CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)

Vikram S. Balasubramanian

Project Number

J1001

Project Title

Capturing Carbon Dioxide with Saltwater Hydroponics

Abstract

Objectives/Goals

Global warming caused by CO2 emissions is a threat to mankind. Plants have been absorbing CO2 since the dawn of time. But the answer is not planting more trees. Land is limited, energy used to grow plants typically emit CO2 and are geographically limited. The objective of this project is to develop a sustainable carbon capture method through the use of marine plants. Our solution is an algae hydroponic barge using solar power, the ocean for nutrients and space to create a self-sustaining, energy-efficient, environmentally-safe carbon-capture method.

Methods/Materials

For this project, we need a fast growing plant with a high O2 release/CO2 absorption, a wide habitat, an energy source(solar power), a natural source of nutrients all which is economically viable. All these aspects are combined in my project - Algae Hydroponic Barge. The barge is designed with a pump and a valve to provide a nutrient flow. The barge is solar-powered and can be an open or closed environment - with LED lights providing an ideal light cycle. The design also includes plans for communications, overflow control and maritime lights. This project also researches conversion efficiencies of various micro and macroalgae and a financial analysis. Macrocystis Pyrifera(M.Pyrifera) is ideal for fast growth, while green algae is the suitable for biofuel production. We used Chaetomorpha Algae as a research substitute to M. Pyrifera.

Results

Algae Growth: Chaetomorpha Algae was grown in a contained environment that simulated ocean conditions - saltwater, light and nutrients. The experiment shows that algae growth can be scaled using a hydroponic barge.

Barge Design: A design duplicating the basic idea of an aquarium-refugium system was constructed. A prototype of a scalable, net carbon-negative, open/closed hydroponic barge with a constant flow of nutrient, solar power and LED lights ideal for micro/macroalgae growth was constructed.

Conclusions/Discussion

Plants absorb CO2 from air, but when they decompose they release it right back. A way to get plants into the energy cycle is to convert them into biofuel. Agricultural crops such as corn are already being converted to biofuel but net carbon capture is low and they use land, water, energy. On the other hand, the ocean is an untapped resource with nutrients and space. Through the self-sustaining hydroponic barge that requires virtually no management, we can reduce global warming.

Summary Statement

My project is about net carbon capture through saltwater hydroponics.

Help Received

My project adviser helped me understand certain concepts and proofread my work.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)

Zachary Benetatos

Project Number

J1002

Project Title

OFO Filtration System: An Environmentally Safe Solution

Abstract

Objectives/Goals

The purpose of my experiment is to conduct multiple tests to see which sorbent is the best sorbent for cleaning up oil spills in our oceans.

Methods/Materials

The sorbents I tested were flour, corn starch, shop towels, sawdust, and coconut husks. 1.) I created my own salt water using a mathematical formula listed in my Procedure. 2.) I made 5 bowls (1 per sorbent) by cutting 5 half gallon bottles in half. 3.) I layered 1 piece of cheese cloth onto each bowl to easily scoop up the sorbents once and if they absorb the oil. 4.) I poured 6 cups of salt water into each one of the bowls. 5.) I poured 2/3 of a cup of motor oil into the bowls to act as the spill. 6.) I poured the sorbents into their individual bowl and timed it for two minutes. 7.) At exactly two minutes I removed the sorbents using the cheese cloth and saw my results.

Results

After I saw my results i noticed some were leaving different amounts of residue. That is when i decided to expand my experiment even more and not only test which is the best sorbent for cleaning up oil spills, but to also compare the different amounts of residue left behind. The best sorbent was the coconut husks. The coconut husks absorbed ALL of the oil and left no residue at all. The 2nd place sorbent was sawdust. Although sawdust left a lot of residue, it absorbed almost all of the oil. The 3rd place sorbent was flour. The flour left a medium amount of residue and barely absorbed the oil. The shop towels took 4th place. Even though the shop towels left no residue at all, it didn't do well absorbing the oil spill. The worst sorbent was corn starch. Corn starch left the most residue and oil behind.

Conclusions/Discussion

When I found out that the coconut husks were #1 in cleaning up the spill, I engineered my own filtration system. I lined a PVC pipe (my filter) with only 6 oz of coconut husks and pumped the oil/saltwater through one end and the coconut husks absorbed the oil. Therefore, perfectly clear salt water came out in the other end.

Summary Statement

My project creates a more efficient way to clean up oil spills using an environmentally safe solution.

Help Received

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)

Jessica Bennett; John Takemura

Project Number

J1003

Project Title

Oil Options: A Sustainable Method of Reclaiming Kitchen Waste Oil and Grease

Abstract

Objectives/Goals

We created a kit that used a sustainable method of reclaiming waste oil and grease into biofuel and the byproducts into compost.

Methods/Materials

The kit includes: safety wear, oil collecting jar, filter, and the pre - measured chemicals you need for the process. Using approximately 1 liter of collected waste oil and grease, the first step is to heat and filter the oil in order to ensure a clean biodiesel. We had to try several different prototypes before we were satisfied with the effectiveness of the filter. Methoxide made from a titrated amount of sodium hydroxide and methanol is then mixed with the filtered oil and blended for about 20 minutes. Let settle for 24 hours resulting a product of biodiesel and glycerin byproduct.

Results

The kit yielded approximately 1 liter of fuel for each liter of grease or waste oil depending on the type of waste grease converted. For each biofuel trial, the fuel's output energy was tested in a calorimetry test. According to the National Institute of Standards and Technology, biodiesel (B100) has an output of 8629. cal/liter. The average calorie output of the biofuel made from waste turkey oil using this kit was just over 9,000 cal/liter. To assure that the product of the kit was completely sustainable, the glycerin byproduct was tested as a compostable substance and found that it completely broke down to make a quality compost for the garden, as seen by it#s dark color and moisture content.

Conclusions/Discussion

Our goal to be completely sustainable in reclaiming waste kitchen oil and grease was successful. With this kit, the average household can sustainably reuse waste grease and oil by creating the useable products of biofuel and compost.

Summary Statement

We created a kit that used a sustainable method of claiming waste oil and grease into biofuel and the bi products into compost

Help Received

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)

Rohan Bhushan; Christopher How

Project Number

J1004

Project Title

Nitrosomonas europaea: Accelerating Bioremediation of Ammonia Using Magnesium Sulfate

Abstract

Objectives/Goals

The purpose of this project is to investigate the effect of magnesium sulfate on the growth of Nitrosomonas europaea, for the purpose of bioremediation. Our hypothesis for this project is that the magnesium sulfate will accelerate the growth of Nitrosomonas europaea, thus enabling more ammonia to be oxidized.

Methods/Materials

The constants in this experiment are 0.2 micron filtered water, water amount, containment dimensions, ammonia amounts, location, temperature, and time. The variable in the experiment is the amount and addition of MgSO4. This project's research methodology consists of three phases. The first phase includes gathering materials needed. The second phase includes the preparation of samples and incubation. The third phase includes testing content of ammonia against different amounts of MgSO4. Five samples were created, each with three trials for more accurate results. The dependent variable was calculated by measuring the amount of ammonia in each containment unit.

Results

The results show that the MgSO4 significantly helped to increase growth of Nitrosomonas europaea, resulting in the reduction of ammonia. The results show that our hypothesis is correct.

Conclusions/Discussion

Based on our results, as a proposed solution, we designed a microbial filter model which has the potential to be used in the bioremedial treatments. If we were going to expand this experiment we would prolong the incubation phase and observe the changes in growth of Nitrosomonas europaea during the experimentation. Also, we would use our filter designs to construct a device which could be implemented in the Salinas River or other ammonia polluted sources.

