CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)
Emily Y. Banno

Project Number
J1001

Project Title
What Is the Best Mulch Material to Prevent Soil Water Evaporation?

Abstract

Objectives/Goals
California is facing a severe drought. Water is an important resource that needs to be conserved. This study examined the question of which mulch material covered on soil conserved the most water.

Methods/Materials
The method to determine which mulch material conserved water the best was to measure which material best prevented soil water evaporation. There were eight mulches tested, four organic mulches: wood, eggshells, moss, pine needles, and four inorganic mulches: small rocks, big rocks, rubber, and fabric. Each mulch covered containers containing 350.0 grams of soil and 300.0 grams of water. The control was the container with no mulch. Each container weight was measured everyday over a one week period to determine how much weight was lost. The total weight loss over the one week period was due to soil water evaporation. The experiment was repeated three times. Also, temperature and dew point data were recorded daily. They were used in the simplified version of the Penman Formula, which is used for calculating the evaporation rate of open water. The Penman Formula was slightly modified and used in this experiment for soil water evaporation.

Results
In my experiment, the #Small Rocks# mulch conserved the most water because it showed the lowest water loss average compared to the other materials for the three trials. The mulch, #Big Rocks# was second best and the mulch, #Rubber# was third best.

Conclusions/Discussion
The results of my experiment did not support my hypothesis. I felt that the mulch #Rubber# would do the best. Instead, the mulch, #Small Rocks,# had the least soil water evaporation. I chose the #Rubber# mulch because it is tough, elastic, water-repellent, stable, and can withstand different temperatures. The mulch, Small Rocks,# might have been best because little gaps can be filled in easily while other mulches probably had larger gaps in between the material, allowing more evaporation. Even though my hypothesis was incorrect, the mulch #Rubber# was still a good choice because on average it was third best in preventing soil water evaporation.

Summary Statement
This experiment studied which mulch material conserved the most water in soil by measuring which material prevented soil water evaporation the best.

Help Received
My parents helped with material purchase and board display.

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)

Peter B. Beer

Project Number

J1002

Project Title

The Efficiency of Using FerroFluid and Magnets to Remove Oil Spills from Water

Abstract

Objectives/Goals

The objective was to determine if ferrofluid and magnets will work as efficient agents to remove oil from water and to determine if the match between the type of oil spilled and the ferrofluid's carrier fluid affects efficiency. A second objective was to determine if oil will be removed more efficiently in fresh water than in salt water because the salinity could affect magnetism by weakening the magnetic field.

Methods/Materials

Vegetable, mineral and motor oils were measured (2.5ml) and placed in petri dishes containing 14 ml of fresh water. One dish contained mineral oil and salt water. Ten drops of ferrofluid with mineral oil as its carrier fluid was added to each dish. Neodymium magnets were placed in a plastic bag and dragged through the oil spill 6 times in a circular motion. The remaining substance was poured into graduated cylinders and recorded for amount of oil left behind and observed for any remaining ferrofluid.

Results

Ferrofluid and magnets were consistently effective in removing mineral oil from fresh water with efficiency quotients of .9/1.0, .8/1.0, .7/1.0. Removal of mineral oil from salt water was less effective (.4, .6, .6), but more effective than removal of motor and vegetable oils from fresh water.

Conclusions/Discussion

As predicted, ferrofluid's carrier fluid must have similar characteristics to the oil being extracted in order to remove the maximum amount of oil. Salt water reduced the amount of oil removed because salinity weakened the magnetic field.

Summary Statement

Can Ferrofluid and magnets effectively remove oil spills from different types of water without further hurting the environment and without spending a lot of time, money and resources.

Help Received

Mother helped manage ferro-fluid properly for safety.

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)

Chloe Berrysmith; Courtney Bishop

Project Number

J1003

Project Title

Desalination Across the Nation

Abstract

Objectives/Goals

There is a huge debate in Monterey right now about whether or not we should have a desalination plant. People say it is our only hope because of the drought--but is it really? Our hypothesis is that desalination using solar power to evaporate the water is more efficient and uses less energy than reverse osmosis and cogeneration. Currently, desalination is powered by fossil fuels, which we are running out of quickly, so if we are going to use desalination, it will have to be powered by renewable energy resources like the wind or the sun.

Methods/Materials

We have tested which version of desalination is the most effective. Our three different setups were: one inside at room temperature, one outside using solar power, and one inside powered by a heat lamp that is 150 watts. The controls in our experiments are the water, and the same level of salt, and the time. The time was five hours, and the trial did not have enough time, so we tried ten hours instead. The variable in our experiment was the level of energy and how much was used.

Results

The solar and heat lamp desalination got the same results: 311 parts per milliliter of salt. The room temperature did not work at all.

Conclusions/Discussion

In the future, with more advanced technology, desalination could be a good choice. Evaporation desalination, with more time than ten hours, is a also a possibility. Right now, though, the economical and environmental impacts are too large for it to be a main water source.

Summary Statement

Our project explored the pros and cons of ocean desalination and a more sustainable alternative process.

Help Received

Daryl Lauer, an employee of the Carmel Wastewater Facility, and Carol Reeb, a scientist at Hopkins Marine Laboratory, gave us opinions and knowledge about desalination; Karen Hansen, our sixth grade science teacher, loaned us her heat lamp.

