken before and after it was processed.Some samples were cultured on auger plates to test for bacteria CFUs (colony forming units),others were tested for turbidity against the McFarland turbidity standards.This was repeated three times for each variable. The.22 micron filter is a known sterilizing filter which I used to compare results from the other tests against.

Results
The contaminated water had a turbidity of 8 McFarlands, and average bacteria colonies of 103 CFUs.The .22 micron filter completely sterilized the water, and rendered it clear. The nylon membrane decreased the turbidity to 4.5 McFarlands. The plastic tarp decreased the water's turbidity to 6 McFarlands. The fine weave plastic fabric decreased its turbidity to 5.5 McFarlands.The nylon decreased the bacterial count of the water to 17.4 colonies.The tarp decreased the water's bacterial count to 29.6 colonies.The fine weave plastic fabric decreased the water's bacterial count to 19.6 colonies.

Conclusions/Discussion
The nylon performed the best;it removed more particulate matter and bacteria from the water than any other variables.These tests prove this device could be a viable means of water purification with low energy and high productivity.With the proper filter this device could be used for water purification, desalinization or possibly in low gravity for use in space.

Summary Statement
I want to create a way to simply and inexpensively purify water for disaster situations with reverse osmosis.

Help Received
Mother helped with tests and moral support. Terry Jones help provide testing equipment.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Jenna Lee Hulme

Project Number
J1115

Project Title
Concrete: A Use for Used Tires

Abstract

Objectives/Goals
The purpose of this project was to determine if crumb rubber (ground up used tires) could be substituted for sand in the making of concrete as a solution to the great environmental problem of what to do with scrap tires, as well as reduce the rate at which sand is being depleted from the available reserves.

Methods/Materials
Concrete was tested with 0%, 25%, 50%, and 100% substitutions of crumb rubber. Sand, rock, crumb rubber, Portland Cement and water were measured and mixed in a concrete mixer. Each mix of concrete was poured into 6 plastic test cylinders, then placed in a curing tank and left to harden for 7, 14, and 21 days. On each test day, two samples of each mix were taken out of the curing tank and placed in a compression machine to determine their compressive strength, measured in Pounds per Square Inch. Data was recorded, graphed and analyzed.

Results
After 21 days of curing, the 25% substitution samples were 29% stronger than the 50% samples and 122% stronger than the 100% samples. Further, the 25% samples achieved strengths that were within the specified strength of the control mix design.

Conclusions/Discussion
This project demonstrates that crumb rubber is a viable substitute for sand in the making of concrete. At 25% substitution, the compressive strength was within the allowable range for most applications of concrete. If crumb rubber were substituted for only 10% of the sand in all concrete produced in the United States, all scrap tires generated each year in the US would be consumed. This would eliminate one of the most significant environmental problems we face and would help to reduce the rate at which sand is being depleted from the available reserves.

Summary Statement
The main purpose of this project was to determine if used tires, which represent a major environmental problem, could be substituted, in their ground-up form, for sand in the making of concrete.

Help Received
My mentor provided lab equipment at iCRETE and supervised the mixing and testing; my father assisted me and proofed my report.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Cameron K. Khansarinia

Project Number
J1116

Project Title
Communities Cleaning Water

Abstract

Objectives/Goals
The objective of this experiment was to determine whether the antique/western method boiling polluted water, African method of adding moringa olefeira seeds, German technique of adding iodine, or the Japanese mode of inserting scallop shells into polluted water, would decrease the level of bacteria the most. My hypothesis was that the ancient method of boiling water used in the west to reduce bacterial colonies would be more effective than any other methods.

Methods/Materials
Then nine hundred forty-five milliliters of water was added to a boiling pot to begin testing the first method of purification, and boiled at 100 degrees C for 15 minutes. After ten minutes I swabbed the water with a sterile swab and made a zig zag pattern in the petri dish for the bacteria test. Three days later I recorded the amount of bacterial colonies from before and after the purification. Then the steps were repeated seven times more. Next I added iodine to the polluted water in a reusable water bottle for the iodine method, next the petri dish process was repeated. Then it was repeated seven more times. Next I added scallops shells to the polluted water and left it for twenty-four hours. The bacteria test process was repeated, and then seven more trials were conducted. Finally crushed moringa seeds were added to the polluted water and left for one hour, then the bacteria test process was repeated, and seven more trials were conducted.