Summary Statement

This project is about the effects of Magnesium Sulfate on Nitrosomonas Europaea and we recorded this effect by using the bioremediation of Ammonia.

Help Received

Dr. Jim Barry from MBARI gave us detailed information on Nitrosomonas europaea; Mr. Peter Hofsteen gave us thorough information on ammonia and its relation to the agricultural industry; MBARI allowed us to use their sieve to filter the Carmel River water.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Rachel N. Clift

Project Number
J1005

Project Title
The Effectiveness of Neodymium Magnets at Cleaning Oil Spills

Abstract

Objectives/Goals
My goal was to measure the effectiveness of neodymium magnets at cleaning oil spills. I tested the process using different densities of oils, chosen to match actual oils that are commonly transported. My hypothesis was that more of the lighter oils would be collected. I also ran tests in various temperatures of water, chosen to match actual ocean temperatures in different parts of the world. My hypotheses was that more oil would be picked up in warmer waters.

Methods/Materials
Materials: mineral oil, gasoline, crude oil, ferrofluid with mineral oil as the carrier fluid, neodymium magnet, tap water, graduated cylinder, petri dishes, pipettes, thermometer. Methods: put water in dish, add 2.5 mL oil, add 3 drops ferrofluid to oil, move magnet through oil, transfer remaining liquid to cylinder, measure remaining oil.

Results
The magnet was more effective with lighter densities of oil (55% for gasoline, 31% for mineral oil, and 16% for crude oil). However, water temperature did not seem to influence the effectiveness very much. There was more variation between the trials than there was between the different temperatures.

Conclusions/Discussion
My hypothesis that the process would work better for lighter oils was correct. One possible explanation is that the magnet had a harder time picking up a heavier substance. Another possibility is that the ferrofluid had an easier time dispersing through the lighter oils. I was surprised, however, that temperature didn't seem to affect how well the oil was picked up by the magnet. This is good news for the environment, because it means that this method should work in any of the world's oceans.

Summary Statement
My project is about a recently-discovered method to clean oil spills, by first magnetizing the spilled oil, and then collecting it with a powerful neodymium magnet.

Help Received
My dad was my lab assistant, and also helped me make my board neat.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Soraya K. Cordero

Project Number
J1006

Project Title
Is It Raining Trash? The Effect of Storm Drains on Ocean Pollution

Abstract

Objectives/Goals
The purpose of my project was to determine how the design of storm drain grates affects the amount of flooding and the amount of trash flowing into the ocean.

Methods/Materials
The storm drains in my surrounding cities were tested to determine how effective they are at preventing ocean pollution. Pictures and measurements were taken of the storm drains for Los Angeles, Glendale and Eagle Rock. Replicas of all three drains were built using polymer-based clay. In addition, I created and built my own storm drain design. The drains were then tested by building a water chute from plastic sheeting and attaching the drains to a hole cut out in the middle. The chute was placed at an angle and 4.75 gallons of water were dumped down the chute. A baseline was first obtained for each drain and then 73 pieces of litter were added to the water similar to the litter I observed had accumulated at the actual city drains. Testing was done for both heavy and light rainfall by adjusting how fast the water was dumped down the chute.

Results
The best drain at preventing flooding was Eagle Rock during both heavy and light rainfall. However, it was the most inefficient at preventing ocean pollution as it allowed 52-56 pieces of trash to enter the storm water. Los Angeles, Glendale and my storm drain were similar in preventing flooding, which were not much less effective than Eagle Rock. However, my storm drain performed significantly better than all of the drains at keeping litter out of storm water. My storm drain only allowed 1.4-4.2 pieces of litter to enter the storm water. My storm drain design surpassed all of the city designs as it was both efficient at preventing flooding and vastly superior at keeping litter out of the storm water.

Conclusions/Discussion
Proper storm drains are essential for preventing ocean pollution. Much of the trash that has accumulated in the Pacific Ocean is due to litter that enters storm drains. Water that enters storm drains is not filtered for pollutants. It flows directly into streams and lakes, eventually ending up in the ocean. Unfortunately, storm water drains in many of our cities are not designed to effectively prevent flooding and ocean pollution. My storm drain, with both slanted, vertical openings and circular openings, was most effective at preventing flooding and ocean pollution because the size, spacing and angle of the grate openings directly affect its efficiency.

Summary Statement
My projected tested storm drains, including my own design, to determine which grate model performs best at both preventing flooding and ocean pollution.

Help Received
My mother helped me bake my clay replicas. She also helped me lift the bucket of water during testing.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Stephanie N. Cudney

Project Number
J1007

Project Title
Earthworms Affect Soil pH

Abstract

Objectives/Goals
I know from my previous science experiment in third grade that earthworms can mix soil and sand together. My purpose for my experiment this year is to find out if earthworms can affect soil pH by mixing soil and sand together.

Methods/Materials
I observed layered soil and sand, and earthworms in a jar labeled two. Also, measured jar two's soil pH by using a pH meter. Another jar labeled one consisted of layered soil and sand only. Jar one was the controlled variable and Jar two had the Dependent variables.

Results
My first trial, I analyzed my data on a graph which showed a change in the soil pH. The soil pH was a 7 on day one and by day 3 it was a 7.5. Day 5,8,10 the pH was a 7.9 and was constant. On the final day, day 12, the pH was an 8. The second trial, my data showed Days 1,3,5,7 a constant pH of 7.9. Days 9,11 was a pH of 8.

Conclusions/Discussion
My hypothesis was correct, earthworms can affect soil pH by mixing soil and sand together. By analyzing my data on a graph; I saw the changes in the soil pH. The only part of this experiment I would do different is use a different type of pH meter to measure the soil pH. By fathering this experiment I would ask myself "Can temperature affect pH in soil and sand that is mixed together by earthworms?" Knowing what I have observed from my experiment. We can use earthworms to mix soil and sand together to change the soil pH in our environment.

Summary Statement
I wanted to find out if earthworms could affect soil pH by mixing soil and sand together.

Help Received
My mentor teacher helped me by giving me a science packet that helped explain the scientific method. My mother kept me on task and answered questions that I had. Also, I attended my hands on science teachers workshop on pH that helped me understand the pH scale.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Callum E. Day Ham

Project Number
J1008

Project Title
The Effect of Elevated CO(2) Concentration on Plant Growth

Abstract

Objectives/Goals
If the percentage of CO2 in a plant's environment affects how fast the plant will grow, then - considering that plants require CO2 for photosynthesis and the production of carbonic acid is slow - the higher the percentage of CO2, the faster the plant will grow.

Methods/Materials
Four healthy dwarf pea sprouts were placed in each of four clear glass jars and the concentration of Co2 in each jar was adjusted to normal air, 10%, 50%, and 100% respectively. The accurate adjustment of the Co2 concentration was achieved using a technique where each jar was filled with water, then blown out and replaced by Co2 until the respective percentage of Co2 was fulfilled, then blow the rest of the water with normal air. This set up was placed under a grow light so that each plant had the same amount of #sunlight#, then the plant's were measured every day for eight days and their gain or loss in height was recorded. Repeat this procedure four times to eliminate as much uncontrollable error as possible.

Results
All plants started at approximately the same height. In the 100% Co2 the average height reduced to 42% of its original height over eight days. In the 50% Co2 the average height reduced to 62% of its original height over eight days. In the 10% Co2 the average height increased to 114% of its original height over eight days. In the normal air the average height increased to 115.5% of its original height over eight days. A significant amount of water vapor was found on the 100% Co2 and it seemed as if the water vapor corresponded to the percentage of Co2 in that jar.