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)

Somil Bhushan

Project Number

J1004

Project Title

Solar Desalination: An Eco-Friendly Solution for California's Water Independence

Abstract

Objectives/Goals

The objective is to determine if solar desalination of ocean water can be used to help end California#s water issues.

Methods/Materials

A solar panel was used to capture energy from the sun and convert it into electrical energy. This energy was stored in a 12V DC rechargeable battery and used to power a water pump. The salt water was pushed by the pump into a Reverse Osmosis (RO) system. The RO system generated clean water and also waste water also known as brine. A total of 5 salinity solutions were desalinated under varying pump pressures over an 8-day period.

Results

As the pump pressure was increased, the time taken to collect the same amount of clean water decreased. It was also noted that as the salinity of feed water into the RO system increased, the amount of energy it took to clean that water sample also increased.

Conclusions/Discussion

The conclusion was made for the salinity levels tested (0.5gm/liter to 1.5gms/liter), the most optimum pressure point is somewhere between 60 and 70psi. Going beyond this pressure point resulted in a greater energy usage for very little gain in clean water collection. It was also observed that the rate of brine production far exceeded the rate of brine treatment via osmosis

Summary Statement

The project is being executed in order to determine if solar desalination is a viable solution to help end California's drought problem.

Help Received

Mentored by Dr. Matthew Stroud

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)
Sarah C. Bruno

Project Number
J1005

Project Title
Can I Drink That Water?

Abstract

Objectives/Goals
The objective was to test different methods to disinfect pond water. The goal was to make pond water safe to drink.

Methods/Materials
Methods: 1) Collect pond water. 2) Prepare incubator plates. 3) Apply four different methods (UV, boil, iodine, home-made filter) to pond water and plate samples. 4) Incubate plates and observe changes over three days including photography and colony count.
Materials: 5 agar plates; 5 MacConkey agar plates; 10 cups of pond water; Ultra Violet wand; Stove; Iodine tablets; Sand; Activated Charcoal; Coffee filter; Thermometer; Incubator; Camera and readily available household supplies.

Results
The Ultra-violet and boiling method both disinfected the water. The filter did not remove E. coli bacteria. The iodine removed E. coli but not other bacteria.

Conclusions/Discussion
I was correct in hypothesizing that the homemade filter would not be very effective. However, my hypothesis about iodine was wrong. The iodine did not remove much bacteria. If I did this experiment again, I would screen out large particles prior to treatment and use more activated carbon in my filter.

Summary Statement
I wanted to find the most effective method to remove E. coli and other bacteria from pond water to make it drinkable.

Help Received
Sonora Regional Hospital Lab for donating MacConkey Plates; My family for helping me construct the board and supplying me with ideas

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)

Zachariah Budd; Nathan Patton

Project Number

J1006

Project Title

Aquaponics Engineering

Abstract

Objectives/Goals

Our objective was to design and build an aquaponics C.H.O.P. (Constant height, one pump) system. We also wanted to use bell siphons to fill and drain the grow-beds. A bell siphon lets the water level of the grow-bed fill to a certain height, then suctions all of the water out of the grow-bed. One pump saves electricity.

Methods/Materials

We designed a multiple grow-bed aquaponics C.H.O.P. system. We used bell siphons to fill and drain the grow-beds. Tilapia was a very common choice for fish when it comes to aquaponics systems, so we used tilapia in our system.

Results

We were successful in designing and building an aquaponics C.H.O.P. system. The bell siphon and single-pump design operates well. We are growing lettuce, peppers, and herbs.

Conclusions/Discussion

We successfully designed and built a C.H.O.P. aquaponics system. It operates by itself. From this project, others can learn about how a bell siphon works or why not to leave the roots of plants in water 24/7.

Summary Statement

We designed and built a self-operating aquaponics system.

Help Received

Zach's dad gave us some ideas for building our aquaponics system; Mrs. Rodriguez gave us financial support; Zach's dad took us shopping.

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)
Allison A. Chung

Project Number
J1007

Project Title
Extracting Nitrates from Water

Abstract

Objectives/Goals
The purpose of my science fair project was to find which plant, Duckweed, Water Hyacinth or Water Lettuce would extract the most amount of Nitrates from fertilizer contaminated water. I decided to do this experiment to ultimately help prevent ocean algae blooms. My hypothesis was: If I purify water polluted with liquid fertilizer using Duckweed, Water Hyacinth, and Water Lettuce, then Duckweed will eliminate the most Nitrates from the polluted water, compared to Water Hyacinth and Water Lettuce.

Methods/Materials
Important materials include: Duckweed, Water Hyacinth, Water Lettuce, Liquid Fertilizer, and Nitrate test strips.

Results
The results of the experiment were that the Water Lettuce filtered the most Nitrates from the contaminated water in the testing period of five days. The results show that my hypothesis should be rejected because it was proven wrong, Duckweed did not filter the most Nitrates.

Conclusions/Discussion
Duckweed didn't filter the most Nitrates because the roots were not big enough to suck up the Nitrates and in turn it didn't make a large change in the level of Nitrates, like the Water Lettuce did. I can interpret that my results showed that Water Lettuce filtered the water the most amount of Nitrates because the plant created a thick mat on the surface of the water and its thick fuzzy leaves were all slightly submerged in the water. This meant that the roots and the leaves were able to suck up more of the nutrients into their leaves and roots. It is also possible that Water Lettuce uses more Nitrates and nutrients than the other plants to grow or that it grows more rapidly than the other plants, and therefore used more Nitrates during the course of the experiment compared to the other plants. If I were going to do this experiment again in the future or expand on this experiment I would test multiple tubs of the same type of plants for a longer period of time, and I would try to find a more exact way to measure the levels of Nitrate.