Results
With the final data, bacteria levels decreased most when the water was boiled. On average the number of bacterial colonies decreased by 1,495 when the water was boiled. Then, the next most successful in decreasing bacteria was the German iodine manner, on average bacteria went down by 929 colonies. Next, in the African moringa method of purification, bacterial colonies decreased on average by 904. Lastly the bacterial tests with scallop shells, commonly used in Japan, the level of bacteria decreased on average by only 275.

Conclusions/Discussion
My hypothesis that bacteria levels would decrease most when the water was boiled was supported by the resulting data. The level of bacteria decreased most when polluted water was boiled, more than adding moringa seeds, scallop shells, and iodine. Therefore, despite the fact that the ancient method of boiling water was most effective in decreasing bacteria, methods in other cultures are still extremely productive.

Summary Statement
My experiment's goal is to determine which culture's method of purifying water is most effective in decreasing bacterial colonies in polluted water, thus solving the world's water catharsis.

Help Received
Ms. Fisher, ms science teacher helped me make petri dishes for the bacteria tests. My Mother helped me collect polluted water to be purified. Amanda Flores bought me scallop shells for the Japanese method. Mrs. Diaz edited many aspects of my project. Philippe Tran proofread my research report.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)

Gerardo de Jesus Lancaster

Project Number

J1117

Project Title

Water Reuse: The Effect of Detergent on Plant Growth

Abstract

Objectives/Goals

The objective is to determine if plants can be safely watered with greywater-water created in a household containing soap, detergent, or other impure material residue.

Methods/Materials

Twenty five identical planting pots were prepared in a standard way with soil and Rye grass seed. These plants were separated into groups of five, with the purpose of each group being irrigated with different water-detergent solutions. The irrigation took place as follows: The first group was irrigated with freshwater. To irrigate groups 2-5 a water-detergent mixture was prepared for each group. This mixture contained 1.8L of freshwater titrated with 1.0 ml or gram of detergent; For group 2, Tide 2x Ultra liquid detergent was used; For group 3 Tide Solid; For group 4, Purex 2x Ultra liquid; and for group 5, Purex Ultra liquid detergent was used. Tide taking the role of common detergent and Purex being biodegradable. The mixture for each group was then separated equally into five parts and applied to every plant. I utilized the experimental method by variating irrigation water for each group; From here I proceeded to observe and measure changes for both the quantitative and qualitative characteristics of all subjects.

Results

Average height was improved by up to 19% utilizing biodegradable detergent mixtures, against the use of freshwater for irrigation. While by using common detergent mixtures, average height was negatively affected by up to 14%, in contrast to freshwater irrigation.

Conclusions/Discussion

Groups of plants watered with common detergents depicted clear negative effects in their growth, health and density compared to the control, freshwater. At the same time, plants watered with biodegradable detergent solutions, compared to the control, showed important benefits in height and size. In addition these plants always showed perfect health and accomplished the best density per square centimeter. the effect biodegradable detergent has on plants can be best described as a fertilizer, making it safe and beneficial to use in the irrigation of plants.

Summary Statement

Determine the effect that the use of biodegradable and common detergents, for the irrigation of plants, has in their growth and development.

Help Received

Father helped type report; Mother helped glue board.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Genesis V. Lucero

Project Number
J1118

Project Title
The Effects of Various Filtration Media on Stormwater Contaminants

Abstract

Objectives/Goals
According to the EPA, the nation's number one water quality problem is stormwater runoff. Runoff water is contaminating nearly half of our rivers and lakes, leaving them unable to support fishing or swimming. I learned about a newly adopted General Permit for Discharges of Stormwater Associated with Construction Activity in California and I was very interested to find out how businesses and land owners were going to meet the new requirements. My experiment tested five filtration media in a modular wetland and their effectiveness in removing stormwater contaminants. I hypothesized that a new type of bonded fibrous material called BioMediaGreen would remove contaminants more effectively than other more traditional types of filtration media.

Methods/Materials
I performed more than 600 tests. The filtration media I tested were aquarium stone (rock), activated carbon with organoclay, expanded shale, zeolite, and BioMediaGreen. I tested eight different water samples for each filter media for a total of 40 water samples filtered through a simulated wetland. Each of the 40 samples was tested for pH, total suspended solids (TSS), total dissolved solids (TDS), dissolved phosphate, dissolved oxygen, dissolved copper, dissolved iron, dissolved chromium, nitrates, nitrites, oil and grease, alkalinity, turbidity, total hardness, and bacteria both before and after filtering.