Conclusions/Discussion
The data proves my hypothesis wrong, but even though I was wrong the data displays a clear pattern. As the Co2 levels rise the plants seem to keel over and die faster or their growth was slowed. There was two noticeable groups though. One which grew from its original point and the other that dramatically died from its original point.

Summary Statement
My project is designed to measure the impact of significantly increased concentrations of CO2 on plant growth and health.

Help Received
Father helped design CO2 supply; Mother helped review written materials

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Hamish S. De La Cruz

Project Number
J1009

Project Title
Chamber, Photodegradation, Action

Abstract

Objectives/Goals
Reduce HDPE #2 Bags time to photo-degrade and contain HDPE Bags residues.

Methods/Materials
Using the UV Radiation from the Sun as well as heat to photo-degrade HDPE Bags and setting them up in aluminum trays with a glass lid to contain HDPE Bags residues.
Materials: HDPE #2 Bags, Aluminum Trays, Duct tape, Aluminum Foil, Cardboard, and Glass Lids.

Results
The chamber materials were able to increase the heat inside the chamber. The UV radiation was reflected all over the chambers as a result of the aluminum foil that was around them. Time for photo-degradation was decreased and HDPE #2 Bags residues were contained and collected from the trays.

Conclusions/Discussion
It was possible to improve the UV radiation, as well as heat (temperature) performance using these chambers. The materials which the trays are made of and the location helped in the success of gaining and maintaining the conditions to photo-degrade and contain the HDPE #2 Bags.

Summary Statement
Reduce and improve HDPE #2 Bags time to photo-degrade and contain the residues using a chamber.

Help Received
Mother helped me email Scientist and people involved in this field. Father helped me with my board.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Amanda B. Diamond

Project Number
J1010

Project Title
Oil Spill Clean Up Using Nanotechnology

Abstract

Objectives/Goals
My objective is to measure the efficiency of using nanotechnology and magnetism to clean up oil spills and determine if it is a viable alternative compared to other methods used today.

Methods/Materials
Materials: Ferrofluid, Neodymium magnet (1.9 x 1.3 x 0.6 cm), Mineral oil, 9 petri dishes, Graduated cylinder, 0.2ml increments, Tap water, Food Coloring, Graduated pipettes.
Procedure: Add water to cover the bottom of three petri dishes, then add green food coloring. Use a pipette to float 2.5 mL of mineral oil on the water in each petri dish. In the 1st dish, don#t add any ferrofluid (control sample), in the 2nd dish add 1 drop of ferrofluid, and in the 3rd dish, add 5 drops of ferrofluid. Put magnet in Ziploc bag and move it around the petri dish (1 complete revolution). Wipe off the oil on the bag and repeat 1 time. Transfer the contents remaining in the petri dish to the graduated cylinder and measure remaining oil. Repeat this procedure for a total of three trials.

Results
My calculated maximum average efficiency was 41% in the dish with 5 drops of ferrofluid. In subsequent follow on testing I was able to obtain efficiencies up to 76% using modified techniques and additional ferrofluid.

Conclusions/Discussion
My initial results showed that the efficiency of this method of oil spill cleanup was only 41% in the best case. Most methods used today, for example oil-skimming machines, have a 90% efficiency rate.
In subsequent testing with additional ferrofluid, the efficiency of the cleanup procedure dropped significantly to 20%. My observation was that as I used more ferrofluid there was a limit to how much oil the magnet could pick up in each sweep. In addition, ferrofluid is made with oil so the more drops I added, the more I increased the amount of oil that needed to be removed. So modified the procedure - used 4 sweeps with the magnet instead of 2 sweeps. I also put the flat side of the magnet in the oil slick instead of the edge. In these tests, as I added more ferrofluid, the average efficiency increased as high as 76%.
Although the application of nanotechnology for oil spill cleanup is still in its nascent stage, I believe it offers great promise for the future. Today, scientists are working on this new method of cleaning up oil spills in order to improve and make it more efficient.

Summary Statement
Nanotechnology has enabled the creation of a magnetic liquid known as ferrofluid, which, when added to an oil spill allows the oil to be picked up with powerful neodymium magnets, at efficiencies approaching current techniques in use today.

Help Received
My Dad supervised me during my experiments.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Ishani Ghosh

Project Number
J1011

Project Title
The Effect of Limestone on Soil and Water

Abstract

Objectives/Goals
The objective was to test the effect of limestone on soil and water. I believe that if soil and water have acidic content (pH) in it, then it can be reduced by addition of limestone. Increase in acid level of soil will negatively impact the growth of plants thriving in alkaline soil conditions.

Methods/Materials
Made limestone by crushing sea shells and mixed with dry plaster and water; left it inside a closed cabinet for 5 days.
Poured organic soil in 24 small pots (2 Sets). Soil Sulfur was mixed to make high, medium and low acid pots with no addition to neutral pots. Placed limestone in Set 1 only as Set 2 was the control group. Planted pea seeds for germination in all the pots and kept in sunlight. Observed pea seed germination and recorded change in soil pH and plant growth.
Water was collected from tap, lake and ocean. Poured water from the 3 different sources into 72 plastic cups (3 Sets, each Set having 2 Subsets). Vinegar was mixed to make high, medium and low acid cups with no addition to neutral cups. Placed limestone in Subset 1 only as Subset 2 was the control group. Water samples were kept in a cool and dry place. Recorded change in pH level of water.
It may be noted that each category of pots and cups had 3 samples each to reduce the margin of error.

Results
The acidic content (pH) in soil and water were neutralized in 7 and 3 weeks respectively. The pea plants at the end of 7 weeks survived in pots containing limestone and in neutral pots. Highest and healthiest growth pattern were recorded in pots containing limestone but without acid.

Conclusions/Discussion
My conclusion is that the acidic content (pH) in soil and water were neutralized by adding limestone, thereby supporting my hypotheses. The faster change in the pH level in water as compared to soil was due to the fact that limestone gets easily dissolved in the former. The results suggest that limestone can be added to attain the desired pH level of soil and water for maximizing growth of plants thriving in alkaline soil conditions and water conditioning.

Summary Statement
To test effect of limestone in modifying pH level in soil/ water and its impact on plant growth.

Help Received
Mentor - specific guidance; School Science Teacher - overall guidance; Parents - overall guidance and providing requisite materials and Uncle - helped in refinement.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Tommy Hartman; Alfryd van Brugggen

Project Number
J1012

Project Title
Nyctinastic vs. Succulent: The Battle for the Green Roof

Abstract

Objectives/Goals
The purpose of our experiment is to find the best plant for using on green roofs. Our hypothesis is that Oxalis will keep a house cooler than grass or a succulent plant, whilst cutting down on the water needed. Some plants are more notorious for being used on green roofs, namely grass and succulent plants. Succulent plants are used because supposedly provide cooling whilst consuming little water. Grass is used out of convenience. However, another plant seem statistically better: Oxalis.

Methods/Materials
We built a model of a flat roofed house, about a foot cubed. It is a wooden box with a sunken in roof, in which we put a controlled amount and type of soil. We gave the plants a standard amount of water only in the beginning to see how well they conserved it. We measured the moisture of the soil and temperature inside the house.

Results
The results showed that oxalis maintains the most moisture whilst still providing a cooler temperature inside the house, which fully supports our hypothesis. The succulent plants didn#t do quite as well, but grass was not effective at all.

