CALIFORNIA SCIENCE & ENGINEERING FAIR
2018 PROJECT SUMMARY

Name(s)
Connor R. Ashton

Project Number
J1401

Project Title
Destroyed or Resistant: The Effect of Acid Rain on Building Materials

Abstract

Objectives/Goals
The objective of this project was to determine which building material (granite, marble, concrete, brick, or wood) would resist acid rain the best.

Methods/Materials
Some of the key materials used included 10% sulfuric acid, distilled water, a kitchen scale, personal protective equipment, and same sized blocks of granite, brick, marble, wood, and concrete. After pre-soaking each sample and recording the initial mass, the samples were placed in the acid or water. After waiting for a week the samples were removed, the mass measured, any observations noted, and the samples returned to the fluid. This was repeated for a total of 4 weeks. The total mass loss was calculated by comparing the week 4 mass with the initial mass.

Results
The experimental results showed wood to resist the acid the best with granite and brick next, then marble, and concrete was the worst. The granite and brick samples suffered very little visible damage and mass loss (<3%) after 4 weeks. The marble samples formed a filmy white substance on the surface but also had little mass loss. The concrete samples broke into pieces and lost almost 80% of their initial mass. The wood samples gained mass, 17% for the samples in acid and 30% for the control samples.

Conclusions/Discussion
Based purely on science, granite and brick should have had the least mass loss, wood would be in the middle, marble the next worst, and concrete the worst. Granite is a hard, dense material not easily damaged by acid and brick is more susceptible to bases so minimal material loss was expected. Wood should have seen some loss because sulfuric acid attacks the lignin in wood. The wood gained mass in the experiment because it was not pre-soaked long enough. Marble should have seen much higher mass loss because sulfuric acid attacks calcium carbonate, the main component of marble. The experimental results did not show this because the filmy white substance, gypsum, did not wash away as it would in a real-life situation. Concrete should have and did see significant mass loss since its pH is highly basic and so would be damaged by acids.

Summary Statement
My experimental data simulating acid rain impact on building materials showed that the wood samples had the least mass loss when exposed to sulfuric acid for four weeks.

Help Received
Dr. Dale Brost to dilute the sulfuric acid and recommended appropriate personal protective equipment when working with the acid.

Name(s)
Nikko K. Baird

Project Number
J1402

Project Title
What Is the Effect of Different Conifer Type Sap Wood in Filtering Bacteria Sized Dye from Water?

Abstract

Objectives/Goals
The purpose of this experiment is to compare White Pine, Redwood and Ginko Biloba sapwood to see how effective they are at filtering bacteria sized dye from water.

Methods/Materials
1) I made the wood filters from the branches of 3 types of conifer which are Gingko Bilboa, Redwood, and White Pine.
2) I made unfiltered water using 1 or 10 micron florescent dye. The reason I will be used this type of dye is because I don't know the particles sizes of food dye compared to bacteria.
3) I added unfiltered water to each wood filter, and waited.
4) I measured each wood filter, the rate of water from each branch, the penetration of dye in each branch, and the presence of the dye in the filter water to the unfiltered water.
3) I made a measurement for the presence of the dye in the filter water of each experiment. I made jars of dye in water at less dilution than the unfiltered water that was used in the experiment.

Results
The presence of the dye in the filter water was compared after passing through wood filters from the branches of Gingko Bilboa, Redwood, and White Pine. The Redwood was the best at filtering the 1 micron dye from the water, measured by rate, presence of the dye in the filter water and penetration.

Conclusions/Discussion
I am very surprised at how all of the conifer wood types did at
filtering the one micron dye. This means that many types of gymnosperm sapwood tissues can be useful for removing disease causing agents from unfiltered water.

Summary Statement
I demonstrated that different conifer type sap wood tissues are effective at removing bacteria sized dye from water

Help Received
I designed my experiment based on a MIT experiment where they filtered water with dye through the sapwood in a branch of a White Pine.

Name(s)
Mihika A. Balaji

Project Number
J1403

Project Title
The Effect of Different Shielding Materials on Electromagnetic Emissions

Abstract

Objectives/Goals
The objective of this experiment is to find commonly available household materials that can be used as effective shields on electromagnetic emissions from electrical and electronic devices.

Methods/Materials
Emission sources used were a TV remote and cell phone (radio waves), hair straightener and electrical outlet (electrical waves), and stereo speaker and streaming media stick (magnetic waves). Shielding materials that were tested were made of cardboard, tin and aluminum foil. A Trifield EMF meter that measures electrical, magnetic and radio waves was used to measure emissions.
Trials were conducted to record EMF emissions from the above sources with and without the shielding materials to determine the most effective shield.

Results
For electrical waves, aluminum and tin performed equally well due to their conductive and reflective surfaces. For magnetic waves, the ferrous properties of tin blocked far better than aluminum or cardboard. For radio waves, the high conductivity of aluminum attenuated the best.