Results
The BioMediaGreen filtration media was more effective in removing total suspended solids, dissolved iron, dissolved copper, dissolved phosphate, oil and grease, turbidity, and total hardness than the other media I tested. BioMediaGreen was also the most effective at increasing the dissolved oxygen levels. I was surprised that activated carbon with organoclay had higher efficiency removals for nitrates and nitrates which are difficult pollutants to remove. None of the filtration media tested had any significant impact on reducing bacteria levels.

Conclusions/Discussion
My findings suggest a combination of BioMediaGreen and activated carbon with organoclay be used as a filtration media to remove pollutants from runoff. This filter media combination could be used to greatly improve water quality before runoff mixes with other water in the environment.

Summary Statement
In my experiment I performed more than 600 water quality tests using five types of filtration media in a modular wetland to assess media effectiveness in removing stormwater contaminants.

Help Received
Mother helped with methods; Science teacher supervised me in the lab and teaching me proper procedures; BioClean Environmental Services supplied a modular wetland apparatus

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Ethan D. Maahs

Project Number
J1119

Project Title
H2O, H2O Everywhere, Let's Have a Drink:The Study of Different Clean Energy Sources to Desalinate Ocean Water

Abstract

Objectives/Goals
The objective of this project was to determine the most efficient clean energy source to desalinate water.

Methods/Materials
Procedure
1. Run the battery down until the alarm on the power inverter alarms. 2. Charge the battery with solar panel or wind turbine and record the time to charge the battery. 3. Measure 800 cc of ocean water and put it in the tea kettle. 4. Set hot plate temperature to 200 degrees C. 5. Allow hot plate to run until power inverter alarms and collect the distilled water. Record the time the hot plate ran. 6. Measure and record the amount of water collected using the graduated cylinder. 7. Repeat steps 1-6 with the same hotplate temperature and run time for two more samples. 8. Repeat steps 1-7 at 250 degrees C. 9. Repeat steps 1-7 at 300 degrees C. Fresnel Lens Procedure 1. Measure 800 cc of ocean water and put it in the tea kettle with the distiller connected. 2. Place the distiller and Fresnal lens in direct sunlight and focus it on the tea kettle 3. Record the temperature of the water at five minute intervals. 4. Adjust the Fresnel lens to maintain focus on the tea kettle. 5. Collect the water for 3 hours 6. Measure the amount of water collected 7. Repeat steps 1-6 for two more data samples. 8. Measure 550 cc of ocean water and place it in the canister. 9. Place the distiller and Fresnal lens in direct sunlight and focus it on the canister 10. Record the temperature of the water at five minute intervals. 11. Adjust the Fresnal lens to maintain focus on the tea kettle. 12. Collect the water for 3 hours 13. Measure the amount of water collected 14. Repeat steps 8-13 for two more data samples. Calculations 1. Calculate the number of cc's of water collected per hour based on the amount of time required to charge the battery for the solar panel and wind turbine and based on the amount of time the water was collected for the fresnal lens.

Results
The fresnel lens on average produced 35.0 cc's of water per hour. The wind turbine produced on average 25.6 cc's of water per hour of charge time with a hot plate temperature of 250 degrees C. The solar panel on average produced 1.7 cc's of water per hour of charge time with teh hot plate temperature of 250 degrees C.

Conclusions/Discussion
My hypothesis was disproved because the Fresnal lens was the most efficient, the wind turbine was the second most efficient, and the solar panel was by far the least efficient.

Summary Statement
To determine the most efficient clean energy source at desalinating ocean water

Help Received
USGI Medical allowed me to use a hot plate. My dad helped me build some of the apparatus and My mom and sister helped with my display board.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Charles P. Macleod

Project Number
J1120

Project Title
Paint Your Roof White: Fourier's Law and Calculating Energy Savings

Abstract

Objectives/Goals
In July of 2009, Dr. Steven Chu, the current US Secretary of Energy and a Nobel prize-winning scientist, proposed something very simple to reduce energy cost and greenhouse gas emissions. He said "Paint your roof white". The objective is to make a simple energy cost calculator to prove or disprove Dr Chu's idea

Methods/Materials
I constructed a small database of roofing material data in Microsoft Excel using albedo, surface temperature measurements, and thermal conductivity collected from the Internet. I developed a simple roof model in Excel based on Fourier's Law "Q = k.A.(DT/DX)", to calculate the heat energy transfer for each of the various roofing materials (with and without insulation in the roof). For the cost calculations I used the energy rates from my parents' electric bill and used data from Pacific Gas and Electric to calculate CO2 emission levels

