CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY

Name(s)
Colton Allen; Gabriel Sigala

Project Number
J1001

Project Title
Let's Talk Trash: A Water Conservation Alternative for Landfill Management

Abstract

Objectives/Goals
Since we have been living in a drought ridden state for the past half decade, we understand how important the precious resource, water, is for us to maintain our lives and economy. In order to preserve this limited resource, we need to adjust our current usage. For instance, are there alternatives to using potable water for dust control at landfills?
As trash disposal will always be a need of any civilization; we decided to test if non-potable water could substitute potable water for dust control at landfills. We hypothesized that if using non-potable water instead of potable water, then the difference in the discharge water of the two water sources would not be significantly different as measured by pH, turbidity, conductivity and bacteria since non-potable water meets many of the same water safety guidelines as potable water, thus providing alternatives for water resource management.

Methods/Materials
To test our hypothesis, we collected potable water from a faucet source, non-potable water from the Clovis Water Treatment Plant, and earth dirt samples from a vacant lot. We developed a simulated landfill using six inches of soil. We placed the dirt in clear plastic columns, with weed paper at the bottom to trap large particles, and placed clear plastic collection vessels at the bottom of the column. We ran both types of water twice in the columns and tested our samples to our expert#s lab for pH, turbidity, conductivity, and bacteria.

Results
Turbidity: Higher values in the non-potable control and sample versus the potable control and sample.
PH: All tests averaged in the neutral to slightly acidic range.
Conductivity: We converted for salinity percentages. The non-potable water retained a higher percentage of salt.
Bacteria: Both the non potable water controls and samples had more bacteria than the potable water.

Conclusions/Discussion
In conclusion, the results of pH and conductivity were similar in potable and non-potable samples. The test of turbidity and bacteria resulted in differences, but were not significant enough to limit usage of non-potable water in landfills. In fact, a higher bacteria count may be more advantageous as bacteria can assist in degradation of trash. This experiment has beneficial implications to California, and globally. The application can provide an ecological alternative to landfills located in drought ridden areas and landfills that don't have sophisticated systems.

Summary Statement
Our project to test potable and non-potable water in a simulated landfill determined that non-potable water is a viable alternative for resource management in landfills.

Help Received
We designed the project, experiment, and simulated landfill ourselves. We used the lab at Clovis Community College Chemistry Dept. under the direction of Shawn Fleming, PhD, who also assisted with statistical analysis.

CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY

Name(s)
Adarsh S. Ambati

Project Number
J1002

Project Title
A Smart, Low Cost, Social Network Connected, Community Sprinkler System (IOT)

Abstract

Objectives/Goals
My Project Goal is to save water wasted during general purpose landscape irrigation of an entire neighborhood by building a moisture sensor based smart sprinkler system that integrates real time weather forecast data to provide only optimum levels of water required. It will also have twittering capabilities that will be able to publish information about when and how long to turn on the sprinklers, through the social-networks. The residents in the community will subscribe to this information by following my account on Twitter and utilize it to prevent water wasted during general purpose landscaping and stay compliant with water regulations imposed in each area. My prototype will also have the capability to log water usage information on a daily basis.

Methods/Materials
Raspberry Pi, Monitor, Keyboard, Breadboard, Relay Control, Moisture Sensor, Analog to Digital Converter, Sprinkler/LED lights, WiFi adapter. Developed a moisture sensor sprinkler system using Raspberry PI and connected it to internet; Using APIs integrated weather forecast data and published sprinkler usage instructions for households in the community to subscribe via Twitter.

Results
Results:
Total cost of my prototype is $50. I piloted it with 10 homes, so cost per home is around $5. But since it has the potential to serve an entire community, the cost per home can be a few cents. For example, there are about 37,000 residents in Almaden Valley, San Jose (where I live). If there is an average of 2-4 residents per home there should be 9,250 to 18,500 homes. If I strategically place 10 such prototypes, cost per house would be 5 cents or less.
Based on two months data, 83% of the water used for outdoor landscape watering can be saved. Average household in northern California uses 100 gallons of water for outdoor landscaping on a daily basis. The 10 homes in my pilot had the potential to save roughly 50,000 gallons over two month period or 2500 gallons/month/home. At $0.007/gallon, the savings equate to $209/year/home.
For Almaden valley alone, we have the potential to save ~$2M to ~$4M per year!

Conclusions/Discussion
Based on two months data, my low cost prototype effectively conserves water used for general purpose landscaping while keeping households compliant with city#s water regulations and maintaining the landscapes.

Summary Statement
Developed and piloted a low cost, social network connected smart sprinkler system that conserves water used by a neighborhood for landscaping while keeping households compliant with city's water regulations and maintaining the landscapes.

Help Received
My teachers Mr. Takemoto and Mrs. Makhijani reviewed my project and provided general guidance. Johan Sosa, a DIY science enthusiast, helped with Twitter integration.

CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY

Name(s)

Srinivas B. Balagopal

Project Number

J1003

Project Title

Effectiveness of Different Insect Shield Mesh Designs on the Amount of Water Collected through Fog Harvesting

Abstract

Objectives/Goals

The objective of this experiment is to design an insect mesh that increases the amount of water that can be harvested from fog to inexpensively and effectively water home gardens, orchards and farms and therefore reduce our dependence on groundwater, surface water and snow-melt.

Methods/Materials

Three different mesh designs were constructed using steel meshes. The control was a square mesh, the 1st independent variable was a pyramid-shaped mesh and the 2nd independent variable was shaped like a flower bud. A humidifier was filled with 300 ml of water. Each mesh design was placed in front of the humidifier for sixty minutes. The constants for this experiment were the humidifier run time, the volume of water used, the material of the mesh, the temperature of the room, and the distance between the humidifier and the mesh. The water captured by the different meshes were channeled to the reservoir and measured.

Results

Three trials were run for each mesh design. The results demonstrated that the bud and leaf mesh design captured an average of 51 ml, while the pyramid mesh capture an average of 30 ml, and the standard square mesh about 14.5 ml. The 2nd independent variable - the bud and leaf mesh captured almost 2½ times the amount of water than the control square mesh.

Conclusions/Discussion

My unique bud and leaf mesh design harvested 2½ times more water than the standard square mesh. This was the result of the following factors. The larger surface area resulted in more water being condensed from the vapor. The obtuse contact angle caused an increased beading of the vapor into water droplets. The surface striations channeled the water efficiently to prevent clogging and the re-entrainment of the water droplets into the atmosphere. Finally, the apex indentation allowed for additional, un-trapped vapor to condense on the secondary mesh. Thus, a cylindrical insect shield measuring 6 inches by 30 inches would harvest about 1000ml of water from fog bank in 1 hour which is enough to water a rose plant for 3 days

Summary Statement

My bud and leaf mesh design condensed and captured 2.5 times more water than the standard mesh. This design can inexpensively, sustainably, and efficiently harvest more water from fog to irrigate crops and plants.

Help Received

Thanks to my parents for purchasing the materials for me.

CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY

Name(s)

Brandon Bonefete; Evan Sano Fleming; Jackson Smith

Project Number

J1004

Project Title

Comparison of Properties between Greywater and Tap Water for the Use of Watering Outdoor Plants

Abstract

Objectives/Goals

The objective of our experiments was to determine if the properties of greywater are similar to tap water and therefore can be used to water outdoor plants.