Summary Statement
My project is focused on naturally filtering Nitrates from water in order to stop algae blooms.

Help Received
Ben Pitterle, my mentor helped design the project; San Marcos Growers provided plants; Santa Barbara Koi provided testing strips.

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)

Hamish S. De La Cruz

Project Number

J1008

Project Title

Photodegradation vs. HDPE #2 Plastic Bags Pollution in Water, Soil and Its Effect on Plant's Growth

Abstract

Objectives/Goals

Photo-degraded plastic bags are a major problem when it comes to recycling. My main objective is trying to improve the photo-degradation of HDPE #2 plastic bags. I also wanted to learn what type of toxins can be released from these bags in water, soil and how could this affect plants growth. I think that the photo-degradation process of High Density Polyethylene plastic bags will reduce the effect of possible toxins remaining in the residues.

Methods/Materials

Soil pollution: Set pots with soil and have some samples with plastic residues to track plant growth for at least 6 weeks and the release of toxins.

Water pollution: Set samples of plastic bags and photo-degraded residues in water to observe any change regarding its properties and the possible release of toxins.

Materials: Soil, Beans, HDPE #2 Plastic bags and Photo-degraded residues, Tap water. Soil and Water test kits for Chromium.

Results

Plants growth wasn#t affected at all in this test. All the plant samples grew bean vines. Soil samples tested no trace of Chromium and photo-degraded plastic bags were not visible in any of the pots used for this procedure. Water samples showed no results of Chromium but plastic pieces were fragile and turned into little pieces. Photo-degraded plastic in water was impossible to retrieve and if they were drained the pieces weren#t visible anymore.

Conclusions/Discussion

Photo-degraded HDPE #2 plastic bags didn#t release any Chromium in water and/or soil. These experiments have proved that in a period of five months HDPE #2 can be degraded. Photo-degradation of HDPE #2 plastic eliminates its mechanical properties: strength, flexibility. The tiny residues of plastic can endanger the life of microorganisms. Water degradation can be performed but photo-degradation shows to be faster and more effective.

Summary Statement

Testing photo-degraded HDPE #2 plastic bag residues for water and soil pollution and the possible release of toxins.

Help Received

Field Research: Dr Roberto Ma. Gregorius-Canisius College, Vince Calder Ph. D., Lydia Zipp, Dr Christopher S. Brazel-University of Alabama, Julie Meloro-EPA

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)

Khushali Desai; Aayushi Kapadia

Project Number

J1009

Project Title

Ocean Rescue 911

Abstract

Objectives/Goals

Use ferrofluid and a neodymium magnet to help separate oil from water and see if increasing the amount of ferrofluid will improve the efficiency of the oil spill cleanup.

Methods/Materials

Take 3 Petri dishes and label them 0, 1, and 5 for the number of ferrofluid drops to be used. Put 9 ml of colored water in all 3 Petri dishes and add 2.5 ml of mineral oil in the middle of the water using a pipette. Put 0, 1, and 5 drops of ferrofluid in the matching labelled Petri dishes. Take the neodymium magnet and put it in a Ziploc bag, and move through the contents of the Petri dish labelled 0. Take the magnet out of the plastic bag and put it in a new bag for the Petri dishes labelled 1 and 5. Now empty the contents of the Petri dish into a graduated cylinder and let the oil set on the top. Record the volume of leftover oil for each Petri dish. Repeat the above procedure 2 more times, and calculate the efficiency using the formula: efficiency equals 1 minus volume of leftover oil over 2.5 ml.

Results

The average efficiency of the oil spill cleanup using no ferrofluid was 12%, 1 drop was 36%, 5 drops was 44%.

Conclusions/Discussion

Using ferrofluid and a neodymium magnet helped to separate oil from water. But increasing the amount of ferrofluid did not make a significant difference in the efficiency of the oil spill cleanup.

Summary Statement

Ferrofluid and a neodymium magnet can help separate oil from water and help marine oil spill cleanup.

Help Received

Our helped us us in driving us to shop for materials, supervising the experiment, and disposing the hazardous materials

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)
Manasi S. Deshpande

Project Number
J1010

Project Title
Cleaning Up Oil Spills Using Nanotechnology

Abstract

Objectives/Goals
The objective of my experiment was to determine if the efficiency of removing oil from water using ferrofluid, a magnetic liquid, would change by varying the amount and temperature of ferrofluid. My hypothesis was that if I lower the temperature and increase the amount of ferrofluid the magnet will separate oil from water more efficiently.

Methods/Materials
In three petri dishes, take 2.5 ml of mineral oil and 15 ml of water. Change the temperature of ferrofluid to 0, 10, 20, 30 and 40 degrees Celsius. For each temperature add 5, 10 and 15 drops of ferrofluid. Put the neodymium magnet into the mixture and measure the remaining oil.

Results
The neodymium magnet was able to remove the most oil with more drops of ferrofluid at a lower temperature. It remove the least when ferrofluid was at the highest temperature and less drops were used.

Conclusions/Discussion
The results of the experiment supported my hypothesis. These results proved that in the real world, cleaning oil spills with ferrofluid would be the most efficient if the temperature was lowered and more of it was added.