Conclusions/Discussion
Though aluminum and tin are both equally effective shielding materials, a shield made of aluminum is not desirable for phones since they hamper its operation. Hence tin is the most effective shield due to its production of magnetic field as well as its conductive and reflective surface. I was able to build a pouch made of cloth, lined on the inside with tin and a small amount of aluminum foil that effectively blocks electrical and magnetic waves, while still preserving radio wave transmission.

Summary Statement
I determined and built an effective shield against electromagentic emissons using common household materials

Help Received
My science teacher provided guidance throughout my project

CALIFORNIA SCIENCE & ENGINEERING FAIR
2018 PROJECT SUMMARY

Name(s)
Tyler J. Bodenhamer

Project Number
J1404

Project Title
Building a Solar Air Heater: A Study to Determine Efficiency of Various Solar Absorber Materials

Abstract

Objectives/Goals
The objective of this project is to build and simultaneously test multiple solar air heaters that use different absorber materials and then to determine the design that will be the most efficient in cost and performance.

Methods/Materials
I built four identical collector boxes out of wood, insulation, and with a plexi-glass cover. Each box was filled with a different type of absorber material including aluminum soda cans, steel downspouts, insect screening, and aluminum sheeting. I also pre-determined the best soda can absorber design by testing soda can towers that had the ends cut open in four unique ways. Air temperature, air flow, and cost data was collected.

Results
The four solar air heaters were analyzed by the net heat raised, the air flow, and the construction costs. The soda can absorber, with the ends cut completely open, outperformed the other absorber materials in both cost and average degree Celsius raised of heat output on both days tested.

Conclusions/Discussion
The soda cans were the most efficient solar absorber because they performed the best at generating the highest average air temperatures for the lowest total cost. These results are significant because the absorber comparisons were done with the same exact collector box size, the same area of solar exposure, and under the same weather conditions. These finding can be used as a base to continue to improve the design and construction of do-it-yourself solar air heaters that are efficient and inexpensive to make.

Summary Statement
Four identical solar air heaters were built and tested to compare the efficiency of different solar absorber materials as determined by their performance, air flow rate, and total construction costs.

Help Received
I built and tested the solar air heaters myself after research online. I borrowed digital thermometers from Mr Bridges, my science teacher, and an air flow meter from Benny Sy, a mechanical engineer.

CALIFORNIA SCIENCE & ENGINEERING FAIR
2018 PROJECT SUMMARY

Name(s)
Nate U. Cantu

Project Number
J1405

Project Title
Effectiveness of Wi-Fi Blocking Paint

Abstract

Objectives/Goals
The purpose of my science project is to determine how well YShield Wifi blocking paint can block a Wifi signal. The reason I am doing this investigation is because this product can potentially prevent someone from hacking your wifi and the potential of identity theft.

Methods/Materials
I am using YShield EMR Protection paint to conduct my project, I also downloaded an app called, Dr. Wifi, that will allow me to see how many Mbps (Megabytes per second) there is. I will place both my phone and router at separate distances and test the data using the app. After I get all 20 signals from each test I will get the average to see how well the paint did.

Results
The results of my investigation on determining the effects of YShield EMR protection paint block a wifi signal indicates that it in fact does block a Wifi signal but not completely. When there was nothing on router at 16.1 ft it averaged 131.315 Mbps at best connection possible. When the box was on router at 16.1 ft (unpainted) it averaged 125.169 Mbps and killed signal by 4.91%. When I placed painted box on router at 16.1 ft (ungrounded) it averaged 126.828 Mbps and signal killed by 3.53%. When painted box was on router at 16.1 ft (Grounded) it averaged 87.8515 and killed signal by 33.1%

Conclusions/Discussion
After performing my tests, I found that my hypothesis was actually incorrect. I discovered that the painted box with the grounder did block a lot of the signal but not entirely all of it. Prior to any of my other tests I had taken a starting test with just the router. After I tested I compared my results and I was actually surprised that the painted box with no grounder had that high of a signal. After completing my testing I discovered that the router by itself had an average signal of 131.3155 Mbps, with just a box I got an average signal of 125.169 Mbps, with the painted box with no grounder I got an average signal of 126.828, and finally with a grounded and painted box I got an average of 87.8515. Before competing at the California State Science Fair I plan to retest my experiment using the grounder made by the YShield Company.

Summary Statement
The purpose of my project is to test the effectiveness of wifi blocking paint.

Help Received
Brianne Fidalgo-teacher; Richard Esqueda-brother

CALIFORNIA SCIENCE & ENGINEERING FAIR
2018 PROJECT SUMMARY

Name(s)
Abhay M. Dharnidharka

Project Number
J1406

Project Title
Soundproofing: Which Material Soundproofs the Best?

Abstract

Objectives/Goals
We hear sounds (or noise) all the time without realizing what impacts their intensity. The objective of this study is to understand the relationship between the density and elasticity of a material versus its ability to block or reduce the intensity of sound.