Conclusions/Discussion
Our results showed that oxalis requires minimal water and keeps it cool, as our hypothesis stated. This proves that oxalis are better plants for a green roof then standard green roof plants.

Summary Statement
Our project identified the best plant for a green roof.

Help Received
Mother help with poster preparation.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Alexander J. Howard

Project Number
J1013

Project Title
Using Oyster Shells to Neutralize Acidity in Water Collection and Treatment Systems

Abstract

Objectives/Goals
I wanted to create a filter that would use shells to reduce acidity in water by a factor of ten (increase by 1.0 on the pH scale) within 5 hours, leave no sediments in the water, have less than $10 in materials, and be simple in its design.

Methods/Materials
I did preliminary tests to prove my concept of neutralization with shells. After these tests, I made preliminary prototypes to get my first ideas tested. With these results, I determined the primary design elements, created final prototypes to finalize my ideas, and developed an overall neutralizing design. I added vinegar to water to create my acidic water, and oyster shells were used as the neutralizing substance. A bucket, several plastic bottles, and plastic tubing were used as the materials for the final prototypes.

Results
I was able to create an overall design that can neutralize acidic water by a factor of 1 on the pH scale in 2 hours. Testing indicated that about 200 grams of shells are required per 1 liter of acidic water (pH = 4.5) to raise the pH level to 5.5 in 2 hours. It leaves no residues in the water output, the materials cost less than $6, and it is extremely simple in design.

Conclusions/Discussion
My results showed I could create a very low-cost filter that can significantly reduce acidity in water. The design is simple and effective, and with a few guidelines can be adjusted for the materials and water filtration needs of a specific area.

Summary Statement
I designed a simple, low-cost filter that can be added to existing water treatment systems to neutralize acidic water with shells.

Help Received
My mother purchased materials, and my father helped me with cutting and drilling of materials for building the prototypes.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Jackson J. Humphrey

Project Number
J1014

Project Title
Can Algae Bloom Be Affected by Manure Produced from a Modified Chicken Diet?

Abstract

Objectives/Goals
The object is to test if manure produced by a feed modified chicken diet can reduce eutrophication effects on algal bloom.

Methods/Materials
Experiment includes 50 test specimens; 10ea x 4 independent variables and 10 control group specimens. 30ml of Ankistrodesmus living algae will be placed in each of 50 individual 8oz plastic containers. Chicken excrement will be collected from backyard flock undergoing a diet modification study. 2g of manure will be placed onto an affixed filter then sprayed with 200ml of distilled water to create a 1% runoff water solution. 3ml of runoff water added to each specimen/variable. A spectrophotometer will be calibrated to 540 nanometers. 7ml of algae will be drawn from each specimen and placed into spectrophotometer. Readings will be taken on day 1 and every 2 days for 15 days.

Results
Manure produced by a charcoal modified chicken diet had a 95.8%, protease enzyme modified chicken diet had a 93.7%, sodium bicarbonate modified chicken diet had a 94.2%, Non-modified modified chicken diet had a 95.4%, and the control had a 97.7% of light transmittance. The charcoal modification recorded the lowest algal growth.

Conclusions/Discussion
Manure produced by the charcoal modified chicken feed shows promise in reducing the environmental impacts from farm operations. Charcoal as an amendment to chicken litter is currently being studied by the University of Georgia and has been shown to reduce ammonia, which is an air quality concern. Protease enzyme is used as a feed modification to increase bio-feed conversion rates, but did not show to have a positive effect on limiting algae bloom. This study indicates diet modification can reduce eutrophication effects on algae bloom.

Summary Statement
Can manure produced by a feed modified chicken diet reduce the eutrophication effects on algal bloom?

Help Received
Mr. Davin Aalto instructed me on the spectrophotometer.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Nia M. Isom

Project Number
J1015

Project Title
Gasoline Soaker-Upper

Abstract

Objectives/Goals
There have been disastrous gasoline spills throughout history. In addition, the runoff from the rain carries gasoline into the surrounding soil causing even greater damage. If this gasoline contaminates the water system, then health effects such as damage to the central nervous system will occur in humans and animals. The objective of the experiment is to determine which of the five main soil types is the most gasoline-absorbent in order to prevent the water system from being contaminated.

Methods/Materials
Each soil(Sand, Silt, Clay, Loam, and Peat soil) was compared to the Control, which we chose as Cat Litter, due to Cat Litter's effective absorption. To measure the absorption, gasoline was poured onto each soil type, using a self-made apparatus with a 5x5 inch metal lattice filter within a large funnel, with a 300mL glass beaker to collect the remaining gasoline.

Results
Of the five soil types, Loam performed the best in absorbing the 300mL of gasoline. Compared to the Control, which absorbed 54.8%, Loam absorbed 50.6% of the gasoline at a rate of 75.85mL/minute, only 6.3mL/minute slower than the Control. The least absorbent was Silt, which only absorbed 18.3% of the gasoline.

Conclusions/Discussion
Overall, Loam absorbed the greatest amount of gasoline following the two-minute contact time, at the quickest rate. This contradicted the hypothesis, because even though Clay may be the most water-absorbent soil type, water and gasoline have a completely different chemical makeup, therefore water and gasoline are absorbed at different rates. Future research would involve simulating a gasoline spill over a greater surface area and using Loam as the surrounding soil.

Summary Statement
Determining which soil type should be surrounding a gas station (or refinery), because in the event of a gasoline spill, there must be a gasoline-absorbent soil to prevent the gasoline from contaminating the water system.

Help Received
Mother and Father supervised when I handled the gasoline, and purchased the necessary materials; Science Teacher (Mrs. Tamara Reyes) helped revise report; MJ Penovich provided each soil type.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Christopher D. Isozaki

Project Number
J1016

Project Title
Reducing Energy Used by Computers Utilizing Green Technologies

Abstract

Objectives/Goals
The goal of my experiment was to reduce the amount of electrical energy used by computers by using green technologies such as thermoelectric and solar technologies.

Methods/Materials
To achieve this goal I created my own cooling system that did not use power from the computers power supply. The electrical energy I used for the cooling system was gathered from thermoelectric generators and a solar cell. The first part of the experiment was to utilize various materials and structural forms so I placed an aluminum slab on the CPU with an aluminum box on top to hold water. This was done to maximize the heat transfer away from the CPU using a solid with a high thermal conductivity coefficient and to move it away from the slab as an intermediate step using water. I used the aluminum from the box and connected it to aluminum sheet metal heat fins to maximize the surface area and the heat transfer to the air. The second part of the experiment was to harvest and utilize the heat generated by the CPU. I placed the TEGs on the aluminum box. I decided to place another thermoelectric device, a TEC, against the aluminum box and by supplying the electricity from the TEGs, was able to create a refrigeration effect to cool the box and water and to transfer more heat away from the CPU. I added a solar cell to give the system more power and flexibility.

Results
The results of the experiment proved my hypothesis correct. When I used the control cooling system consisting of fans and a heat sink, the computer consumed approximately 125 watts. When I used the cooling system I created, the computer used approximately 85 watts which was an energy savings of about 32%.

Conclusions/Discussion
My hope for this project was to show that computers could use significantly less energy derived from environmentally harmful materials and processes (e.g. oil, coal, nuclear). My results have shown that using my cooling system resulted in a 32% energy savings. If we extrapolated this result to the millions of computers currently in use, it would make a significant difference in energy utilization.