Summary Statement
This experiment explores whether a difference in temperature and volume of ferrofluid will change the efficiency of removing oil from water.

Help Received
My mom helped me heat the ferrofluid.

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)
Tanshi Jain

Project Number
J1011

Project Title
A Healthier Filter: The Effect of Different Natural Materials on Purity of Water

Abstract

Objectives/Goals
The present day world faces an extremely serious threat. Nearly 750 million people worldwide lack access to clean drinking water, and 82% of these live in rural areas. Diarrhea is the fourth leading cause of death in children, most of which are water related. My project aims at comparing the efficiencies of simple water filters made using readily available natural materials like charcoal, terracotta, tea, coffee, rice husk, and wood for removing physical, chemical, and biological impurities from water.

Methods/Materials
Six identical filters were created using 2-liter soda bottles with a layer of sand and gravel in each. In five of these filters, another filter layer of the material being tested was added between the sand and gravel layers. Different samples of water were run through the filters, and the filtered water was tested for pH, turbidity, nitrates, phosphates, and presence of coliform bacteria. The water samples tested included distilled water for control, lake water, and lake water mixed with cow manure and liquid fertilizer. Two trials were conducted for each sample.

Results
The terracotta filter with tea gave the best turbidity results of 0 JTU for lake water and 10 JTU for cow manure water. The nitrate levels in all tested water samples remained at 5 ppm for all filters. Similarly, the phosphate level in distilled and lake water remained at 1 ppm for all filters. However, for cow manure lake water, the terracotta-tea filter produced the best average reading of 1.5 ppm. pH values remained fairly consistent at drinkable levels for all filters. For cow manure water, pH was 8 for all filters except terracotta-tea and charcoal, which had a pH of 7.5. Coliform test for lake water was negative for all terracotta filters and positive for all others. For lake water with cow manure, the results were the same.

Conclusions/Discussion
Terracotta filters with organic materials were more effective in filtering water than the others. They removed coliform bacteria from lake water as well as lake water to which cow manure had been added. Furthermore, terracotta with tea proved to be the best filter of all. The experiment proved that organic materials added to terracotta improve its filtration capacity. People living in rural areas can use these natural cheap materials, which are usually thrown away as waste, to get clean drinking water.

Summary Statement
My project aims at designing a small-scale, homemade water filter using natural materials.

Help Received
Mrs. Nguyen provided guidance and feedback.

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)

Angela Lee; Christina Lee; Samantha Morris

Project Number

J1012

Project Title

Hope 2 Others (H2O): The Bioremediation of Water Using the Plants Moringa oleifera and Coriandrum sativum

Abstract

Objectives/Goals

Objectives/Goal: The objectives of this project were to study and compare the abilities of two widely available plants, Moringa oleifera (moringa) and Coriandrum sativum (cilantro), to purify water of turbidity, metals, and bacteria and to create a prototype that could be used in developing nations.

Methods/Materials

Three types of experiments were performed studying the effects of moringa seeds, fresh cilantro, and dried cilantro on turbidity, metals, and bacteria. In the turbidity experiment, dirt solutions were prepared and treated with one of the plants and the clarity of the water was recorded over time. In the metals experiment, solutions of copper, iron, and lead were prepared and treated with the plants. The concentrations of these metals were measured over time using metal test strips. In the bacteria experiment, contaminated water was collected from a local pond and treated with the plants in varying concentrations then poured through a filter of gravel, sand, and cheesecloth and then tested for bacteria using bacteria test strips. Finally, a prototype water purification system was created.

Results

Overall, we found that moringa was more effective than cilantro at purifying water. In terms of turbidity, moringa cleared the water significantly whereas cilantro did not. Moringa was also able to reduce levels of all the metals to 0 ppm in just 30 minutes. Dried and fresh cilantro were also able to reduce metals but were not as effective as moringa. Finally moringa was able to purify bacteria from water while both fresh and dried cilantro were ineffective.

Conclusions/Discussion

780 million people in the world lack access to safe water and more than 3 million will die each year after drinking from a contaminated source. There are many water purification devices and methods, but these are often ineffective, expensive, or inaccessible. Bioremediation is the use of bacteria or plant matter to solve environmental problems. Moringa and cilantro are plants that grow widely in regions around the world that lack clean water. Our team compared the purification abilities of these plants and found that the moringa tree is an inexpensive, effective, and widely available solution to the need for clean water in developing nations. Bioremediation of water using native plants holds exciting potential to eradicate death and suffering from waterborne diseases and bring hope to others.

Summary Statement

Our project studied the bioremediation of contaminated water using the plants Moringa oleifera and Coriandrum sativum.

Help Received

Parents helped purchase supplies, supervised procedures for safety, and provided transportation to collect pond water samples.

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)

Connor R. Lough

Project Number

J1013

Project Title

The Effect of Vitamins on Hatching Artemia salina (Brine Shrimp) in Various Polluted Waters

Abstract

Objectives/Goals

My project was to determine when vitamins are added to various polluted Artemia salina (Brine Shrimp) habitats, if the added nutrients would increase the amount of hatched Brine Shrimp.