Results
The best performing roofing material was white concrete tile, albedo 73, while the worst was black asphalt shingle, albedo 5. For example, given a 2000 square foot roof, with R30 insulation, the estimated cost of offsetting the heat energy entering a house with white concrete tile would be approximately $85/yr with a related CO2 emission of 168.9 lbs/yr. Compare that to the worst performing material, Black Asphalt Shingle, with an estimated annual cost of $330/yr and a related CO2 emission of 662.5 lbs/yr

Conclusions/Discussion
I believe my findings support Dr Chu's original premise that painting your roof white is an easy and effective way to reduce energy costs and greenhouse gas emissions. My energy calculator is an effective tool for illustrating the correlation between roofing material albedo, energy costs and CO2 emissions for the homeowner, home builder, and even legislator or community leader interested in incentivizing "green" roofing products for home construction.

Summary Statement
The development of an energy calculator to compute the effect of surface albedo of roofing materials on energy costs and related CO2 emissions

Help Received
My Dad showed me how to program Microsoft Excel and how to do formatting in Microsoft Word

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
James M. McCabe, III

Project Number
J1121

Project Title
The Effects of Macronutrients Recycled from Food Waste Products on the Growth of Lactuca sativa and Raphanus sativus

Abstract

Objectives/Goals
As our population continues to grow, so does our demand for food. Farmers have relied upon manufactured fertilizers to increase crop yields. These fertilizers have many harmful effects. I hypothesized that food waste products known to be sources of primary macronutrients could positively effect plant growth in an eco-friendly and sustainable way.

Methods/Materials
In this experiment, five treatments were used to evaluate the growth rates of Romaine Lettuce (Lactuca sativa) and French Breakfast Radish (Raphanus sativus) plants. Initially, all the lettuce plants were similar in size and health. All the radish seeds were from the same package. Weekly, I embedded the soil of fifteen lettuce and twenty radish plants separately with dried tea grounds from boiled tea bags, pureed cantaloupe rinds, pureed banana peels, and a mixture of all three previously mentioned supplements. The final group, my control, received nothing additional embedded in the soil. Every seven days, I measured the height of the lettuce leaves and counted the number of radish and lettuce leaves. On day 28, the end of the experiment, radish root lengths were also recorded.

Results
By day 28, all lettuce and radish plants receiving supplements had more leaves than the control groups. The tea group of lettuce plants had the highest average increase in number of leaves. Tea and cantaloupe lettuce plants' average heights were taller than the control. Additionally, the radishes with the mix had the longest roots.

Conclusions/Discussion
This experiment provided useful information regarding the usage of recycled food waste products on plant growth. Overall, my results supported my hypothesis. My research explained that tea grounds, cantaloupe rinds, and banana peels are respectively rich in nitrogen (N), phosphorus (P), and potassium (K). These nutrients are referred to as macronutrients and are vital for plant development. I learned recycling food wastes is one of the sustainable ways in which to increase plant growth.

Summary Statement
My experiment examined whether food waste products can be recycled and used to positively effect plant growth.

Help Received
A nursery manager provided guidance on plant selection; my mom helped with registration, editing, and cutting materials for the board, and my siblings helped with writing down measurements and filling pots with soil.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Warner Myerson

Project Number
J1122

Project Title
Which Water Works?

Abstract

Objectives/Goals
My objective was to learn which type of water produced the fastest growing bean plant. I initially hypothesized that spring water would work best because it was the purest, having the least amount of chemicals, contaminents, or impurities in it.

Methods/Materials
Bean seeds were planted in four separate containers using the same soil, exposed to the same light sources, but watered with four different types of water (tap, spring, grey, and reclaimed). The plants were observed and measured on a regular basis to see which plant grew the fastest.

Results
The seed plant watered with tap water sprouted first. However, over the duration of the project, the seed plant watered with grey water grew the fastest.

Conclusions/Discussion
I did not prove my hypothesis. The opposite was proven. However, I attained my objective. I learned that a hypothesis can be proven wrong during an experiment. Grey water, with its impurities, was the best water to use to grow the beans the fastest. Now, instead of wasting grey water by allowing it to go down our kitchen sink drain, I collect it and use it to water plants in and around our house. Everyone can do this to help conserve water and help prevent water shortages.

Summary Statement
My project was to determine which type of water helps plants grow the fastest.

Help Received
My mother watched over plants when I wasn't home to make sure they did not get over exposure to sun.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Michaela F. Posner

Project Number
J1123

Project Title
Desalination: Water for the Future

Abstract

Objectives/Goals
I originally wanted to find out if it is possible to desalinate ocean water at home for drinking. From there, I created my hypothesis, which states that if the concentration of the salt water is increased, then the volume of freshwater collected will decrease.