Summary Statement
Reducing the amount of electrical energy used by a computer by utilitizing physics principles and green technologies

Help Received
Parents helped with constructing the display board, father helped with some of the testing and product assembly, friend donated computer equipment

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Andrew A. Jakab

Project Number
J1017

Project Title
Can a Change of State Material Improve Cool Roofs and thus Lower Energy Use in Buildings?

Abstract

Objectives/Goals
The objective of this project is to see if the #winter penalty# of cool roofs, i.e. the potential for increased heating demand in winter due to reflected solar radiation by light-colored roofs, can be reduced or eliminated by coating them with a #change of state# material, one that is solid and energy absorptive at one range of temperatures and liquid and transparent at a higher range of temperatures. Such a coated cool roof would have its reflectivity blocked while the building is warming up and its reflectivity exposed once the building reaches a desired, warmed up temperature.

Methods/Materials
A small, enclosed structure was insulated, its roof was coated with white paint to make it a cool roof, and a probe thermometer was inserted into the structure. Paraffin wax was sandwiched between thin glass panels, sized to cover the roof. A light source was placed above the cool roof and the temperature inside the enclosed structure was measured at 5 minute intervals until the temperature leveled off. This process was repeated with the cool roof covered with the enclosed wax panels. The results were then compared to determine if the glass panels improved the performance of the cool roof with respect to the winter penalty.

Results
The interior of the structure warmed up more slowly with the wax panels in place than without, and the interior temperature leveled off at a higher temperature with the panels in place than without them.

Conclusions/Discussion
From the data collected and the model used, it appears that a change of state material does not reduce or eliminate the #winter penalty# of a cool roof. In fact, it does the opposite. As the wax warmed and melted, it absorbed energy and so there was even less heat to pass along to the inside of the structure. Once the wax had melted, it seemed to act as a thermal blanket, increasing the heat inside the structure above that resulting from a cool roof alone. So, the addition of a change of state material layer over the cool roof appears to make the winter penalty worse, not better.

Summary Statement
This project was designed to test whether one of the few negative features of cool roofs could be fixed.

Help Received
Dad and friend helped assemble glass panels and structure; dad helped with some wording of project report.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)

Ananya Karthik

Project Number

J1018

Project Title

A Greener Cleaner: Investigating a Potential Biosorbent for the Removal of Heavy Metals from Aqueous Solutions

Abstract

Objectives/Goals

Heavy metal contamination of water poses a serious threat to the global ecosystem, since heavy metals are toxic even at low concentrations. Lead, copper, and chromium have been classified as priority pollutants by the U.S. EPA, and their accumulation in the body may cause disorders like brain damage and cancer. Conventional methods of removal are expensive and may generate toxic sludge; therefore, a need exists for a low-cost and eco-friendly biosorbent for heavy metal removal from wastewaters. Since scientific literature about using spent coffee grounds (SCG) as a biosorbent is limited, this experiment investigated the use of SCG for the removal of heavy metals from aqueous solutions. The effects of pH, contact time, adsorbent dose, and initial metal ion concentration on the biosorption of lead, copper, and chromium were studied.

Methods/Materials

Adsorption experiments were conducted in triplicates by treating the metal solutions with SCG at 37.5°C and 100 rpm and varying: pH values (3, 4, 5, 6, and 7); contact times (30, 60, 90, 120, and 150 minutes); adsorbent dose (0.5, 1.0, and 1.5 g); and initial metal ion concentrations (10, 25, and 50 ppm). The samples were analyzed using Atomic Absorption Spectroscopy. The removal efficiency (RE%) of the SCG for each sample was calculated.

Results

The highest removal efficiency was ~99% for lead, ~97% for copper, and ~89% for chromium. The maximum RE% was at pH 5 for lead and copper and pH 3 for chromium. RE% increased with the increase in contact time and equilibrium was reached at 90 minutes. Increasing the adsorbent dose resulted in greater RE%. By increasing the initial metal ion concentration, RE% decreased. The removal efficiency for lead was the highest, followed by copper and chromium, respectively.

Conclusions/Discussion

SCG can be used as a biosorbent for the removal of lead, copper, and chromium from aqueous solutions. Functional groups on the surface of coffee grounds and cell wall components are responsible for metal ion adsorption. Experimental data showed that removal efficiencies up to 99% can be achieved when using SCG as a biosorbent, depending on the adsorption conditions. Over 6 billion kilograms of SCG are generated worldwide every year and are of no commercial value. The utilization of SCG as a biosorbent of metal ions can promote this large amount of waste into a new, environmentally-friendly resource due to its low cost and easy availability.

Summary Statement

My novel project investigates the use of spent coffee grounds as an environmentally-friendly and low-cost biosorbent for the removal of heavy metals from aqueous solutions.

Help Received

My family and teacher for their support; Mr. Caesar Munera from San Jose State University for help with the AAS equipment.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Ava M. Killoran

Project Number
J1019

Project Title
Fresh Water from the Sea by Desalination

Abstract

Objectives/Goals
California has been through many severe droughts such as the recent drought of 1987-1992, where Santa Barbara turned to desalination, installing a temporary emergency desalination plant. 2013 was the driest year in recorded history in many California areas. The need for freshwater is critical during drought conditions. Since coastal California has access to plenty of sea water, my goal was to build an environmentally friendly solar desalination device and test how temperature and surface area affect its efficiency of freshwater production.

Methods/Materials
I built two solar desalination devices using plastic boxes of different sizes to test the effect of surface area on freshwater yield. I tested the effect of temperature at 80 degrees and 90 degrees Fahrenheit. I was not measuring the temperature of the water, but the temperature of the environment. Each test duration was three hours. I used an artificial heat source to maintain the same temperature for each test but theoretically it could be done with the sun.

Results
A surface area of 330 square inches produced four times as much freshwater as a surface area of 96 square inches at 80 degrees. At 90 degrees Fahrenheit the device produced three times as much freshwater as the same device did at 80 degrees Fahrenheit.

Conclusions/Discussion
My hypothesis predicted that higher temperatures would produce a higher yield because it would increase evaporation and condensation. A higher surface area would create a higher yield because there is a larger surface for droplets to
form. My results supported my hypothesis. Surface area had a greater effect on the freshwater yield but temperature is still very significant.

Summary Statement
I built a solar desalination device and tested how temperature and surface area effect its efficiency.

Help Received
My Mom helped revise drafts, helped with cutting and pasting, and photographed.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Rachel J. Linton

Project Number
J1020

Project Title
Mycoremediation

Abstract

Objectives/Goals
The purpose of this experiment was to see whether Pleurotis Ostreatus (pearl oyster mushrooms) can break down diesel in contaminated wheat straw substrate. The hypothesis states that the trial samples with the mycelium treatment will have a lower concentration of hydrocarbons than the control samples at the end of three weeks.

Methods/Materials
The procedure involved spraying 10 ml. of diesel mixed with water onto 2.5 pounds of substrate for two treatment samples (inoculated with mushroom mycelium) and two control trials (without mycelium). All 4 samples were stored in the same location, under the same conditions. At the end of a three week period, each sample (2 treatments and 2 controls) were broken up and thoroughly mixed, for uniformity. At APPL labs, incremental sampling was performed on the treatments and controls, solvent was added to each sample, fluids were concentrated and extracted, then analyzed using a mass spectrometer.

Results
The average concentration of diesel for the control trials, in ppm, or parts per million, was 1,317 ppm, and the average concentration for the treatment trials was 1,819 ppm. This means that the hypothesis was rejected. The control levels were higher than the treatment levels.