Methods/Materials

I constructed 10 Artemia salina hatcheries using 946 ml (1 quart) mason jars with attached air pumps. Each jar was filled with 800 ml of 26 degree Celsius distilled water. Baking soda (1.25 ml) was added to each jar and the pH level was tested. Sea salt (15 grams) was then added to each jar. After waiting 1 hour, 2.5 grams of Artemia salina eggs were added to each jar. No pollutants were added to Control Jars 1a and 1b. Storm drain water (30 ml) was added to Jars 2a and 2b. One cigarette was added to Jars 3a and 3b. Bleach (15 ml) was added to Jars 4a and 4b. Motor oil (15 ml) was added to Jars 5a and 5b. Kent Marine Zoe vitamins (1 ml) were added to Jars 1b, 2b, 3b, 4b and 5b. No vitamins were added to Jars 1a, 2a, 3a, 4a and 5a. After 24 hours, the air pumps were turned off and light was directed to the bottom of the jars. I collected a 1.25 ml sample from the bottom of each jar to observe, count and record the number of Brine Shrimp hatched. I replicated the 10 versions, 5 times each for a total of 50 tests.

Results

In the experiment, on average more Artemia salina hatched in the jars with vitamins added than without vitamins. Specifically, there was a (1) 74.4% increase in the control jars, (2) 78.8% increase in the jars with storm drain water, (3) 39.58% increase in the jars with cigarettes, (4) 569.57% increase in the jars with bleach, and (5) 18.82% increase in the jars with motor oil. Standard deviations were calculated for each testing group.

Conclusions/Discussion

In my experiment, I determined that more Artemia salina would hatch when nutrients from vitamins are added to their polluted water habitats. The data I collected did support my hypothesis. The overall average increase of Artemia salina hatched in habitats with vitamins added was 156.23%.

Summary Statement

When I added vitamins to various polluted Artemia salina (Brine Shrimp) habitats, I discovered that more Artemia salina hatched.

Help Received

My teachers reviewed my report and offered guidance with the experiment. My parents purchased the materials, supervised the experiment and the construction of the hatcheries. Catherine Takata offered suggestions and edits for the project and presentation board.

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)
Henry C. Lyon

Project Number
J1014

Project Title
The Coolest Place in Town: Does a Greenwall Affect the Surrounding Urban Environment?

Abstract

Objectives/Goals
My goal was to find out whether a greenwall would affect the environment surrounding it. Most research deals with the effects on the inside of the building, so it would be interesting to find out whether the temperature of a sidewalk under a greenwall was different than a control.

Methods/Materials
My family had decided to install a greenwall on the back of our house, which measured 6'w x 8'h, and consisted of 60 plants. I set up pavers on the ground under the wall and a control area on the same wall to represent the sidewalk. I set two digital thermometers on the sidewalk, and measured the two temperatures every day at 7am and 3pm for 42 days.

Results
After my trial, we put the data into a statistics program, and figured out that the average temperature increase between 7am and 3pm was .54 degrees higher for the control wall than the green wall. The sidewalk in front of the green wall was also .44% cooler on average at 3pm.

Conclusions/Discussion
While the effect isn't large, it was statistically significant. The greenwall sidewalk was slightly cooler, and the temperature increase was smaller. This was likely because the greenwall cools the air around it, and this cooler air sinks towards the ground.

I also found that the sidewalk in front of the control wall was cooler in the morning than the sidewalk in front of the greenwall, which was a surprise. The greenwall plants and soil seem to absorb and retain the heat over the day, and moderate the cooling through the night.

Greenwalls may be used to cool streets and parking lots in cities, especially if on the side of a big building.

Summary Statement
My project attempted to find out whether a greenwall affects the surrounding urban environment.

Help Received
My father's company manufactures products used in greenwalls, and we decided to install one in our back yard.

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)

Trinity Mobley; Danya Novak

Project Number

J1015

Project Title

Water-Wise: Rainwater Catchment and Its Possibilities

Abstract

Objectives/Goals

Our objective was to find the most efficient roof material and design for rainwater catchment for storage and later use. We also looked in to whether a hydro turbine could be applied to a roof to collect energy for use in redistribution pumping later.

Methods/Materials

We tested three variables; the roof design, the roof material, and a hydro turbine, to find the most efficient combination to use in a rainwater catchment system. On the first two tests, we poured 300 ml. of water over the same area of roof on four roof prototypes, based on common roof patterns and materials. For the hydro turbine test, we continued to try new ways of pouring water to get an attached light bulb to turn on.

Results

For the roof design results, we concluded that the shed roof with a return was the most efficient. The roof material results for the different types of roofing were the same, the type of material did not affect the amount of water collected in our study. The result for the hydro turbine was inconclusive.

Conclusions/Discussion

From the two parts of the hypothesis the roof design and material results proved that there was a "most efficient" roof design, and that the materials were all capable of shedding the same amount of water. By knowing this variant, you now have information which can be applied to your roof design specifications. We concluded that the hydro turbine we had did not work in our circumstance.

Summary Statement

Rainwater catchment is a viable means to collect and utilize water from your roof.

Help Received

Fred Ballerini, Roger Manley: Garden Solutions Landscaping, Catherine Stedman: CalAm, Denise Wood answered questions. Craig Novak: Sage Building Solutions Inc. answered questions, helped build prototypes, and supplied the majority of materials.

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)
Anshul Narain

Project Number
J1016

Project Title
Water Desalination: Reducing Seawater Salinity Using Low Voltage Current

Abstract

Objectives/Goals
The objective of this project is to use an alternative means of energy for desalinating seawater instead of using conventional methods (burning of fossil fuels). The alternative energy source proposed to be used is electricity. The goal is to desalinate the water to the point where it will be suitable for agricultural and drinking purposes (salinity levels reaching .01%).