Methods/Materials

We collected 500 mL samples of; tap water (the control), hot water from the tap, water after dishes were washed, water after a shower, and water after washing your face and brushing your teeth. To test the pH we used a Vernier pH meter. We submerged a pH probe into the water sample and recorded the measurement. To test the salt content we measured the conductivity with a conductivity indicator. To test for solids we poured 20 mL of the water sample into an evaporating dish and boiled off the water. We measured the grams before and after we boiled the water off on an analytical balance. To test the effect on plants we used 150 mL test tubes and poured our water samples to the top. We put the plant elodea in for seven days and recorded the health of the plant compared to the plant in the control. To test for bacteria we used an inoculation loop to transfer a small amount of the water sample. We streaked TSA plates. We recorded the amount of bacteria that grew at room temperature four days.

Results

The conductivity average for the control was 4.33 EC and for all our samples had an average of 3.6 EC. The average pH level of the control was pH 6.79 and the samples where higher with the highest at pH 7.11. There was about 10 times the amount of solids in the samples from the control. Overall the plants health was not as healthy in the samples compared to the control. The bacteria test showed a significant amount of bacteria in the kitchen sink and shower water compared to the control.

Conclusions/Discussion

Greywater can be used to water plants in times of water shortage. According to our research both the pH and the salt conductivity levels where in the range that healthy plants can grow. There is the possibility of solid build up around the outdoor plants and unwanted bacteria in the greywater. You should not store greywater before you water your outdoor plants because the bacteria will grow in the greywater being stored.

Summary Statement

Our project showed that greywater is within the pH and salt content levels to water outdoor plants but may have an unwanted buildup of solids and high content of bacteria.

Help Received

We performed all experiments in the chemistry lab at Clovis Community College with Mrs. Shawn Fleming, Chemistry Instructor, as our mentor. She taught us how to use the pH meter, conductivity meter, and how to streak a TSA plate. We had access to all the equipment used during our science fair project.

CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY

Name(s)
Kimy Alexi Buere

Project Number
J1005

Project Title
Creating Potable Water and Electricity for Undeveloped Countries

Abstract

Objectives/Goals
My objective is to create a device that purify unsafe water and while generating electricity.

Methods/Materials
Get the 4x18 inch PVC ½ inch and connect it to the PVC 3 way cup-links.
Connect all the 4x8 inch PVC ½ inch to the 3 way cup-links creating a box.
Before Filling the silicone tubing, attach one end with the 2 ½ reduced ½ cup-links.
Now you can fill the filter with your filtrating materials; carbon, sand and
Now attach the second 2 ½ reduced ½ cup-links on top to complete the filtration system.
Secure Filter tubing to structure with the 2 ½ inch hose clamps.
Attach hose to shut off valve and connect to the bottom of the filtration tubing.
Gather a 5 gallon bucket and drill a ⅝ hole towards the bottom of the bucket
Affix drain hose to the bottom of the bucket.
Screw in the hose from the bottom of the bucket to the top of the filtration system.
Drill ½ inch hole on back side of 2 ½ reducer and affix hose reducer.
Cut 10 inch piece of hose, attach to hose reducer then to the top port of your O2 side of your Fuel cell.
Building your Water/Gas tank module.
Get (2) 1 inch PVC T reduced to ½ inch and attached by 4 inch by ½ inch PVC pipe.
Cut two 14 inch tubing.
Attached the two pieces of hose to either side. (O2 and H2)
Connect the O2 tubing to the O2 side of the power cell
Connect the H2 tubing to the H2 side of the power cell.
Plug in your solar panel to fuel cell

Results
.The data collected in Experiment indicated that...
Decomposition of glycerol could be efficiently performed through photocatalysis;
Around 90% of the glycerol in each solution was removed after two hours;
The hypothesis was supported.
The data accuracy could be improved by measuring Chemical/Biochemical Oxygen Demand. However, the data collected could still clearly examine the ability of photocatalysis to remove organic pollutants.
In Experiment, the results showed that
The addition of organic reductants could greatly enhance the yield of photocatalytic hydrogen generation.

Summary Statement
I created a device that could purify unsafe water and at the same time generates electricity for homes in undeveloped countries

Help Received
I would like to express my gratitude to the following people: - My family for their endearing support and their assistance provided in the construction of the device. My brother Zachary Benetatos for supervising me while conducting experiments

CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY

Name(s)
Cynthia Chen

Project Number
J1006

Project Title
A Novel Method to Reduce Water Consumption in Germinating Seeds

Abstract

Objectives/Goals
The objective of this project was to engineer a product that helps relieve the drought by reducing water consumption of agricultural plants. It focuses on the stage of germination, since water is wasted the most then.

Methods/Materials
I made my product from a small biodegradable filter and a smaller biodegradable pod, and a layer of water crystals in between. Then, I tested the capsule by separating the seeds into different groups with normal farming conditions, but with varying amounts of water.

Results
After experimentation, I measured the average number of days to germinate and the germination success rates for all groups. After analysis, it was clear that the groups with the capsule had the advantages of growing faster and having a higher survival rate than that of groups without the capsule.

Conclusions/Discussion
My engineered capsule is effective in reducing the amount of water used in early plant growth. Compared with previous solutions, mine is novel because it specifically targets the germination stage. When compared on a mass scale, this product would have a major impact on farmers and the drought, as it can save a lot of water.

Summary Statement
In order to eliminate the drought, I created a capsule which successfully reduces water wastage and consumption in farming.

Help Received
I did most of the project myself, and my mentor, Dr. Thomas Artiss, gave me feedback on my work.

CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY

Name(s)
Sonya R. Cullen

Project Number
J1007

Project Title
Ghost Fishing

Abstract

Objectives/Goals
The objective of this study was to find an alternative material for crab fishermen to use as the automated release system on crab pots.

Methods/Materials
PVC piping, rubber tubing, metal hooks, jute, hemp, nylon,and cotton twine. Checked deterioration on submerged twines over a 32 day period.

Results
The hemp twine (versus the nylon, jute, and cotton) broke first which indicated that it would be the best material for the crab fishermen to use as their automated release system.

Conclusions/Discussion
The study concluded that if all crab fishermen switch from using cotton twine, which takes over a month to break, to using hemp, which takes less than one month, millions of crabs would be saved each year.

Summary Statement
I discovered that if crab fishermen switch from using cotton twine to hemp twine as their automated release system on crab pots, millions of crabs will be saved each year.

Help Received
My father helped me to build the frame used for my project. I got help in understanding how the automated release system works from a local commercial crab fisherman.

CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY

Name(s)

Eden M. Davison

Project Number

J1008

Project Title

Salt Water Desalination

Abstract

Objectives/Goals

The purpose of my experiment was to desalinate three different types of salt water by thermal distillation, in order to create fresh water and dry salt as the end products.

Methods/Materials

I built a distillation chamber using wood, mirrors, Lexan polycarbonate sheets, and polyvinyl chloride pipes. In order to simulate solar energy, I used heat lamps to distill the water. I desalinated three types of saline water- Pacific Ocean water, Irish Sea water, and local groundwater with high conductivity. I used a YSI 556 multi-parameter water quality meter to measure pH and conductivity of the water samples before and after desalination.

Results

My hypothesis stated that if I evaporate salt water and condense it to a liquid, then fresh water would be the end result, and dry salt (not brine) would be the end product. My initial experiment involved desalinating 250 mL of three types of salt water for a period of 3 hours. Salt water was determined to have been desalinated if the conductivity of the water, as measured by the YSI 556 meter, was zero. After 3 hours, each of the three types of salt water resulted in approximately 5 mL of desalinated water, and brine (concentrated salt water), but no dry salt. My next experiment involved desalination of 45 mL of each type of salt water, with no time limit. In this second experiment, I was able to obtain desalinated water and dry salt as the final end products, and the experiment run times were between 3 and 12 hours.