Conclusions/Discussion
The results were inconclusive, possibly because evaporation was not accounted for. These results show that Pleurotis Ostreatus may or may not be able to break down the hydrocarbons in the substrate.

Summary Statement
The project examines the ability of Pleurotis Ostreatus (pearl oyster mushrooms) to breakdown hydrocarbons introduced into a wheat straw substrate.

Help Received
Used lab equipment at APPL Labs under the supervision of Sharon Dehmlow, lab director.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Anne C. McDaniel

Project Number
J1021

Project Title
Filtration Station

Abstract

Objectives/Goals
The purpose of this investigation was to learn which filtration material: marsh plants, oyster mushroom spores, ceramic balls, charcoal, or gravel and drainage rocks, purified greywater so its pH and other nutrient levels were optimum to irrigate plants. The hypothesis was that the marsh plants would filter the greywater to the most desirable nutrient levels.

Methods/Materials
Sand, pH Testing Kit, soil testing kit, washing machine, detergent, ceramic balls, crushed charcoal, marsh plants, landscaping fabric, 5 1-gallon pots, 1 5-gallon bucket, 5 1-gallon buckets, pH litmus strips, ruler, scissors, 2 medium sized bowls, drill, oyster mushroom growing kit, kitchen knife

The filters were set up by lining the pots with landscaping fabric and filling with 1 inch of sand and a different material in each pot. Greywater was gathered from a wash cycle containing one ounce of detergent and color brightner. One gallon of the gathered water was run through each filter.

Results
The data collected showed that marsh plants filtered water had almost perfect levels in every nutrient including the pH of both the water and the soil where it had closest to 7, a desirable neutral pH. The ceramic ball filtered water, while lacking in nitrogen, had good pH levels. The charcoal did well in every nutrient except pH which was at a level of 8. The gravel and drainage rock filtered water had the worst phosphorous at 0. The oyster mushroom filtered water had a low pH of 6.

Conclusions/Discussion
The results of this experiment support the hypothesis. The marsh plants filtered the greywater the best, having the most desirable nutrient levels, when compared to ceramic balls, charcoal, gravel and drainage rocks, and oyster mushroom spores. This information could help people save water and money by using water they would normally dispose of to water plants instead. It supplies households with the most effective method to reclaim and filter their greywater.

Summary Statement
Filtration Station explores which method of filtering greywater: marsh plants, ceramic balls, charcoal, oyster mushroom spores, or gravel, is most effective at purifying the water back to adequate levels for using to safely water plants.

Help Received

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Nathifa Nasim

Project Number
J1022

Project Title
Using Different Species of Houseplants on Reducing the Amount of CO in the Air

Abstract

Objectives/Goals
The purpose of my project is to investigate to see which houseplant removes the Carbon Monoxide (a toxic gas) in thirty minutes. Based on my research, the hypothesis I formed is that if I use a fast growing plant like the Spider Plant, then the most CO will be removed.

Methods/Materials
I used five species of plants: Peace Lily (Spathiphyllum cochlearispathum), Gerbera Daisy(Gerbera jamesonii),Warneck Dracaena(Dracaena deremensis), Spider plant(Chlorophytum comosum), and pothos(Epipremnum aureum. I enclosed each plant with a CO monitor inside a trash bag securely held down, and I inserted a pipe with one end connected to the exhaust pipe of the car, and I measured the amount of CO in the bag and then after every five minutes for half an hour. I repeated three times with a pot of soil as my control.

Results
My results showed that in 30 minutes the Spider Plant removed 119 ppm total, the Warneck Dracaena reduced the level of CO by 96 ppm, and the Pothos removed 62 ppm. 95 ppm of CO was reduced by the Gerbera Daisy, and lastly, the Peace Lily removed 14ppm. The Spider Plant removed the most Carbon Monoxide, while the peace Lily was the least efficient out of all the plants. The soil, or the control, removed 63 ppm.

Conclusions/Discussion
I reached the conclusion that based on my experiment plants can reduce the amount of Carbon Monoxide in the air significantly. The hypothesis I had formed that if I use the Spider plant the largest amount of CO will be reduced, was correct. This was probably because plants remove Carbon monoxide with the help of microorganisms in the soil, or they break them down into their organic tissue such as amino acids. The soil removed 63 ppm, which was the fourth efficient. This shows that having a plant plus soil is more effective than just soil, though it does remove CO, because there are bacteria in the soil which helped remove it. My results prove that a plant is necessary for removing more CO, and it does have apart in removing toxic gases, not just the microorganisms.

Summary Statement
I am investigating which species of houseplant removes the most CO from the air.

Help Received
Mother and Father assisted me in preforming and planning the experiment; teacher gave advice and helped me decide on a project

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Flora L. Perlmutter

Project Number
J1023

Project Title
Testing the Effects of Carbon Dioxide on Wheatgrass Plants

Abstract

Objectives/Goals
The objective of this experiment was to see how different levels of carbon dioxide affect plant growth.

Methods/Materials
Air was pumped through aquarium tubing into a carbonate-bicarbonate solution to produce specific levels of carbon dioxide. Carbon dioxide was pumped into a grow chamber where wheatgrass was growing, and then forced through an outflow tube into a cup of water. Each trial included wheatgrass grown in 200, 800, and 1000 ppm of carbon dioxide and the control which was 400 ppm of carbon dioxide. There were seven trials each of which lasted 12 days.

Results
The wheatgrass growing in 200 ppm of carbon dioxide grew .056% shorter, the wheatgrass growing in 800 ppm of carbon dioxide grew .004% taller, and the wheatgrass in 1000 ppm of carbon dioxide grew .064% shorter than the plants in a normal carbon dioxide level. Samples of carbon dioxide taken with Mylar balloons showed that the carbon dioxide levels in the grow chambers were higher than expected, therefore throwing off the results of the experiment. More trials would be needed in order to achieve accurate results.

Conclusions/Discussion
More difference in growth between the wheatgrass grown in the different carbon dioxide concentrations was expected. One reason for the results being different than expected could be soil respiration because soil respiration increased the carbon dioxide concentrations in the grow chambers. carbon dioxide is generally good for plants until a certain point, but when that point is exceeded, the plant is photosynthesizing so fast that it runs out of nutrients so the growth slows or even stops.

Summary Statement
This project tested to see how the growth of wheatgrass plants would be affected by different levels of carbon dioxide in the atmosphere.

Help Received
Mrs. Gillum reviewed report; Dr. Lisa Welp provided insight on the project, and helped to test the carbonate-bicarbonate solutions and take samples of the CO2; my mom assisted me throughout the project.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Tate N. Reynen

Project Number
J1024

Project Title
Soak It Up

Abstract

Objectives/Goals
In my experiment I tested which material would best absorb petroleum oil out of water: straw, wood shavings, shop towels (ultra-absorbent paper towels), Swiffer Dry Sweepers (electrostatically-charged polyester microfiber), or polypropylene pads. My goal was to find a material that would effectively soak oil up out of water without leaving behind chemicals that would pollute or harm marine life.

Methods/Materials
I began my experiment by cutting up enough of each of my 5 sorbents to fill six one-cup measuring cups. I filled a 4-cup glass measuring cup with 24 oz. of water followed by 8 oz. of petroleum oil carefully poured on top. I then put the first cup of sorbent into a micro-screen coffee filter and slowly submerged it into the water/oil mixture. After it was fully submerged, I began a swishing motion for 15 seconds then let it sit still for another 15 seconds. I then pulled out the filter and let it drain over the measuring cup for 30 seconds, and discarded the used sorbent in a container which was taken to a local auto shop for proper disposal. I measured the total oil and water amount left in the measuring cup, then just the oil level, then just the water level, all in ounces. I recorded the data in my logbook, discarded the oil and water in the same container as the sorbents, and cleaned the coffee filter and measuring cup with dish soap and water. I tested the rest of the same sorbent 5 more times recording the results in my logbook. I repeated the process for the other 4 sorbents, and found the results fairly consistent within each category.