Methods/Materials
The salt water will be entered into the containment unit. In the containment unit there will be 2 charged carbon electrodes, the cathode collecting the sodium ions and the anode collecting the chloride ions. The Refractometer will measure the salinity of the water and the pH meter will measure the pH of the water making sure that it is still neutral.

pH meter
Refractometer (measures Salinity)
Salt water (4 %)
Carbon electrodes
Variable power source
Containment unit

Results
Even when the voltage was increased, the water was only desalinated to a certain extent and could not go below a certain level of salinity.
The test was run at 3 volts, 4.5 volts, and 6 volts. At all levels of voltage, the water could only be desalinated to 3% salinity. Each time the desalination process occurred at different a rate and as the voltage increased, the time the water took to desalinate decreased.

Conclusions/Discussion
The results most likely occurred the way they did because the carbon electrodes did not have a large enough surface area. This meant that the electrode would be covered in the sodium and chloride ions to the point where they could not collect any more of them.
Now the project will be continued with the use of larger surface area electrodes (preferably copper).

Summary Statement
The purpose of this project is to create a system which will desalinate water without the conventional methods of burning fossil fuels, instead it will be using electricity at a low current voltage to carry out the procedures.

Help Received
Used lab equipment from Clovis North High School

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)
Jordan B. Paff

Project Number
J1017

Project Title
Pseudomonas fluorescens Exposed to Plastics: Decomposition Proposition

Abstract

Objectives/Goals
The objective of this experiment was to determine which of three different types of plastic would decompose at the fastest rate when exposed to the bacteria Pseudomonas fluorescens for a five week period.

Methods/Materials
Three different types of plastic, polyethylene terephthalate (PET), high-density polyethylene (HDPE), and polyvinyl chloride (PVC), were selected for the experiment based on their widespread use in products. In the experiment, 40 small disks of each type of plastic were put in petri dishes: six experimental petri dishes and one control petri dish for each type of plastic. Pseudomonas fluorescens that had been incubated in a nutrient broth was then added to each experimental petri dish, and nutrient broth without Pseudomonas fluorescens was added to the control petri dishes. All of the petri dishes were then placed on a rack in an incubator set to 25º C for 5 weeks. In the end, the petri dishes were taken out of the incubator, the plastic pieces were removed from the dishes, dried, then weighed. The percent change was found by comparing the original weight of the disks to their weight after 5 weeks.

Results
For PET, the average percent change in weight was -6.6%. For HDPE, the average percent change in weight was -4.6%. For PVC, the average percent change in weight was -3.5%.

Conclusions/Discussion
According to my data, PET decomposed at the fastest rate and is therefore more environmentally friendly than the other two types of plastic. PET decomposed 2.0% more in weight than HDPE and 3.1% more in weight than PVC. The fact that PET decomposed faster than the other two plastics that I tested suggests that if it were used more often, the global build up of plastic waste would be less severe.

Summary Statement
The goal of this project was to find which of three types of plastic would decompose at the fastest rate when exposed to the bacteria Pseudomonas fluorescens.

Help Received
I received assistance from Mark Stefanski, a 9th grade biology teacher at Marin Academy, and Rachel Quirk, a Dominican University Laboratory Technician, in regard to my methods.

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)
Saafiyah N. Patel

Project Number
J1018

Project Title
Solution to Cooking Pollution

Abstract

Objectives/Goals
I have asthma and allergies which becomes worse someone is cooking in the kitchen. This made me think what pollutants were causing me to cough. I decided to investigate more and designed an experiment to measure these pollutants emitted from cooking on stoves and the impact of the range hoods at low and high speeds and having the window open while cooking. I hypothesized that the amount of CO and NO2 emitted during cooking will exceed the acceptable outdoor profiles as set by the Federal and State regulations when stoves are used without a range hood. I also hypothesized that the concentration of NO2 and CO will be significantly lower when the range hood is on at high speed because the ventilation will dissipate the airborne chemicals that are created during the cooking process.

Methods/Materials
I rented a wireless portable gas monitor with six sensors (MultiRAE), to measure NO2, CO, and O2. During the experiment, my constant variable was the amount of onions sautéed, the pan, the amount of olive oil, the flame of the stove, the cooking time, & where the monitor was kept. My only manipulated variables were whether I used the vent, what speed I used the vent, and if I opened the window. Using the monitor, I established the background data for NO2, CO, & O2 by the stove, 10 ft, 20 ft, 30 ft away from the stove and also the outside air. I sautéed onions, a very common cooking ingredient, on the stove and measured the CO, NO2, and O2 while cooking. Then, I did this 3 more times again except with the range hood open on low and high speed and with the window open. I repeated 2 more times for each different intervention for accuracy of my results. Between each reading, time was given for the monitor to recalibrate. Data was analyzed.

Results
During the simple process of sautéing onions, I found out that high levels of NO2 and CO are released. The levels of NO2 exceeded ARB indoor air quality guidelines and ambient air quality standard of 250 ppb per hour and EPA#s national air quality standards of 0.053 ppm. The levels of CO also exceeded ARB indoor air quality guidelines and ambient air quality standard of 9 ppm.