Conclusions/Discussion

My hypothesis was supported by the results of my second experiment. In the first experiment the volume of water distilled (250 mL) was too great for the control period of 3 hours. In the second experiment, a smaller volume (45 mL) of each type of water was distilled, and the experiment was run until desalinated water and dry salt were the end products. My purpose for doing this project was to determine if there is a simple, energy efficient, and environmentally safe way to desalinate water, and not have a toxic end product, like brine. The results of my project demonstrated that desalination by thermal distillation is an effective, but slow and energy inefficient means of desalination, and that dry salt and desalinated water are the final end products.

Summary Statement

I created a thermal distillation chamber that effectively desalinated three different types of salt water, resulting in fresh water and dry salt as the end products.

Help Received

I designed the distillation chamber, and my father helped me to build it. My mother, who is an environmental engineer, showed me how to use the YSI 556 mult-parameter water quality meter in order to analyze my data.

CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY

Name(s)

Katherine Dean; Dilan Patel

Project Number

J1009

Project Title

Solar Powered Water Desalination

Abstract

Objectives/Goals

The objective of this experiment is to determine how the color of the bottom of a solar powered desalination device affects its efficiency.

Methods/Materials

Tested and compared how the color of the bottom of a solar powered desalination device affects its efficiency by measuring the amount of desalinated water produced by a solar powered desalination device after a four-hour testing period. Used clear plastic shoe boxes, small funnels, plastic straws, modeling clay, duct tape, plastic cling wrap, disposable plastic cups, metal washers, various colors of construction paper, and aluminum foil to build the devices. Used water, salt, and beakers of various sizes in testing the solar powered desalination devices.

Results

The amount of fresh water produced by each solar powered desalination device, each with a different colored bottom, was collected and compared at the end of a four-hour testing period to determine which color on the bottom of the solar powered desalination device is most effective in producing fresh water. The results concluded that solar powered desalination devices with black construction paper on the bottom produce the most desalinated water compared to solar powered desalination devices with white construction paper, blue construction paper, brown construction paper, and aluminum foil on the bottom. In most trials black produced approximately 10 ml of fresh water from 250 milliliters of saline water. The darker colors generally outperformed the lighter colors in the majority of tests.

Conclusions/Discussion

The solar powered desalination device with black construction paper on the bottom is most effective in removing salts, ions, and other dissolved solids from saline water. This demonstrates that solar powered desalination devices with black on the bottom could provide a reasonable alternative to reverse osmosis filters to produce freshwater from saline water without damaging the environment or using extensive natural energy resources typically from fossil fuels.

Summary Statement

My partner and I built five solar powered desalination devices to determine how the color of the bottom of a solar powered desalination device affects its efficiency.

Help Received

None. My partner and I built and tested the experiment by ourselves.

CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY

Name(s)
Athena F. Fung

Project Number
J1010

Project Title
A Bluer Ocean: Replacing Microplastics with Water-Soluble Bioplastics

Abstract

Objectives/Goals
An estimated minimum of 5.25 trillion microplastics weighing 268,940 tons is in our oceans. By 2020, that number is projected to increase tenfold. Microplastics lead to detrimental health effects across the food web (eg. impaired neurodevelopment) due to their ability to adsorb toxins, which bioaccumulate in living tissue. Bioplastics could solve the microplastic crisis, but most are made of insoluble materials. The primary objective of my project is to create a strong, flexible, water-soluble bioplastic to reduce the rising amount of toxic microplastics in the ocean. Bioplastics consist of a polymer, plasticizer, and additive. In this project, pectin, a natural gelling agent found in cell walls, will be the polymer, and glycerol, a plant derivative, will be the plasticizer. Calcium carbonate will be the additive to add thickness and strength. The parameters of strength, flexibility, and water-solubility will be evaluated.

Methods/Materials
Pectin (C(6)H(10)O(7)) was extracted from Citrus sinensis peels and precipitated into a gel with isopropyl alcohol. Grinding eggshells yielded calcium carbonate (CaCO(3)). Calcium carbonate and glycerol (C(3)H(8)O(3)) were folded into the pectin precipitate and set in a 50°C temperature chamber.

Results
After each trial, the results were observed and the procedure was revised. A ratio of 20 mL pectin precipitate to 2.5 grams calcium carbonate yielded best textural results (not thin or crumbly). Glycerol did not affect texture and it increased flexibility. As the amount of glycerol increased, the strength decreased, which can accommodate the uses of different products. All pectin in the bioplastics dissolved in 3 days, proving solubility.

Conclusions/Discussion
Pectin, calcium carbonate, and glycerol can be used to make a strong, flexible, water-soluble bioplastic. It could also aid in reversing negative effects of ocean acidification on mollusks and corals. Calcium carbonate from the bioplastic would disassociate into Ca^(2+) and CO(3)^(2-), which could be used by mollusks and corals to grow. By dissolving in the ocean instead of adsorbing toxins, the bioplastic reduces risks of toxins accumulating and leading to adverse health effects. Further research includes finding other uses for this bioplastic and pectin precipitate. Pectin has been found to induce apoptosis in two lines of cancer cells, and polymers are gaining popularity as favorable mechanisms for drug delivery.

Summary Statement
I used pectin, calcium carbonate, and glycerol to create a strong, flexible, and water-soluble bioplastic that could potentially reduce the rising amount of toxic microplastics in the ocean.

Help Received
Mrs. Iyer, my science teacher, was my mentor, and my parents provided the money for materials.

CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY

Name(s)

Jacob R. Gibbs

Project Number

J1011

Project Title

The Most Superior Way to Conserve Water When Growing Grass

Abstract

Objectives/Goals

This project's main goal ways to help deal with California's drought by finding ways for homeowners and farmers to use water for growing plants more efficiently.

Methods/Materials

Materials - 800 sq foot Marathon grass, Lab Colorimeter (FRU Precise Color Reader, WR-10), Vigoro moisture meter, manually controlled sprinkler

Methods - Color, moisture, and appearance levels associated with healthy grass were experimentally determined. These levels were then used to determine when patches of grass needed to be watered, and water savings with each method calculated.

Results

Soil moisture levels and quantitative levels of green color both were equally good predictors of when grass needed to be watered, followed by visual inspection. All three methods used between 25 to 35 percent of the water used when setting the sprinkler on a standard timer using municipal watering guidelines.

Conclusions/Discussion

Both colorimetry and moisture sensors result in less use of water to grow grass when compared to visual inspection alone. This largely confirms the hypothesis that moisture sensors would be the superior method. All methods of observation are better than simply setting a sprinkler timer. Moisture sensors are the optimal method for residential lawns because they are inexpensive and easy to use, while colorimetry is likely the superior method for large scale agriculture. California could save billions of gallons per year using better watering guidelines.

Summary Statement

My project investigated the effect of using color sensors, soil moisture levels, and visual appearance to determine when grass needs to be watered.

Help Received

The staff at Southland Sod Company assisted me with watering and grass care advice.

CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY

Name(s)
Ethan C. Hung

Project Number
J1012

Project Title
Reducing Global Warming through Chemosynthesis

Abstract

Objectives/Goals
The point of my project was to see if I could use bacteria, specifically chemosynthetic bacteria, as a replacement for absorbing carbon dioxide instead of plants. Plants use photosynthesis, and in order to compare apple to apple, I used a photosynthetic bacteria to compare to the chemosynthetic bacteria.