Results
My experiments showed that the Swiffer Dry Sweepers were most effective in absorbing the oil (77%) average absorption), verses the polypropylene pads (57%) that I predicted would be most effective.

Conclusions/Discussion
The Swiffer Dry Sweepers absorbed the most oil possibly because of the surface area of the polyester microfibers that make it up. Of the natural materials, the wood shavings absorbed the most--again, possibly because of the surface area of the many small pieces of wood. It would be interesting to further research if the surface area is, in fact, the key to pulling the oil out of water, and also how salt water may affect the absorption. I believe studies like this can be helpful for the oil industry, which spends over 70 million dollars to research the cleanup of oil spills.

Summary Statement
My project attempted to discover which of five materials (shop towels, polypropylene pads, Swiffer Dry Sweepers, straw, wood shavings) best absorbs petroleum oil out of water.

Help Received
My mother assisted in measuring out the liquids and cleaning the containers for each trial.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Srijani Saha

Project Number
J1025

Project Title
The Use of Nanotechnology in the Aftermath of Oil Spill

Abstract

Objectives/Goals
The objective of my project was to experiment the use of magnets and ferrofluid (to make the oil magnetic) as a viable oil spill cleanup method.

Methods/Materials
The procedure began with two petri dishes in which a set amount of oil and water was present. During the tests different amounts of ferrofluid (0.5 mL and 1 mL) were added to see the effects of the amount of ferrofluid on the results or the volume of the solution after the magnet was hovered over the solution. The remaining solution was then poured into the graduated cylinder, measured for volume in mL, and then recorded as the results.

Results
The efficiency was measured in a ratio of the altered volume divided by the original volume of the oil-water solution. Adding 1 mL of ferrofluid to the oil proved to be more potent as a cleanup method than adding 0.5 mL shown in the average efficiency of 0.75 rather than 0.53.

Conclusions/Discussion
The results achieved by the experiment supported my hypothesis. Using magnets and nanotechnology (the study of particles the size of 1 billionth of a meter) can magnify the success of the cleanup of oil that sinks beneath the surface and later allow companies to sell their oil in the future. With more research and study, the possible pollutions can be found and the 40 billion dollars of profit lost by BP in the gulf oil spill could be avoided.

Summary Statement
My project experiments with different amounts of magnetic liquid (ferrofluid) and a neodymium magnet in effort to find a new viable oil spill cleanup method.

Help Received
My father helped me in procuring the materials, my mother helped with my report, and my science teacher mentored me.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Mari O. Sanders

Project Number
J1026

Project Title
Help Wanted: Green Filters for Sweet Corn. Seeking Solutions to America's Fertilizer Fixation

Abstract

Objectives/Goals
The purpose of this project was to see if sod can reduce the amount of nitrate and phosphate runoff from fertilizer application. This is a follow-up study of last year#s project where chemical runoff was measured from soil after adding inorganic and organic fertilizers. This year#s hypothesis states that the addition of sod will reduce the amount of chemical runoff in the water samples.

Methods/Materials
Sod was planted in five plastic troughs, which had been altered with PVC pipe to act as spouts for the collecting of samples. Then organic and inorganic fertilizers were added. Water was poured onto each trough at regular intervals and the runoff was tested with nitrate and phosphate test kits.

Results
This study found that the addition of sod resulted in reduced amounts of nitrates and phosphates compared to last year#s measurements. It was observed that turf could be used as a filter 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. Seen as an answer to our renewable fuel problem, corn cultivation for ethanol is growing in popularity. Corn production requires relatively large amounts of nitrogen fertilizer per acre. Since sod can be used as a filter to absorb excess nitrates and phosphates, this means that farmers can plant sod 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
Comparing the data from 2013 with this year's results, it was found that planting sod around an agricultural area can reduce the amount of nitrate and phosphate runoff produced by organic and inorganic fertilizers.

Help Received
Father assisted with power tools to cut PVC pipe and drill holes in the troughs.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Serena E. Tang

Project Number
J1027

Project Title
Earthworms: A Cost-Effective Solution for PCB Soil Contamination?

Abstract

Objectives/Goals
As of 2008, there were 40,000 sites in the US that contained contaminants such as polychlorinated biphenyls (PCBs). PCBs are a man-made organic chemical that are found everywhere in our environment. Not only are PCBs carcinogenic in humans, but they are also difficult to biodegrade. To peoples' dismay, there has not been a single developed method that has met all of the requirements to safely remove PCBs from the environment. Therefore, the goal of my project was to find an efficient, cost-effective, and environmentally friendly way to remove PCBs from soil using the vermi-remediation method. Based on my research, I hypothesized that the earthworms would bioaccumulate significant amounts of PCBs within their bodies, suggesting that they may be an effective tool for PCB soil decontamination.

Methods/Materials
In total, there were three concentrations: 50 ppb, 200 ppb, and 1,000 ppb. With each concentration, there was a control jar (no worms), and an experiment jar (50 worms). Once all six jars were spiked with the above PCB concentrations and 50 earthworms were added to each of the three experiment jars, they were left alone for two weeks. At the end of the two weeks, I extracted a soil sample from all six jars using the Incremental Sampling method, and tested them for PCBs. This step was repeated at the end of the fourth and sixth week period. At the end of the six weeks, I also extracted all the earthworms from the soil in the experiment jars and tested the worms for PCBs as well. With the data collected, conclusions were made.

Results
My results can be best explained when split into two parts. Regarding the levels of PCBs found in the soil, there was an inconsistent recovery rate over the six week experiment. However, the results of the PCB concentrations in the earthworms' bodies showed a much more consistent pattern. The earthworms in all three jars had bioaccumulated significant levels of PCBs in their bodies at the end of the experiment. In fact, all of the earthworms contained approximately 50% of the original amount of PCBs added to the jar.

Conclusions/Discussion
Despite the inconsistent recovery rate of PCBs in the soil, my hypothesis was still supported based on the data regarding the levels of PCBs found in the earthworms' bodies. Because significant levels of PCBs had bioaccumulated in the earthworms, the data suggests that earthworms had removed PCBs from the soil within the six week experiment.

Summary Statement
Earthworms were used as a cost-effective, efficient, and environmentally friendly method to remove polychlorinated biphenyls from soil.

Help Received
APPL Labs allowed me to use their lab equipment and helped acquire the materials necessary for my experiment. My mom helped me put my board together.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Alana R. Tessman

Project Number
J1028

Project Title
Bioremediation vs. Chemical Cleaning of Oiled Birds and the Effluent

Abstract

Objectives/Goals
My objective was to determine if a top bioremediation agent, (OSEII -the only 1st response EPA listed bioremediation agent) used for cleaning oil spills could be applied to the cleaning of oiled birds and perform as effectively or better than the top chemical cleaning agent (DAWN- used for the past 30 yrs.) in cleaning oiled birds and remediating the effluent.