Conclusions/Discussion
My experiment proved my hypothesis correct. During the simple process of sautéing onions, I found out that high levels of NO2and CO are released. All interventions evaluated had a great impact of minimizing indoor air emissions of NO2 and CO resulting from sautéing onions.

Summary Statement
Mitigating indoor air cooking pollution through the use of a vent hood.

Help Received
My parents helped and supervised.

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)
Anna T. Rioux

Project Number
J1019

Project Title
Farming for Water: A Solar Desalination Solution for the Water Crisis Facing California's Farmers

Abstract

Objectives/Goals
In the past four years California's drought has been getting worse, this year is on pace to be the worse yet. California's economy depends on the farmers, and the farmers depend on water. Solar desalination can be a solution to this problem. The purpose of this experiment is to determine what material, PVC pipe, plastic sink pipe or foam insulation tubing desalinator, will produce the greatest amount and best (pH closest to 7) freshwater. It is my hypothesis that the PVC will produce the best fresh water.

Methods/Materials
In the experiment I designed a solar desalinator using various materials; including three 30 cm pieces, 1 ½ inch width PVC pipe, plastic sink tubing, and foam insulation pipe. Plexi-glass, plastic wrap and aluminum foil were also used in the assembly of the desalinator, and food coloring was added to the water to act as a contaminant. In multiple trials ocean water from the San Francisco Bay was used (120 ml for each test), and the desalinators were placed outdoors in a sunlight area and left for 48 hours allowing the water cycle to purify the water. As a control bottled water was used in the same way as the ocean water was tested.

Results
The results of the desalinator tests included the pH level of the recycled water, the amount of recycled water produced and the color of the recycled water.
The PVC pipe produced an average of 28.75 ml, and a pH of 7.85 with a light blue, almost clear color. The plastic sink pipe produced an average of 8.5 ml, and a pH of 7.34, with a clear color. The foam pipe produced an average of 2.5 ml, and a pH of 6.59, with an almost clear color. Control: The PVC tubing produced 12.5 ml, with a pH of 6.78, with an almost clear color. The plastic sink tubing had 32.5 ml with a pH of 8.40, with an almost clear color. The foam insulation tubing had 12.5 ml with a pH of 8.08, and a blueish tint.

Conclusions/Discussion
I found that the results somewhat supported my hypothesis because the PVC produced the most recycled/freshwater when using ocean water. However, in the control the plastic sink pipe produced a greater amount of recycled/freshwater. When considering the pH level the PVC desalinator performed better when both the control and the ocean water tests are compared. The average pH was 7.3 which is reasonably close to 7.0.

Summary Statement
The purpose of this experiment was to design and test homemade solar desalinators to find which will produce the greatest freshwater to be used in agriculture settings.

Help Received
My mom helped me by revising and editing my typed work, she also took pictures and provided me with the money needed to buy the supplies. My dad helped me using power tools to cut the tubing and the notches in the tubing.

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)
Mari O. Sanders

Project Number
J1020

Project Title
From Seed to Sod: An Examination of Seed Germination and Its Effectiveness in Establishing Riparian Buffers

Abstract

Objectives/Goals
The purpose of this project was to see if grass grown from seed can reduce the amount of nitrate and phosphate runoff from fertilizer application. This is a follow-up study of last year#s project where commercially grown sod was tested to see if plants could act as a filter to reduce chemical runoff. This year, scientific testing materials were acquired to get more accurate results. This year#s hypothesis states that grass grown from seed will effectively reduce the amount of chemical runoff in the water samples.

Methods/Materials
Grass seed was planted in five plastic troughs, which had been altered with PVC pipe. Then organic and inorganic fertilizers were added. Water was poured onto each trough in regular intervals. The water was tested by using nitrate and phosphate test kits.

Results
This study found that the grass grown from seed resulted in reduced amounts of nitrates, measuring 25% of last year#s results. Phosphates this year were higher than last year for unknown reasons. It was observed that grasses could be used to establish riparian buffers around natural waterways to absorb some of the nitrates and phosphates found in fertilizer to help reduce the toxic effects of chemical pollution.

Conclusions/Discussion
The extreme amount of pollutants entering waterways from fertilizer has had catastrophic effects on water quality, marine life, and human health. Since grass grown from seed can be used to establish riparian buffers to absorb excess nitrates and phosphates, this means that farmers can plant riparian buffers around agricultural areas to help reduce the amount of toxic chemicals that could enter waterways causing environmental damage. While it was exciting to see how well plants can filter environmental toxins, it is important to remember that despite their effectiveness, chemical runoff will always occur with fertilizer application.

Summary Statement
By comparing the data sets from 2014 with this year's results, it was found that planting grass grown from seed to establish riparian buffers around an agricultural area is effective in reducing chemical runoff.

Help Received
Parent supervised during testing because the test kits contained harmful chemicals.

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)
Milan Y. Sanghvi

Project Number
J1021

Project Title
Investigating the Novel Use of Carbon Aerogel for Water Treatment

Abstract

Objectives/Goals
I recently read an article about researchers trying a new method of water purification using carbon aerogel. Carbon aerogel is an amorphous form of carbon which is extremely lightweight because of its high porosity. The carbon aerogel I used was derived from cellulose, which has a very high carbon content. The cellulose aerogel was heated at 800°C to reach 98% carbon content to produce carbon aerogel. The objective of this project was to determine if using carbon aerogel might actually be a safe and effective method for removing heavy metals, dyes, and oils from contaminated water, and if so, would activated carbon and charcoal be able to remove the same contaminants at the same rate. My hypothesis stated that carbon aerogel would show a significantly higher percentage of absorption of dyes, heavy metal copper (Cu) and iron (Fe), and oil (gasoline, motor oil and peanut oil) than the activated carbon.