Methods/Materials
I used a Vernier Labquest Mini, Vernier CO(2) sensor, Version 10.3 Vernier LoggerPro software in order to measure the CO(2) level in the sealed container. I sealed the bottle in with petroleum jelly, in order to make sure I had a true air seal. I borrowed the bottle, Vernier CO2 sensor, and Vernier Labquest Mini from my mentor Dr. Todd Haney. I also ordered the two bacterial strains, Synechococcus elongatus and Thiomicrospira crunogena from ATCC through my mentor's school. The incubator for maintaining temperature was also borrowed from my mentor and was used at Sage Hill School as that was where the bacteria was kept alive when we first got the bacteria. Also, the medium was mixed by my mentor and I at Sage Hill School.

Results
During my experiment, the two bacterial strains I used absorbed carbon dioxide at a fairly fast and regular rate over time. In the end, the photosynthetic bacteria absorbed carbon dioxide until the carbon dioxide level was around 50 ppm (parts per million) lower. However, the chemosynthetic bacteria's carbon dioxide level dropped over 200 ppm by the end of the project.

Conclusions/Discussion
The chemosynthetic bacteria absorbed 4 times as much carbon dioxide as the photosynthetic bacteria. This means that the chemosynthetic bacteria may be a better source for absorbing greenhouse gases such as carbon dioxide than plants.

Summary Statement
Chemosynthetic bacteria are more efficient than photosynthetic bacteria in absorbing greenhouse gases, such as carbon dioxide.

Help Received
Dr. Todd Haney, from Sage Hill School provided much-needed assistance in materials, equipment, and advice. Sage Hill provided the laboratory in which I worked at. Also, my parents provided all of the financial help I needed. Lastly, Ms. Elizabeth O'hara at ATCC greatly reduced the cost of the bacterial

CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY

Name(s)

Megha Jain

Project Number

J1013

Project Title

The Water Friendly Toilet Tank: Saving Millions of Gallons of Water Daily

Abstract

Objectives/Goals

The objective of this experiment was to isolate the best detachable dual mode toilet tank apparatus design (out of the two constructed apparatuses) based on its efficiency, production cost, and water saving capacity.

Methods/Materials

Large bottle
Sharpie
Stopwatch
Pulley wheels
Small cup
Lexan plastic sheets

A suction bottle apparatus was made using the large bottle (with a hole drilled at the bottom), and the pulley apparatus used pulley wheels attached to the small cup. Both apparatuses were constructed on Lexan plastic. After construction, both were marked with sharpies to measure their water saving capacities, and tested 3 times each in 2 different toilets. The toilet bowl refill rate was also timed after each trial for more accuracy.

Results

The suction bottle apparatus, with a capacity of 48 ounces, saved 34 ounces (0.26 gallons) of water, while the pulley apparatus, with a capacity of 8 ounces, saved 7 ounces (0.05 gallons) of water. The suction bottle apparatus costed about $12 to make, and the pulley apparatus costed $15. The toilet bowl refill time was also significantly less when using the suction bottle apparatus than the time after the use of the pulley apparatus. Both apparatuses seemed to function properly.

Conclusions/Discussion

Of the two apparatuses designed, the suction bottle apparatus was more effective overall than the pulley apparatus. It was easier and cheaper to make, and saved a lot of water. This experiment has shown that there is a way to make your old toilet fairly water efficient and dual mode while spending 4% the money and a small amount of the time of installing a new dual mode toilet.

Summary Statement

I invented an extremely cheap and easy to make replacement of expensive dual mode toilets that can help save millions of gallons each day.

Help Received

Home Depot employees in the Tool Rental section helped me drill holes with the right tools while constructing the apparatuses.

CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY

Name(s)
Gavin C. Joyce

Project Number
J1014

Project Title
Surviving Drought II: How Much More Food?

Abstract

Objectives/Goals
The goal of this experiment was to determine if recycled water grew squash fruit in higher quantities and in higher quality than tap water.

Methods/Materials
Materials
1.18 pots
2. 18 square feet of black fabric
3. 9 small bags of rocks
4. 4 1/2 trash cans of soil
5. 18 squash seeds
6.2- 2 gallon watering cans
7.Recycled water source
8. Tap water source
9. Biomass scale
10. Thermometer
11. Clock
Method:
1. Place pots in two rows of 9 each
2. Fill the pots 1/3 of the way up with rocks
3. Cut and place one square foot of fabric in each pot, covering the rocks
4. Fill pots another 1/3 of the way with soil
5. Plant 2 squash seeds in each pot
6. Water daily and adjust amount used to the temperature and season
7. Record data on amount of fruit produced and stand-out qualitative traits

Results
The recycled water grew roughly double the amount of squash fruit that the tap water grew. The recycled water squash was also more developed and healthier than the tap water squash.

Conclusions/Discussion
The results of my project show that recycled water is great for producing food especially when it contains high amounts of phosphorus. This is important because it may not be the quantity of water that will help us through this drought but quality in water that will help us in the end.

Summary Statement
After last year determining that vegetables can be grown with recycled water, this year I wanted to investigate if recycled water grew more squash fruit than first use tap water and by what margin.

Help Received
My grandfather provided access to gardening space as well as materials.

CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY

Name(s)
Nahla Kattih

Project Number
J1015

Project Title
Oil Spills: Polymers vs. Detergents

Abstract

Objectives/Goals
Oil spills have disastrous effects the ecosystem/environment on the environment and ecosystem. The objective of this project is to test the effectiveness of several agents, including two different polymers and detergents in cleaning up oil from oil water suspension.

Methods/Materials
Oil absorbing polymer, Dawn detergent, hydrogel powder (slush powder), Tide detergent, mystery oil, graduated cylinders, ruler, plastic cups, filters. The four different agents were added to 220 ml of oil and water suspension (20 ml oil and 200 ml water)each. Oil band thickness was measured and compared before and after for each of the different agents and control five times. Each suspension was then filtered and observed.

Results
Average oil band thickness was highest for Dawn detergent and lowest oil absorbing polymer. It was not possible to measure band thickness for slush powder since it turned the whole suspension into a heterogeneous gel substance. Oil polymer was the only agent resulting in clear water after filtration.

Conclusions/Discussion
The oil absorbing polymer was the most effective agent in removing the oil from the oil water suspension and Dawn detergent was the least effective. Oil absorbing polymers offer the most effective economic, and ecofriendly solution to removing oil spills from water bodies.

Summary Statement
I demostrated that oil polymer is the most effective agent in removing oil from oil water suspension.

Help Received
I designed and conducted the experiement after internet research. My mentor reviewewed my design and results.

CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY

Name(s)
Daniel Kazarian

Project Number
J1016

Project Title
Pre-Cycling before Recycling

Abstract

Objectives/Goals
The objective of this study was to explore the possibility of extracting more power, and extending the life of single use batteries that are considered dead, and altimately discarded.

Methods/Materials
For the purpose of this experiment, a self-ocillating circuit with the unique ability to extract nearly all of the power, far below the voltage were other circuits consider the battery fully discharged was constructed. Materials used for this experiment: Torid Core, 25 gauge wires, transistor, resistor, LED bulbs, new, and discarded AA, and AAA batteries, Bread Board, soldering iron, and flashlights.

Results
It became clearly evident that AA, and AAA batteries once stopped powering the flashlights, still retained 50% of their energy. These dead batteries with the help of my circuit, were able to power LED bulbs for many additionl hours.
Discarded AA battery: Ran for and additional 16 hours and fifty minutes.
Discarded AAA battery: Ran for an additional nine hours and thirty minutes.