Methods/Materials
I tested this by taping a small bowl to the bottom of the larger bowl and then filled it up with 500mL of distilled water. Then I added 18, 36, 54, 72, 90, or 108 grams of salt to the bowl. Once that was finished, I covered the bowl with cling wrap with a rock or stone, weighing about 0.4 Kg on top, creating a dip over the center of the smaller bowl. Then I placed it in the sun for a week. After a week, I used the graduated cylinder to measure how much water was left in the larger bowl, how much was collected (desalinated), and the salinity of the water collected using some salt test strips.

Results
My results supported my hypothesis by showing that the bowl that had one tablespoon of salt had about double of the desalinated water of the six-tablespoon bowl for all of my trials.

Conclusions/Discussion
They also showed that it is possible to desalinate ocean water at home, but it is tastier to drink the water from a desalination plant.

Summary Statement
Testing to see if ocean water can be desalinated at home for drinking purposes.

Help Received
Mother purchased supplies and drove me to the desalination plant for a field trip.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Samantha B. Royall

Project Number
J1124

Project Title
Which Water Filter Is Best?

Abstract

Objectives/Goals
My objective was to see how different types of water filters (sediment and carbon) affect the pH level, total alkalinity, total chlorine, total hardness, iron level, copper level, nitrate level, and nitrite level of different types of water (sea water, Petaluma River water, tap water).

Methods/Materials
In my experiment, my materials consisted of coffee filters, Brita Water Filter refills, milk jugs, and plastic containers to create these two different types of water filters. It was also crucial to have a water quality test kit and water from the Petaluma River, the tap, and the ocean. I made two different contraptions out of the two filters, the milk jugs, and the plastic containers to test my water with by pouring the water through the two filters.

Results
Most of my results were consistent, some of the levels however were raised or lowered drastically. For example, the sea and tap water pH levels with the carbon filter went from a save level, to a highly acidic level. The sea water chlorine levels with the sediment filter were also lowered to an unsafe level.

Conclusions/Discussion
Based on my results, I was able to see how the two different filters affected the three water samples. In some ways, my hypothesis was supported, but in other ways, it was not. Since some of my results were so far off of what I had originally thought in my hypothesis, I think that some of the tests were not accurate.

I also realized that it might not be safe to filter tap water with a carbon filter because it results in a highly acidic pH level. The fact that I used bleached coffee filters was a confound because there is chlorine in bleach which is why the chlorine level was raised for most of the sediment filter results.

Summary Statement
My project was about how different types of water filters (sediment and carbon) affect different levels in water (sea water, Petaluma River water, tap water).

Help Received
Father helped me cut the containers, mother helped me collect river water samples.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Andrew Shimshock; Daniel Sours

Project Number
J1125

Project Title
The Living Roof

Abstract

Objectives/Goals
Which vegetation planted on the roof, works best to cool down the temperature of a miniature house?

Methods/Materials
Dirt, Succulent plant, Chocolate Mint herb, Blue fescue, Vernier Probe, Water Syringe, Fluorescent Lamp, Water, Caulking/caulking gun, Boxes 12" X 7.75"X 7.75", Plastic Containers 12.5"x 13" x 2". Build boxes; Caulk boxes; Plant vegetation into plastic containers with dirt; Grow plants under fluorescent lights; Add 200ml of water to plants every other day (continual); Place plant onto boxes; Measure temperature of ambient air and boxes in morning, afternoon; Repeat step 7 for one week.

Results
Date Time Temp.(C) Outside Succulent Plant Chocolate Mint Plant Grass Dirt
1/5 7:35 am 5.9 5.8 5.7 5.8 5.8
1/5 3:38 pm 15 14.5 14.3 14.5 14.9
1/5 6:30 pm 10.2 10.2 9.8 9.9 9.8
1/6 7:35 am 6.4 6.3 6.3 6.3 6.3
1/6 5:10pm 11.1 10.9 10.9 11.0 11.0
1/7 7:35 am 5.8 5.7 5.7 5.7 5.6
1/7 5:05 pm 11.9 11.7 11.6 11.7 11.7
1/8 6:15 pm 10.3 10.2 10.0 10.2 10.2
1/9 11.56 am11.7 11.7 11.6 11.7 11.6
1/10 10:41 am12.7 12.6 12.6 12.6 12.7
1/10 4:37 pm 13.6 13.4 13.4 13.5 13.5
1/11 7:30 am 7.4 7.3 7.3 7.3 7.2

Conclusions/Discussion
The data shows that the chocolate mint plant cooled down the temperature of a miniature house the most during midday. The dirt and chocolate mint cooled down the miniature houses most in the morning. During midday the chocolate mint cooled down the house the most, followed by the succulent, the grass the third most and the dirt the fourth most. In the morning, the dirt and chocolate mint cooled down the house the most followed by grass and succulent. Much more cooling occurred during the day when the sun was out and air temperature was highest.