Methods/Materials
I performed a total of 140 tests. I used a UV spectrophotometer to take readings during my experiments with the dyes and I used a centrifuge to mix all my solutions. I used the ratio of 25mg of carbon aerogel, activated carbon, or charcoal in 1ml water contaminated with dye, heavy metal (copper and iron) and oil (gasoline, motor oil and peanut oils). I took readings in two minute intervals up to ten minutes.

Results
My findings showed that both carbon aerogel and activated carbon were effective at removing heavy metals, dyes, and oils. After only two minutes the carbon aerogel was able to remove 90% of both heavy metals (Cu and Fe). After ten minutes the carbon aerogel was able to remove 100% of the oils, metals, and dyes. Activated carbon was able to remove 100% of the dye and 95% of the copper and iron in 10 minutes. Activated carbon was only able to absorb an average of 30% of peanut oil and gasoline and 85% of motor oil in ten minutes. Charcoal was able to absorb only negligible amounts of oil and dye, but it was able to remove 50% of the heavy metals in 10 minutes.

Conclusions/Discussion
I would recommend carbon aerogel as an effective means of sewage treatment as it is able to rapidly absorb a wide variety of contaminants.

Summary Statement
The purpose of my project was to determine if using carbon aerogel could remove dyes, heavy metals and oils from contaminated water.

Help Received
Used lab equipment at AM Chemicals, LLC

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)
Liam T. Smith

Project Number
J1022

Project Title
Crazy Composting

Abstract

Objectives/Goals
To find out the best compost preparation method (chop, blend, or freeze) that will make compost worms the healthiest.

Methods/Materials
I tested 12 compost bins with 50 grams of worms and 50 grams of bananas, apples and lettuce (all foods combining to make 50 grams), 14 oz. of vermicastings, and 14 oz. of coconut fiber to absorb excess moisture. I used old coffee cans for the bins. I chopped 150 grams of food and disrubuted them evenly across three compost bins. I froze and chopped 150 grams of food, and distributed them among another 3 bins. I did the same except blend 150 grams of food and distribute them among the next 3 bins. I put 45 grams of rice in 4 bins, and 25 grams of citrus in 5 different bins. One bin was the control, with only 50 grams of worms and no food. The experiment itself was over the course of 3 weeks.

Results
The bins that had only banana, apples, and lettuce had generally low food weights, the worm weight didn't change much, but with varying egg numbers. The bins with rice had high food and worm weight, but low egg count. The bins with citrus had low food weights surprisingly, and very high egg counts, with low worm weight. The most successful bin was the bin with blended food. there was no food that we could measure, the worms had actually lost weight though, probably because they ate all of it at the beginning, and there was not much to eat from there on. It had an extremely high egg count, only one egg behind the highest, 105.

Conclusions/Discussion
My hypothesis was incorrect. I expected the frozen food with added rice would make the worms the healthiest, but it turns out the blended food made them the happiest and healthiest. What most likely happened was that frozen food had less nutrients after it froze. In the blended bin, there was literally no food to weigh, and many eggs.

Summary Statement
An exploration about what compost preparation method makes worms the healthiest.

Help Received
My Dad helped weigh food and count eggs and he helped pick out worms, helped review and revise project.

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)
Hannah G. Sugano

Project Number
J1023

Project Title
Can Chemically Altered Water Be a Drought Solution?

Abstract

Objectives/Goals
The purpose of my investigation is to find out if water from a pool or spa could be used to grow grass. If chemically treated water can be used to effectively grow grass, then people in California who are currently suffering from a drought could use the water from their pool or spa to water their lawn and save water. My hypothesis was that water treated with Bromine would grow the best.

Methods/Materials
For my project, I watered 3 pieces of sod for each of the different types of water I was testing (Bromine, Chlorine, hose water and salt water). The hose water was my positive control and the salt water was my negative control. I had four buckets filled with regular hose water and added the chemicals to three of them. I added nothing to one of the buckets of water and ¼ a cup of salt to another. I calculated the amount of Chlorine and Bromine in the third and fourth bucket by making sure that the level of Ph in the water matched the level on the bottle of the pool testing strips I used. Each day, for a total of 14 days, I watered the different squares of grass according to the type of water they were being tested with and recorded their growth rate.

Results
The grass watered with Chlorinated water averaged the highest growth with and average of .4 cm per day. Next came the hose water with a .3 cm average. Bromine had a .3 cm average and salt water had the lowest average of .1cm per day.

Conclusions/Discussion
In summary, my hypothesis was proved incorrect due to the fact that Chlorine had the highest growth rate. I believe this could be because Chlorine contains stronger purification elements that might stimulate grass growth. Overall, the Chlorinated water proved best for plant growth; however, hose water and Bromine water will still keep the grass healthy.

Summary Statement
My project was finding the effect of using chemically treated water on grass.

Help Received
My teacher gave me the basic outline for how to do a science fair project. My mentor (Ruth Finklestein, a professor at UCSB) helped me with suggestions for the set up of the experiment and my dad bought the materials and helped me set up the sod/experiment area. My mom helped me proofread my project.