Conclusions/Discussion
179,000 tons of batteries are thrown away prematurely each year. The energy used to manufacture them is 50 times greater than the electrical energy they produce. The single largest source of mercury is found in household batteries, and most of them end up in our landfliis. My circuit operates by taking the direct current from the battery, amplifing it to a higher voltage at the expense of the current, and delivering it in pulses. This self-oscillating circuit, can dramatically extend the battery life.

Summary Statement
This self-oscillating circuit, can dramatically reduce the amount of mercury, magnesium, and zinc that are commonly found in batteries. Hence the term "Pre-cycling Before Recycling".

Help Received
I built the circuit by my. My parents drove my to different stores to buy the components for this experiment.

CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY

Name(s)

Erik L. Kokke

Project Number

J1017

Project Title

Solar Powered Desalination

Abstract

Objectives/Goals

The objective is to determine if salt water can be turned into fresh water using only the power of the sun and if certain surface materials are more effective than others.

Methods/Materials

Four identical plastic containers, funnels, straws, plastic cups, rubber bands, Styrofoam bases and cling wrap with tape were used to construct each apparatus. Aluminum foil placed on hangers was used to create parabolic reflectors on each apparatus. Different surface materials were placed under each container. These materials were black paper, white paper, aluminum foil and Blu-ray DVD discs. Each container was filled with ocean water having the same properties. All four apparatus were placed on a table in the sun all day. The clean water which was produced in each cup connected to each container was measured at the end of each day. There were a total of 13 experiments conducted.

Results

Black paper was the surface material which produced the largest volume of water on 9 of the 13 days tested. The Blu-Ray DVD discs produced the most water on 2 days and on one day the black paper and Blu-Ray surface had the exact same volume. The black paper absorbed more heat from the sun and produced the most water on a consistent basis, more than the other three surface materials.

Conclusions/Discussion

Solar powered desalination may be part of the solution to the water shortage in California with the added benefit of not producing additional CO(2)in the process. Testing different surface materials and their properties to absorb and reflect heat can help improve the efficiency of these technologies and the amount of water produce over a given period of time. In this specific experiment black paper produced the most water followed by Blu-ray discs. Future studies on incorporating the properties of these two materials or other materials into solar powered desalination technologies may make them more efficient. One day solar powered desalination may become part of a viable solution to our problem.

Summary Statement

I proved that ocean water can be turned into fresh water using solar powered desalination and that using black paper in the process produced the most fresh water.

Help Received

The idea of the project came from the Science Buddies website as did some of the materials. An article about researchers at Northwestern University gave me the idea for testing Blu-ray DVD discs. My science teachers helped provide examples on how to improve my project as did my father.

CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY

Name(s)

Meagan Lee

Project Number

J1018

Project Title

Biodiesel: Fuel for the Future

Abstract

Objectives/Goals

The goal of this project is to find out which source produces the best quality biodiesel. These sources include, fish tank algae, chlorella algae, scenedesmus algae, duckweed, and used fryer oil.

Methods/Materials

Press for algae-built from plywood and mechanical screws, and bolts
Reacting Oil into Biodiesel-transesterification, blending methanol alcohol and sodium hydroxide
Testing Quality of Biodiesel-pHLip test-bought online

Results

Scendesmus algae produced best, fryer oil produced second best, chlorella algae third, duckweed, fish tank algae last.

Conclusions/Discussion

By concluding which source created the most usable biodiesel, it is concluded that certain vegetable based sources can be renewable and converted into fuel.

Summary Statement

Converting different sources into biodiesel.

Help Received

CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY

Name(s)

Seth Madden; Gabrielle Nannie

Project Number

J1019

Project Title

Out with the Oil-d, In with the New: Magnetizing Oil

Abstract

Objectives/Goals

The objective of this experiment is to find the most efficient ratio of magnetite to oil that will remove oil from saltwater.

Methods/Materials

We tested magnetite to oil ratios of 1:1, 3:1, 4:1, and 6:1, with three repetitions of the process for each ratio. For each repetition, we added 4 liters of saltwater to a plastic container then turned a fan on high for one minute to create typical ocean wind and current conditions. We then poured 5 milliliters oil into the water and waited another minute before sprinkling the current ratio of magnetite on the oil slicks to allow the magnetite and oil to bond. After another minute, we glided a hand-held magnet across the container above the water five times to collect the oil out of the water. If no oil remained visible in the container, the test was considered successful. The constants in the experiment were the size of the container; the amount of oil; the time between turning on the fan, pouring in the oil, sprinkling the magnetite, and removing the oil; the magnet used to remove the oil; the wind speed; and the motion of the magnet. The materials used were saltwater, oil, and magnetite. Equipment used included a desktop fan, a stopwatch, measuring spoons, cardboard, and a handheld bar magnet.

Results

The 1:1 ratio failed to remove 100% of the oil on all three tests. The 3:1 ratio and 4:1 ratio succeeded in removing 100% of the oil on the second and third repetitions with even sprinkling of the magnetite using a piece of cardboard, but failed on the first repetition due to uneven sprinkling of the magnetite using a spoon. Using the 6:1 ratio, all of the tests were successful.

Conclusions/Discussion

The conclusions of the experiment are that the 6:1 ratio, 4:1 ratio, and 3:1 ratio all worked while the 1:1 ratio did not succeed. The 6:1 ratio worked the best because it used the most magnetite. The 1:1 ratio did not succeed because it used the least amount of magnetite. As hypothesized, the 3:1 ratio proved to be the best because it worked consistently, with even sprinkling, while using less magnetite than the 4:1 and 6:1 ratios. Knowing that a 3:1 ratio of magnetite to oil works to remove oil from saltwater in simulated ocean conditions will allow future researchers to focus on other important variables such as efficient sprinkling of the magnetite, calculating the amount of oil spilled, and larger-scale testing.

Summary Statement

We added various ratios of magnetite to oil in simulated ocean conditions and found that a 3:1 ratio achieves 100% removal of oil from saltwater while using the smallest amount of magnetite that works.

Help Received

Former Coast Guard Captain Rich Harbert helped identify ways currently used to clean oil spills. We developed our testing setup and procedures ourselves.

CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY

Name(s)

Michael Maregne; Dylan Shragg

Project Number

J1020

Project Title

Shade Balls: Sphere vs. Tetrahedron: Using Geometric Shapes to Reduce Evaporation in Open Air Reservoirs

Abstract

Objectives/Goals

The objective is to determine whether different geometric shapes will reduce evaporation better than shade balls (sphere) while at the same time reducing cost.

Methods/Materials

Materials to make the mold and plastic tetrahedrons: cardboard, Smooth-On Mold Star# 30, hot glue, wooden dowels, razor blade, metal ruler, bucket, plastic cups, stirring sticks, scale, tape, saw, Plexi-glass cut into the shape of a triangle, rubber gloves, Smooth-On Smooth-Cast# 60D, Smooth-On Sonite# Wax, Smooth-On UVO Black Color Pigment, paint brush, rubber bands, water.

Materials to conduct the experiment: two plastic containers 1 foot in height, 2 feet in length, and 1 foot in width, 40 liters of water in each container, two different types of shapes (10 of each type), sunlight, scale, measuring tape.

Method: Place the two different shapes into their own container filled with water and measure the rate of evaporation.

Results

The amount of water remaining in the container with the spherical shade balls was 37.0 liters and the amount of water remaining in the container with the tetrahedral shade balls 36.8 liters. After seven days, the tetrahedral shade balls saved 0.20 more liters than the spherical shade balls. These results indicate that the tetrahedral shade balls reduced evaporation more than the spherical shade balls.