This experiment shows that plants transpiration different rates cool houses down at difference rates. Many factors like temperature, humidity, light, wind and water affect how each plant uses transpiration to

Summary Statement
Investigating how living roofs of different plant types affect the temperature inside of miniature houses.

Help Received
Father helped build the houses.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Anna N. Shuster

Project Number
J1126

Project Title
Antibacterial Effects of Solid Copper on Waterborne Bacteria

Abstract

Objectives/Goals
I came across an article about people in India who are throwing copper and silver coins into their rivers. They believe copper and silver coins will be able to disinfect their polluted water systems. I designed an experiment to test the antibacterial effects of copper in water. After researching, I hypothesized that solid copper might have a moderate effect in reducing the amount of bacteria in contaminated water, and would not contribute an excessive amount of copper ions to the water.

Methods/Materials
I followed sterile procedures, using disposable, serological pipettes and Coliscan Easygel. I tested samples of aquarium and creek water. I compared control samples in every trial. In the experimental cups, I placed either a new penny or a piece of copper pipe fitting. I then tested to see if either the copper pipe fitting or the penny had any effect on the bacterial content of the water.

Results
The results of the five trials and 66 plates showed the control samples contained thousands of coliform and noncoliform colony forming units per 100 ml, which sometimes included E. coli. Most of the control samples contained so many colony forming units they were too numerous to count. Samples treated with a copper penny had significantly lower bacteria counts, but still contained bacteria. After 24 hours, samples containing a copper pipe fitting were completely sterile. The water samples which held a penny had a concentration of approximately 3 ppm of copper. The samples containing a pipe had concentrations of between 4 and 10 ppm copper.

Conclusions/Discussion
According to these results, copper appears to have a significant antibacterial effect on waterborne bacteria. Unfortunately, copper ions leach into the water at levels far above the acceptable limit (1.3 ppm) for drinking water. Some animals have a very high tolerance for copper, so farmers could conceivably place a copper pipe in drinking water troughs to help reduce or eliminate bacteria. It might also be possible for a copper pipe piece to be used to eliminate bacteria in drinking water for human consumption on an emergency basis, but the practice of throwing copper coins into bodies of water should be stopped. Throwing copper coins into drinking water sources may lead to problems with copper contamination for years to come.

Summary Statement
This project tested the antibacterial effects of solid copper on waterborne bacteria in creek and aquarium water and the resulting copper concentrations.

Help Received
Thanks to my parents for their time and patience. Thank you to my science teacher for guidance and supervision.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Nicholas E. Thomas

Project Number
J1127

Project Title
The Effect of Native Plant Matter on the pH of Water

Abstract

Objectives/Goals
My project was to determine if native plants could be used to alter the pH of rainwater. My ultimate goal is to set up a rainwater collection system using native plants as filters here in Westhaven where there is an extremely acidic rainwater.

Methods/Materials
I collected, identified and composted native plant matter from the Westhaven watershed. During this time period I also collected rainwater in sterile glass jars. I collected the rainwater away from any contamination. Next, I percolated the rainwater through the composted plant matter using ceramic trays with drainage holes. I tested the pH of the original rainwater, after percolation, and then, finally, sitting overnight with the plant matter. I recorded the results and then attempted to mix "recipes" to adjust the rainwater pH to a drinkable level. I then repeated this process a second time.

Results
My results clearly show that plants can be used to adjust the pH of rainwater. Some plants, like sorrel, raised the pH significantly. Other plants, like douglas fir, lowered the pH. The recipes of combined matter were not as successful in altering the pH. The mixed plants seem to counterbalance one another. Hedge-nettle worked the best to produce a pH between 6.5 and 8.5.

Conclusions/Discussion
Rainwater pH can be successfully manipulated with native plant matter to produce a desirable drinking water.

Summary Statement
My project is to determine if it is possible to alter the pH of rainwater using native plant matter.