Methods/Materials
I designed and implemented a procedure based in part on the internationally accepted cleaning protocol of oiled birds at treatment facilities.
I used three different types of feathers (Primary/ Contour/ Down) and expanded the research to include treatment of the effluent produced during the cleaning process.
Light crude was used so no pretreating was necessary.
All feathers were soaked in oil for 5min., blotted and weighed
Each feather was then submerged in 1 wash/1 rinse solution of 50mL of each cleaning agent to 500mL. of water (51.2mg/L hardness) heated to 40ºc. and 1 wash/rinse control consisting of water with no cleaning agent
Each wash/rinse cycle was timed for 10 min. with agitation for .5min at 1, 5 &10min.
Feathers were removed, blotted once and hung to dry for 2hrs then weighed again.
All cleaning and rinse water was then added to three aerated 10gal aquariums containing 5 gal of water (51.2mg/L hardness) each. Water levels were marked and temperatures recorded.
Aquariums with effluent were monitored for 30 days.

Results
The bioremediation agent removed 3% more oil than the chemical agent and completely detoxified the effluent leaving only CO2 and water. The chemical agent cleaned the feathers leaving slightly more residue but showed no remediation of the effluent. The control neither cleaned the feathers nor remediated the effluent.

Conclusions/Discussion
I feel these results may indicate the possibility of a less stressful protocol for cleaning oiled birds due to the reduction in handling time (fewer rinse tubs and no final spray rinse), a reduced amount of effluent (a typical oiled bird requires an average of 2 to 300gal. of water to clean) and a protocol that can at the same time remediate the effluent so there is no need for further toxic waste treatment.

Summary Statement
My project was testing to see if a top bioremediation agent could perform as well or better than a top chemical agent in cleaning oiled birds and remediating the effluent.

Help Received
Mother helped type report, purchase needed equipment and display board materials, and took pictures during my experiment.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Wil C. Valtakis, III

Project Number
J1029

Project Title
Removing Waste Oil from Water Utilizing Magnets

Abstract

Objectives/Goals
The objective of this project was to utilize nanotechnology in the form of ferrofluid to remove waste oil from water effectively. Further testing will determine the amount of ferrofluid with the best efficiency.

Methods/Materials
The project started with petri dishes, and I took the volume into consideration to structure the experiment. I separated the dishes into three groups to run the test 3 times in order to gain an average in data.
I started with 15mL of colored water in each dish, then added 2.5mL of mineral oil to all 10 of the petri dishes that held water. After this, it was time to decide how much ferrofluid to use in the experiment. In each group, I tested 1 drop of ferrofluid, 5 drops of ferrofluid, and 10 drops of ferrofluid. I thought this would give a good range of data.
The next step was to use a magnet to remove the ferrofluid, and hopefully the mineral oil, from the water. Using a magnet held within a plastic baggy, I ran the magnet through the water across the petri dish, and clockwise in a circular motion to capture as much oil as possible. Each petri dish received two passes with the magnet. Afterwards, I utilized the graduated cylinder to measure how much oil was left with the water after those two passes of the magnet.

Results
With the data from my experiment and all my observations, 10 drops of ferrofluid proved to be the most efficient. The magnet was able to pull the oil from the water in all petri dishes, save the one that contained no ferrofluid at all. As the ferrofluid drops increased, so did the amount of oil I was able to remove.

Conclusions/Discussion
In conclusion, this was a very interesting topic to explore. The results proved my hypothesis, that the more ferrofluid I used would result in more oil being removed by the magnet from the water. I decided to do one more test, utilizing the 10 drops of ferrofluid and keeping the other fluids at the same level. With six passes of the magnet, the ferrofluid/oil combo was visible, but not able to be measured with the methods available. So I believe as a real world application, this method has a lot of promise.
I would like to see if I can turn the waste oil itself into the carrier fluid so as to not introduce excess oil to the existing spill; but my experiment shows that it has a lot of potential to really assist in the cleanup efforts during a waste oil spill.

Summary Statement
Using magnets to remove oil from water utilizing nanotechnology.

Help Received
Mother took pictures and did proofreading, also gave instructions for using hot glue gun in board prep.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)

Anthony T. Vu

Project Number

J1030

Project Title

No Longer Delicious: A Study of the Effects of Different Soils on the Biodegradation Rate of Organic Matter

Abstract

Objectives/Goals

The purpose of this project is to determine the effect of a change in the type of soil (sand, silt, clay, loam, and base, or backyard soil) used to cover red delicious apple slices on their rate of biodegradation. Research suggested that the rate of biodegradation in sandy soil would be the highest.

Methods/Materials

Three pots (one for each run) of each soil type were used, for a total of 15 pots. Each pot contained two apple slices in a mesh bag sandwiched between 3 cm of soil on the bottom and 8 cm of soil on top. Every other day for 20 days, the apple slices were weighed and observed, and observations were compared with a reference sheet to determine the stage of decomposition. Soil moisture was also measured.

Results

Clay apples had the highest average cumulative weight loss (26.3 g), followed by base (19 g), loam (16.3 g), sand (14.3 g), and silt (13.7 g). At day 20 (end of experiment), clay apples also reached the highest average stage, followed by base again, then silt, loam, and sand.

Conclusions/Discussion

Organic matter will actually decompose the fastest in anaerobic conditions when covered with clay soil and second fastest when covered with base soil that likely contained a high percentage of clay. No significant difference in the rate of decomposition occurs when organic matter is covered with loam, sandy soil, or silty soil. My data indicate that clay soil is the best soil cover to use in a "no-service" compost pile, and that landfills should experiment with using clay in the six-inch soil covering that is placed over trash daily in order to speed up biodegradation.

Summary Statement

This project examines the effects of different soil coverings on the biodegradation rate of red delicious apple slices in order to determine which soil will optimally promote biodegradation in no-service compost piles.

Help Received

Observations stated verbally by me were written down by a family member

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
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Project Number
J1031

Project Title
Would You Like a Glass of Ocean?

Abstract

Objectives/Goals
The problem was to determine whether ocean water could be purified in an ecologically healthy and inexpensive way using a home built parabolic trough solar reflector.

Methods/Materials
I built a parabolic trough solar reflector using pvc pipe, copper pipe, solar reflective film, drip valve, copper male adaptor and fitting, PE tubing, pipe wrap insulation, black heat resistant spray paint, plastic container and lid, plastic fitting, glass thermometer, lumber, plywood, Nalgene bottle, paint bucket, wing nut & carriage bolts. Ocean water was collected, and on four days it was fed it into the device: the PE tubing with the drip valve ran the ocean water through the copper tubing to the rest of the trough, where it was heated to separate pure water from ocean water.

Results
At 15 minute intervals, saline waste and desalinated water samples were collected. Temperature data was measured for the saline waste, desalinated water, and immediate surroundings. Volume of saline waste and desalinated water was measured. Flow rate was calculated. An optical refractometer was used to measure samples. Parts per thousand (ppt) and refractive index (RI) of samples was obtained. Two of the four days of testing small droplets were produced. The outcome was <1 mL of clean water.

Conclusions/Discussion
The hypothesis was supported. During testing the temperature of the ocean water rose to a higher point than 50°C. This allowed for water to be purified, though only <1 mL separated from the ocean water, on two of the four dates of testing. This data suggests that people without an adequate clean water supply, who are located near the ocean, could use a low cost, portable, parabolic trough solar reflector to produce useable drinking water.

Summary Statement
Can ocean water be purified using a self-built parabolic trough solar reflector?

Help Received
Father purchased materials, supervised construction (for safety); Dave Sar helped me brainstorm and develop concept; Margaret Jameson let me conduct testing on her property; Mother help with application process and took photographs.