Conclusions/Discussion

According to the data collected, the hypothesis that states if the spherical shade balls and tetrahedral shade balls are placed in different containers filled with water, then less water would evaporate in the container with the tetrahedral shade balls. This hypothesis appears to be supported. It is suggested by the shapes that they can be made to increase the amount of water California saves.

Summary Statement

Had a different geometric shape been used in the LADWP's open air reservoir shade ball project, anywhere from $3 to 10 million could have been saved (depending how how the results are calculated)

Help Received

Mother and father assisted with handling the chemicals, where to find and calculate equations, the formatting of the report in Microsoft Word, proofreading the report, the SketchUp program which helped analyze different shapes in 3D.

CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY

Name(s)

Nicolas A. Martinez

Project Number

J1021

Project Title

Is Your Kitchen Trash Useful? The Secret Power of Eggshell Powder

Abstract

Objectives/Goals

My project is about the use of organic fertilizer like eggshell powder on plants. If the eggshell powder is a good organic fertilizer, then the medium amount (1/4tsp) of this fertilizer will work best for more plant growth.

Methods/Materials

This project included grinding the dried eggshells until powder consistency is obtained. Then mixed plain top soil with the eggshell powder at different concentrations (1/8tsp, 1/4tsp and 1/2tsp) making 3 different group plus a control group (no fertilizer). Grass seeds were added to each pot (average of 50 seeds per pot) including a control group for comparison. Then I watched them grow for 6 weeks. Each pot grew between 20-40 grass plants. I measured the 3 tallest grass plants for each pot and calculated the average. I recorded the results (average growth for each group of pots and pH) and made the graphs.

Results

I discovered that this organic fertilizer did not change the acidity of the soil (pH). The group with highest amount of fertilizer (1/2 tsp) was the one with lowest height and the group with the lowest amount 1/8tsp) was the most successful with an average height of 18 inches. These results showed that this organic fertilizer worked but it did not work out the way I predicted.

Conclusions/Discussion

The hypothesis was incorrect because my estimation on the amount of fertilizer that would grow the plants the tallest was off. The best result was achieved with the smallest amount (1/8 tsp). The results varied within the different groups of amounts of fertilizer. I was surprised that the group of pots with the highest amount (1/2 tsp) of fertilizer had the shortest measurement. I discovered that the eggshell powder did not affect the acidity of the soil because the pH remained the same for all of the plants, including the control group (pH8). I think the 1/8 tsp measurement was the most successful because the size of the small pot only allowed 1 cup of soil and this amount of fertilizer must have been the right proportion for that amount of soil.

Summary Statement

Eggshell powder is a great organic fertilizer when it is used in the right proportion for your plants.

Help Received

CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY

Name(s)

Arshia A. Mehta

Project Number

J1022

Project Title

Pure2: A Low Cost, Portable, Microbe-Resistant Water Filtering System Powered by Solar Radiation

Abstract

Objectives/Goals

This year, I focused on eliminating heavy pathogen from contaminated water, using methods besides boiling, which is inefficient and harms our environment. The overall theory I wanted to prove through experimentation was that pasteurization is only temperature needed to purify water to point where it is consumable. Pasteurization is relatively lower than boiling point, (149 degrees F versus 212 degrees F) which saves energy.

Methods/Materials

For prototypes, I used polypropylene and polyethylene plastic, bubble-wrap, foam, pressure-heat sealer, waterproof sealant, and individual plastic pieces found at local hardware store. Created three prototypes, pouch, pillow, and pack. Focused on simplicity, quantity, and insulation, respectively. For filter I used PVC pipe, and porous earthen material. Constructed so filter attaches to prototype, water runs through, and ends in prototype, which is left in sun. Focused on ensuring waterproof quality of prototypes, and insulation ability, so water could heat to pasteurization temperature fast. Tested each filter plus prototype combo for metal/quality using testing strips (i.e. nitrite, pH, copper.) Tested for bacteria count using a local laboratory.

Results

Tested in two categories, original (contaminated sample) and processed (purified sample). Compared both to ideal level. Found that processed sample had matching levels of test variable compared to ideal level, (i.e. ideal pH is 7, processed sample had 7 pH). Original sample had relatively higher/less quantities of metal/quality compared to ideal (i.e. original sample had a 6 pH). For microbe, lab results came back stating that original sample had 7 colonies of coliform bacteria and other pathogen, whereas processed sample had 0 colonies.

Conclusions/Discussion

Proved that pasteurization is the only temperature required to turn contaminated water consumable. Rather than wasting energy and harming the environment by boiling water over open fire, we can use plentiful solar energy, which works the same, and is more efficient. Also formed a bill of materials cost, and prototypes plus filter result in cost varying from 10 cents to 5 dollars, depending on prototype. In the end, achieved most all goals, and would like to start manufacturing this product soon.

Summary Statement

Through microbial analysis, I have discovered that heating water to its pasteurization temperature, using solar radiation, is just as effective as the inefficient boiling point.

Help Received

Designed and built prototypes/filter by myself. Tested with testing strips by myself, found microbial data of before and after sample from Zone 7 Water Laboratory.

CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY

Name(s)

Rachel Meyer; Jasmine White

Project Number

J1023

Project Title

Clean Water?

Abstract

Objectives/Goals

This project could help make drinking water cleaner all around the world. Rapid sand filters are used to purify water and work very well when removing turbidity and bacteria from stream water. The problem is that rapid sand filters don#t remove oil or gas from the water. Use of watersheds by humans including illegal pot grows has increased the risk of contaminates such as oil and gas entering streams. Our goal was to add a substance to the rapid sand filter that would successfully remove the oil from the water. We tested clay cat litter (clay), charcoal, shredded redwood bark, and organic cotton. We hypothesized that charcoal would do the best because it is a common substance used in filters, including fish tanks.

Methods/Materials

We set up our project by building a stand that held four, 3in. diameter PVC pipes. We then placed organic cotton fabric over one end and lightly hammered on a 3in tapered cap. Next we filled the PVC pipe with 4in of sterilized gravel on the bottom followed by 11in of sterilized sand. On top of the sand we added 6in of a tested substance to 3 of the tubes. One of the tubes had no added substance and was our control. The first substances tested included clay, shredded redwood bark, and charcoal. We ran clean water through each filter until water was clear. During this process we came across an issue, the clay wasn#t letting any water pass through. We then substituted organic cotton cloth for the clay as our third substance tested. Once the filters were clean, we put one tablespoon of oil into one cup of distilled water and ran the water through each filter five times, separating each test into it's own cup. After testing was complete we evaluated results by smelling and looking at the water in each cup, and looking at the water through a microscope.

Results

With a score of 0 meaning no trace of oil present, the results of our experiment found out that the rapid sand filter with no added substance scored a 25 and the one with cloth scored a 17 while the shredded redwood bark and activated carbon did the best, both scoring a 13. However, they too didn't get rid of all of all of the oil.

Conclusions/Discussion

None of our tests were successful at removing all the oil from the water. If we did this project again we would create a separate filter to try to remove oil from the water before it reaches the rapid sand filter. This way we could just focus on trying to remove oil from water.

Summary Statement

We added substances to rapid sand to filters to make it remove oil from water, however none of the water was fully purified.

Help Received

Derrin Mierau showed us his working rapid sand filter and explained how they work. Fred Meyer helped us put together our experiment and answerede questions we had.

CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY

Name(s)
Melanie E. Quan

Project Number
J1024

Project Title
Worldwide Water: One Pot at a Time

Abstract

Objectives/Goals
The objective of the project is to see if the scientist can create an inexpensive, homemade water filter using all natural materials that is equally or more effective than commercially available water filtration devices on the market.

Methods/Materials
Four homemade water filters were constructed using terracotta clay mixed with either coffee grounds or sawdust. All filters were fired to a high temperature, cooled, and painted with colloidal silver. The filters were compared to LifeStraw Family 1.0, SteriPEN Traveler, and Brita Water Filter. They were tested for multiple water purity and quality indicators, including the presence of Coliform bacteria.

Results
The data indicated that the homemade water filters rid the polluted water of coliform bacteria, nitrates, and nitrites more efficiently than the Brita and SteriPEN filters. The data showed that the Coliform bacteria did not appear in the homemade water filters at all, but instead showed in the SteriPEN and Brita Water Purifiers after 48 and 72 hours. LifeStraw Family 1.0 did best in all of the tests when comparing each filter individually, but the homemade water filters performed better than 2 of the 3 commercially available water filters.

Conclusions/Discussion
The performance of the homemade water filters were shown to be more effective than the majority of the commercially available filters. The data suggests that it is possible to create an inexpensive water filter using all natural materials that can successfully provide potable water.

Summary Statement
I created an inexpensive, homemade water filter using all natural materials that effectively filtered water safe to consume.

Help Received
None. I designed, built, and performed the experiments myself.

CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY

Name(s)
Christopher D. Raney

Project Number
J1025

Project Title
Can Mealworms Fix Our Plastic Waste Problem?

Abstract

Objectives/Goals
The objective of this study is to see if mealworms can eat plastics. Plastics are a huge environmental problem. The world produces enough Styrofoam cups every day to circle the earth and they take 500 years to decompose. The average American throws away about 185 pounds of plastic per year and only 5% of plastic is recycled. It would be great if we could find a solution to this problem.

Methods/Materials
I tested seven plastic and two paper samples by putting each sample in its own jar, and then adding 21 mealworms per jar and left them there for 8 days. The first test was just observations to see if they had eaten anything. The second test included weighing the materials before and after the 8 days.

Results
I made observations of how many mealworms died and if there was visible evidence of mealworms eating plastic. It was obvious they ate the hard Styrofoam, the Styrofoam ball, paper towel, the produce bag, the plastic wrap, the Noah#s Bagels paper bag and even the Lego. In test 2 when I looked at the weight difference, it became clear that they actually ate everything!

Conclusions/Discussion
The results indicated that the mealworms ate everything, which is great. They ate more types of plastics than what I thought they would in my hypothesis. They were able to eat an average of 15.62% of what I gave them in 8 days This could be a big breakthrough, but we should do further testing on if the plastic digested impacts the health of mealworms, our soil and the food chain. I'm also curious if the darkling beetle will also eat plastic.

Summary Statement
My project investigates whether mealworms can eat different types of plastics and paper with the hope of finding a potential solution to our plastic waste problem.

Help Received
I designed and performed the research myself. I used the scientific scale at the CVS pharmacy because I needed to be able to weigh to centigram accuracy.

CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY

Name(s)

Kami E. Richardson

Project Number

J1026

Project Title

Investigating Ocean Acidification on Bivalves and Echinoids: Filter Study and Water Preservation Using Vector Mapping

Abstract

Objectives/Goals

(1) To determine if acidification will affect the calcium structure of sea urchins (lytechinus variegatus) and bivalve clam (venerupis philippinarum) and (2) minimize the damage with a two-stage filter design. Since Ocean Acidification is composed of diffused CO2 from industrial waste and eutrophicated water, I analyzed waterbody reports to track input from local runoff, to (3) determine the best placement of said filter by vector field analysis.

Methods/Materials

This project has two phases of study: Phase (1) utilized three different water types, current ocean water as the control (pH 8.1), increased acidity ocean water emulating a 100yr projected level (pH 7.5), and increased acidity ocean water (pH 7.5) with an activated carbon filter. The dependent variable was the weight and decay of bivalve shells over time. Data was taken every three days with six shells in each type of water over 27 days. They were baked at 120F for six minutes to ensure that the absorbed water in the shells was not contributing to the total weight. To study the effect on the urchins, twelve urchins were bathed with water of varying pH, four in each level pH 8.1, pH 7.5, and pH 7.5 with filter. The urchin activity levels, food consumption and life spans were recorded. The waterbody mapping analysis is based on EPA reports and vector analysis was used to trace back from three different ocean estuaries: Santa Cruz, Long Beach and the Gulf of Mexico.

Results

Data showed that while shells in acidic ocean water had weight decreased by 13% on average, the acidic water with the filter and current ocean water decreased by 0.3% and 0.5% on average. The waterbody mapping showed increased pollutants and contaminants from over fertilization and street runoff contributing to the ocean decay.

Conclusions/Discussion

Overall, the filter decreased the average weight change from the acidic water significantly. The results show we can reduce ocean acidification with a filter placed in front of storm drains to purify water flowing to the bay, or attached to boats in a cage over the propellers to prevent animals from being cut by the propellers and purifying the ocean as well. With a little love and dedication, in time, we can restore our acidifying ocean to normal.

Summary Statement

As part of my investigation of the effect of ocean acidification, I created a two-stage filter and analyzed optimum placement based on vector mapping; with the hope that it can clean our oceans, one stream at a time.

Help Received

Dr. Jim Barry (MBARI) encouraged me to use sea urchins in addition to clams because they are particularly sensitive to ocean acidification.

CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY

Name(s)
Ariana O. Ruiz

Project Number
J1027

Project Title
Investigating the Effect of Different Organic Substances in Changing Soil pH in the Environment

Abstract

Objectives/Goals
The objective of this project is to investigate how pH levels of our Central Valley's orange orchard soil is affected when different organic substances have been added to it.

Methods/Materials
pH meter, orange orchard soil, one 16oz. Cup, fifty 5oz. Dixie cups, 4 different organic materials, one container capable of holding 15lbs., food scale, 3 pound containers

Results
I conducted multiple trials to ensure a preside average of the effect the organic materials had on the orange orchard soil. At the end of my expirement I realized that my organic materials have turned into organic matter. What I mean is at first my soil was affected by the new additives. As time went on, however, the levels began to increase back toward the neutral area. What this means is as my expirement length increased my organic materials be came organic substances.

Conclusions/Discussion
When my project was complete I had concluded my hypothesis had been incorrect. However, at the beginning of my expirement it had been correct, but as time went on the results changed. I had thought that my project would have a result of the soil becoming more acidic. This did happen to the soil at the beginning of my project, but soon the levels began to become increasingly alkaline. This is because the organic materials began to decompose and soon became organic matter thus no longer affecting the pH levels of the soil.

Summary Statement
My project was about how different organic materials will affect our Central Valley's orange orchard soil's pH levels over a certain amount of time.

Help Received
None. I built and performed my expirements myself.

CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY

Name(s)
Mari O. Sanders

Project Number
J1028

Project Title
The Effectiveness of Cereal Crops in Riparian Restoration Design

Abstract

Objectives/Goals
This project explores the role of cereal grain crops in riparian restoration design as part of a four year examination of nitrate runoff resulting from fertilizer use. Last year#s project analyzed grass planted from seed compared to commercially grown sod to determine which alternative acted as a better nitrate filter. This year, the hypothesis states that cereal crops such as barley and oats will be more effective in reducing nitrate runoff compared to rye and fescue grasses.