Help Received
Mom helped type report and oversee backboard. Bob Stewart at North Coast Labs helped me calibrate my pH checker as well as supervision and insight into testing water. Carol Ralph from the Native Plant Society helped me correctly identify the native plants as well as suggesting methodology of the testing.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Kabir A. Torres

Project Number
J1128

Project Title
Cleaning Up Oil Spills in Aquatic Environments

Abstract

Objectives/Goals
To determine if changes in temperature and environment (purified, lake and sea water), affect the amount of oil and water absorbed by 3 different sorbents. I hypothesize firstly, that if there are changes in temperature and environment then the ability of the sorbent to absorb oil and water will change. Secondly, at high temperatures there will be more absorption of oil due to less viscosity of the oil. Thirdly, in purified water there will be more oil absorption due to the absence of organic and inorganic substances that could interfere with oil absorption.

Methods/Materials
Used 81 samples in 3 groups: A-Enviro-Bond, B-Macerated paper and C-Coconut husk; 3 stages in each group: Room (55-65 °F), High (90-100 °F) and Low (30-40 °F) temperatures. Each stage had 9 containers: a set of 3 for validation purpose from each water type: purified, lake and sea water. Manipulated variables: changes in temperature and water types. Constant variables: amount of water, Marvel Mystery Oil, sorbent, and time periods. Within groups A, B and C, the control groups were the samples with purified water at room temperature and the specific sorbent. Hot and cold water baths and thermometers were used to maintain temperature ranges. A stocking with 10 g of sorbent was placed in 300 ml of water and 50 ml of oil for 30 minutes of absorption; drained for 5 minutes. Measure the amount of oil and water absorbed (Responding variable) with graduated cylinder. Repeat for all samples.

Results
Temperature variable: In Group A, all 3 types of water had more oil absorption at high temperature, followed by room (Control Group) and low temperatures. In Group B and Group C with all 3 types of water, at high temperature there was more oil absorption, but water absorption resulted in changes without any specific pattern. Water variable: In all 3 groups, changes in the type of water resulted in changes in oil and water absorption without any specific pattern.

Conclusions/Discussion
The first and second parts of my hypothesis were proven correct, changes in the temperature and water types resulted in changes in the sorbents oil and water absorption and samples at high temperature (90-100 °F) absorbed the most oil in all the sorbents groups. The third part of my hypothesis could not be proven. The change in water types (purified, lake and sea) showed no specific pattern in the oil absorption in this experiment.

Summary Statement
I tested the effect of changes in temperatures and environment (water types); on the absorbency capacity of three sorbents that could be used for oil spill clean-up and environment preservation.

Help Received
My parents and grandma acted as observers to validate the experiment; drove me to the sea and lake, helped with clean up, graphs, and proof-reading the project. Mrs. Blakemore loaned a triple beam scale. New Pig Corporation supplied their product.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Nathaniel B. Tweed

Project Number
J1129

Project Title
Can Cross Linked Polymers Help with California's Water Crisis

Abstract

Objectives/Goals
My goal is to see if by using cross linked polymers, I could reduce the amount of water usage to sustain the life of a plant which could help save California's water if it were used in agriculture.

Methods/Materials
I used a baby's diaper for the crossed linked polymers, peat pots, a snapdragon (plant), unsweetened cherry mix, 2 glasses, different liquids, and mixed soil.

Results
The results in the first experiment was that the cross linked polymers swelled up and held the liquid that I poured into them for two weeks.
The second experiment showed that soil treated with cross linked polymers held all the water poured into it, and the untreated soil could not retain the water.
The third experiment showed that a snapdragon plant lived eight days longer in soil treated with cross linked polymers than the same kind of plant that was potted in untreated soil.

Conclusions/Discussion
My conclusion is that by using crossed linked polymers a plants life will be sustained using less water.

Summary Statement
To see if crossed linked polymers can help with California's water drought.

Help Received
Mother helped with proofreading and dad helped with understanding and pronunciations.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Alexandra N. Vredenburgh

Project Number
J1131

Project Title
Save Water, Save the World: Evaluating the Effectiveness of Using Gray Water to Reduce Home Water Consumption

Abstract

Objectives/Goals
About 55% of our residential water is used for landscaping. San Diego residents will have to make an 8% cut on their use of water beginning July 1st under a drought emergency plan approved by the city counsel. Because of the water shortage, in August, 2009 California regulators have issued an emergency decision that allows residents to create simple reuse systems without a construction permit. I convinced my parents to install a gray water system when they remodeled their bathroom.