Methods/Materials
The hypothesis was tested by planting ryegrass, fescue, oats, and barley into troughs. Triple 15 fertilizer was added and the troughs were watered at regular intervals as the crops grew. Only one type of fertilizer was used in order to reduce the amount of variables in the study. In previous years, inorganic and organic fertilizer results were analyzed to compare nitrate levels. This year, a local accredited municipal water lab was contacted and an Ion Chromatograph was used to more accurately measure nitrate concentrations in water. Some samples required dilution to be within the calibration range of the system. By dividing the nitrate result by the dilution factor, it was determined if a water sample was in the calibration range. Samples had to be diluted and retested depending on the outcome of the initial nitrate measurement.

Results
Cereal crops demonstrated the ability to decrease runoff from fertilizer from the first to the third test run more effectively compared to grasses. However, grasses demonstrated the overall ability to reduce nitrates in samples to a greater degree compared to baseline throughout all three samples. All plant types analyzed were found to reduce nitrates to a significant degree (over 50%) compared to baseline.

Conclusions/Discussion
The large amount of pollutants entering waterways has had catastrophic effects on water quality, marine life, and human health. Adding to the problem is the fact that seventy to ninety percent of the riparian forests throughout the nation have been destroyed over the last 150 years. Riparian systems filter toxins in the environment. According to this study, cereal crops can be used as bank stabilizers to reduce erosion in riparian design due to their deep root systems, while also absorbing nitrates. Furthermore, cereal grains can be planted as cover crops in the off-season to reduce nitrate runoff before the toxins reach traditional riparian zones.

Summary Statement
Cereal crops and grasses were compared and both were shown to significantly reduce nitrate runoff from fertilizer use, as part of riparian restoration design.

Help Received
I grew the test plants, applied fertilizer, and collected the water samples myself. I contacted the City of Porterville Water Lab and was assisted in using an Ion Chromatograph by the staff chemist Michael Cotton. He provided help in diluting and calibrating the water samples for the Ion Chromatograph.

CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY

Name(s)
Vedha Santhosh

Project Number
J1029

Project Title
What Is the Effect of Using Bioplastic As a Packaging Alternative to Petroleum Based Packaging?

Abstract

Objectives/Goals
I wanted to find out if Bioplastic could be used in food preservation as an alternative to petroleum based packaging (polyethylene terephthalate). I tested for the biodegradability, compostability, water resistance, food preservation, and tensile strength.

Methods/Materials
I tested and observed the Bioplastic against petroleum based packaging (polyethylene terephthalate - PET) in 4 areas: compostability, food preservation, tensile strength, and water resistance. The Bioplastic was produced using vegetable starch, water, glycerin,and vinegar. Three different varieties were produced with corn starch, tapioca starch, and potato starch.

Results
After analyzing my results, I conclude that the Bioplastic food packaging is both biodegradable and compostable. Although it preserves food products up to 75% of the same time as the PET packaging (the control), it is not water resistant as my control. Bioplastic packaging has the ability to withstand forces when food items were placed and had a strain of 1% to 3% more than the control.

Conclusions/Discussion
Bioplastic packaging is a reasonable alternative for storing dry food. It contributes to enriching the soil by replenishing the nutrients through composting. Bioplastics reduce the depletion of nonrenewable resources such as fossil fuels, thus preventing toxic emanations from landfills.

Summary Statement
I created a Bioplastic bag that can effectively store dry food.

Help Received
My science teacher reviewed my use of dependent and independent variables in the context of my project. I built a vermicomposting bin and created Bioplastic for this project.

CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY

Name(s)
Sara E. Senzaki

Project Number
J1030

Project Title
Which Is the Most Effective Layer in Helping to Prevent Evaporation from Large Bodies of Water?

Abstract

Objectives/Goals
The objective of this experiment is to determine which layer is the most effective in helping prevent evaporation in large bodies of water, like reservoirs.

Methods/Materials
20 containers that were the same size and shape, 4 different layers (monolayer, monolayer 3x, shade balls prototype, and cover) were tested with different environmental factors (wind, air temperature, and water temperature). Measured evaporation by weight loss for 4 days.

Results
In this experiment, the physical pool cover was the most effective in preventing evaporation. The shade balls were also very effective. The monolayers were not very effective.

Conclusions/Discussion
In conclusion, the shade balls and physical covers were the most effective, but in a large reservoir, they may not be practical or cost-effective. The monolayers weren't very effective in this experiment, but perhaps improvements in the monolayers and how they could be applied could make them more effective.

Summary Statement
I tested to see if monolayers could be just as effective as shade balls and covers in preventing evaporation.

Help Received
I designed and did the experiment myself.

CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY

Name(s)

Rebecca E. Starr

Project Number

J1031

Project Title

During Drought Mulch Matters

Abstract

Objectives/Goals

The object of this study was to determine which mulch, black plastic, hay, bark nuggets or plain soil retained more water over a six day period.

Methods/Materials

4 ceramic stakes, 4 wine bottles, black plastic, hay, bark nuggets, plain soil, 2 garden beds. Wine bottles filled with 800ml of water, marked with 50ml increments, over six days measurements were taken of how much water was used by each mulch.

Results

The bark nuggets used the least amount of water, after the six day test period, also showing it had the lowest evaporation rate.

Conclusions/Discussion

The best mulch to use in a garden to prevent water waste is bark nuggets. Landscape owners and farmers will be able to save water by using the mulch that retains the largest amount of moisture.

Summary Statement

I tested black plastic, hay, bark nuggets and plain soil to see which one would retain the most water.

Help Received

I set up and gathered results for this experiment myself. My science teacher, Mr Semple reviewed my procedure and results.

CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY

Name(s)
Iris Zhou

Project Number
J1032

Project Title
Soil Moisture Level Detector

Abstract

Objectives/Goals
Fresh water is a limited but important source that we depend on to live. However, 50% of outdoor water usage is wasted due to inefficient watering systems. Due to these alarming circumstances, I was motivated into making a soil moisture level detector. The goal of this invention is to develop a soil moisture level detector that will turn on or off the sprinklers based on the the electricity generated by the detector.

Methods/Materials
One zinc and one copper rod, an amplifier/comparator chip, several copper wires, two electrical relays, 1 liter soil with various degrees of wetness, 1 liter of acidic (pH 6.4) soil, 1 liter of basic (pH 8.4) soil, and a multimeter are needed. Connect the rods, amplifier/comparator chip, and relay1 with copper wires. Insert relay1 between the timer and the actual watering system of the existing sprinkler system. Insert relay2 between the two rods and connect relay2's control to the sprinkler timer. To test the system, connect the rods, amplifier/comparator chip, and multimeter. Submerge in soil with various degrees of wetness, and measure the current generated. Repeat the same process with the acidic and basic liters of soil.

Results
Higher soil moisture content produces a higher current, and the detector can turn on or off the sprinklers with the current. The detector's voltage increased slightly int he acidic and basic soil. This is due to the electrochemistry process that takes place when he rods are submerged in a soil and water mixture.

Conclusions/Discussion
The detector's materials don't noticeably corrode after several uses. The threshold can be adjusted by the owner. The current generated is strong enough to turn on or off the relay. The detector works similarly under different conditions, such as the pH level of the soil differing. Furthermore, the detector stops generating electricity after the sprinklers have stopped, thus slowing down the rusting of the material. Finally, the detector is inexpensive, at only $33.

Summary Statement
My soil moisture level detector helps farmers and homeowners save water by turning on or off the sprinklers based on the water content in the soil.

Help Received
I researched how the detector generated electricity and how that corresponded with the moisture content of the soil and how to create the detector.