Methods/Materials
My study was conducted in two parts: plant growth and soil lab testing. My independent variable for both parts was water type (gray vs. hose). My dependent variable for part 1 was plant growth. My dependent variable for part 2 was soil properties (pH, phosphorous, potassium, and nitrogen). Materials included: Gray water, hose water, one bag of potting soil, corn seeds, grass seeds, eight 4" pots, 2 flats with 8 sections each, soil testing kit, measuring syringe, and a moisture probe. I measured plant growth weekly. I controlled for water amount, sunlight amount, plant seeds, soil, and removed plants from the rain.

Results
For Part 1, there was a positive relationship for number of days vs. plant growth for both the gray water and the hose water (control). The actual data collection began on the 14th day, when the seeds germinated. The growth rate was nearly identical for the first 6 days. On day 20, the growth rate for gray water plants become greater than for the control. For Part 2, my lab testing indicates that plants watered with gray water had all the nutrients that they needed; the soil was found to be the same, or better than soil watered by hose.

Conclusions/Discussion
The data supported my hypotheses: Gray water was as good as hose water for both plant growth and soil properties. In my study, I saved 133 cubic feet or 994 gallons or 3,766 liters in about three months or 331 gallons (1,253 liters) per month, or 3,972 gallons (15,036 liters) a year. If every single-family household in California (6,883,493; US Census Bureau, data from 2000) alone had this system in one bathroom, we would save, on average, 2.7 trillion gallons a year! Saving this amount of water could help us protect more endangered habitats, by using a lot less river water, and not transporting or cleaning the water (which require a lot of energy).

Summary Statement
I evaluated the effectiveness of using gray water as a substitute for hose water to reduce home water consumption.

Help Received
My brother, Michael, helped me set up my study and with my poster. My father supervised my lab testing. My mom helped with my report. My brother's high school teacher provided the lab testing kit.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Hannah Washburn

Project Number
J1132

Project Title
Will the Addition of Polyacrylamide to Hydrophobic Soil Affect Its Ability to Allow Water Percolation?

Abstract

Objectives/Goals
The purpose of my science project is to determine if the addition of polyacrylamide (PAM) will help water percolate through a hydrophobic layer of soil. This is a water repellant layer of soil that often forms 3 to 5 inches below the top soil after an intense forest fire. This is important because hydrophobic soil causes greater runoff which contributes to post fire mud slides and depending on the thickness of the hydrophobic layer it could take years for the water repellancy to go away. My goal is to speed up the rehabilitation process of the hydrphobic soil.

Methods/Materials
I collected coarse, upland soil and covered it with dried leaves and wood. With supervision, I burned the organic material for 8 hours and then let it cool. I did a WDPT test to determine if the soil was hydrophobic. I had 5 test soils: untreated soil, hydrophobic soil, hydrophobic soil & linear PAM, hydrophobic soil & crosslinked PAM, and hydrophobic soil with both linear & crosslinked PAM. I placed 1 cup of test soil into a clear tube that is standing on wire mesh with a measuring cup underneath. I had 147.8ml of water rain into the clear tube and measured the time it took and the amount of water that percolated the soil. I repeated this test for a total of 10 trials per test soil.

Results
The results show that the addition of both linear and cross-linked PAM actually made the water repellency worse. Untreated soil allowed an average of 84.2ml of water to percolate the soil and collect in the measuring cup in 30 minutes. Hydrophobic soil allowed an average of 42.5ml of water percolation in 30 minutes. Hydrophobic soil with linear PAM had only 28ml of percolation while Hydrophobic soil with cross-linked PAM had 33ml of water percolation. The hydrophobic soil with both linear and cross-linked PAM had an average of 31.9ml of water percolation in 30 minutes.

Conclusions/Discussion
After completing my investigation I found that the addition of both linear and cross-linked PAM to hydrophobic soil made the soils water repellency worse. These findings are very important because both linear and cross-linked PAM are widely used today to prevent soil erosion and to retain water, but applying PAM to a post fire hillside could possibly contribute to a mudslide. I believe that finding a way to help rehabilitate hydrophobic soil would be both economically and environmentally beneficial.

Summary Statement
The purpose of my project is to help rehabilitate hydrophobic soil by increasing its ability to allow water percolation using both linear and cross-linked polyacrylamide.

Help Received
Mother photographed the testing process; Father supervised the creating of hydrophobic soil; Dr. Bob Sojka guided me to accurate research; Dr. Rodrick Lentz supplied the polyacrylamide; Peter Wohlgemuth helped with forest fire research