Methods/Materials
I placed a cell phone inside boxes made of the materials I wanted to test and used a second cell phone (from outside) to call the phone inside the box. I measured the intensity of the cell phone ring using a sound meter outside the box. This gave me a measurement of how much sound was getting transmitted outside the box. Boxes were made of: Floor Tile, Acoustic Panels, Wood, Plastic, Wall Insulation, Metal (Tin), Cardboard, and Foam. Other testing materials included 2 cell phones, sound meter, and a digital (or triple beam) weighing scale.

Results
The data signifies that a higher density material provides the most sound insulation. Floor tiles had the highest density, and they therefore sound-proofed the best. While tin had the next highest density, it has a very high elasticity compared to wood. Hence wood sound-proofs more than tin. So the top three are tile, wood, and then plastic.

Conclusions/Discussion
Density and elasticity are key properties of a material that impact sound-proofing. Highly dense materials such as tile are capable of providing the best sound-proofing.

A key finding is that density and elasticity have opposing impacts on sound transmission. As a result, materials such as wood that have lower density than tin, but have lower elasticity will provide more sound-proofing compared to tin.

Summary Statement
I illustrated that density and elasticity of a material have opposing impacts on it's ability to sound-proof.

Help Received
I researched the topic and designed the testing by myself. My science teachers, Mr. Berwald and Mrs. Suresh, reviewed my test results for completeness and logic.

CALIFORNIA SCIENCE & ENGINEERING FAIR
2018 PROJECT SUMMARY

Name(s)

Alice Feng; Arely Sun

Project Number

J1407

Project Title

The Effect of Mushroom Species and Substrates on the Properties of a Novel Biodegradable Material: Mycelium

Abstract

Objectives/Goals

Mycelium is a new biodegradable, sustainable and eco-friendly material. Mycelium is the vegetative part of a mushroom, made up of cotton-like fibers called hyphae, and acts as natural glue. The goal of our project is to test the effects of various combinations of mushroom species and substrates on the properties of mycelium blocks and to grow mycelium blocks that are strong, effective at insulating heat and sound. Our hypothesis is the best mycelium blocks can outperform Styrofoam, Fiberglass, cardboard and other materials that are harmful to the environment.

Methods/Materials

We inoculated various substrates with the mycelium cultures of various mushroom species. We let the mycelium grow in sterilized filter bags for six weeks, and then we grew mycelium bricks and containers for another three weeks. We then tested the physical properties of mycelium blocks of various combinations of mushroom species and substrates, Styrofoams, Fiberglass and cardboard. The physical properties tested include strength (how much weights a brick can support), thermal insulation (how well a container sustains temperature under a constant heat source), and acoustic insulation (how well a container reduces noise decibels from a constant noise source). We further tested the benefits of broken mycelium block pieces on plant growth, and the biodegradability of mycelium.

Results

Our results show that the strongest brick comes from Reishi grown in sawdust substrates. The containers with the best thermal insulation performance are Reishi with woodchip substrates and Phoenix Oyster with sawdust substrates. Reishi with woodchip substrates container is also the best at acoustic insulation. Overall, there is always a mycelium block that outperforms Styrofoam, Fiberglass and cardboard for each tested category. Our results also show that mycelium material is biodegradable and benefits plant growth.

Conclusions/Discussion

Our results strongly support our hypothesis that by using the right combination of mushroom species and substrate, mycelium materials can outperform Styrofoam, Fiberglass, cardboard in strength, acoustic and thermal insulation performance. We also discovered that mycelium is exceptionally strong, lightweight, flexible, fast-growing and versatile. With further research, mycelium can replace many non-sustainable, non-recyclable, non-biodegradable, and hazardous materials that are harmful to the environment.

Summary Statement

We grow biodegradable, sustainable and eco-friendly mycelium materials that outperform Styrofoam, Fiberglass and cardboard in terms of strength, soundproofing and thermal insulation.

Help Received

Our science teacher Mrs. Morgensen helped us purchasing materials and she also provided instruments and tools for testing.

CALIFORNIA SCIENCE & ENGINEERING FAIR
2018 PROJECT SUMMARY

Name(s)
Sam T. Freeman

Project Number
J1408

Project Title
Can Trees Beat E. coli?

Abstract

Objectives/Goals
The purpose of this experiment was to test pine sawdusts ability to filter E.coli out of fresh water.

Methods/Materials
The methods used in this experiment involved syringes filled with pine and redwood sawdust plugs of standard volume. Solutions with known amounts of E.coli and a color indicator were filtered through the sawdust plugs and the resulting solutions pipetted into cuvettes. These cuvettes were placed in an incubator overnight at 37 °C. The results were measured visually and quantitatively using a colorimeter. Five control samples of sterile water and five control samples of the bacteria solution with indicator were also prepared in cuvettes. They were placed in the incubator overnight at 37°C and the absorbance measured. The controls were used to set a baseline to show how much absorbance is due to the bacteria solution and sterile water so that the filtered samples could be compared and the filtration effectiveness determined.

Results
The results of this experiment showed that pine sawdust has the ability to remove E.coli from fresh water. In addition, it shows that the wood from other parts of a tree, in this case the heartwood, may not have the ability to remove E.coli.

Conclusions/Discussion
One unusual observation was that the first data point in both the pine and redwood samples was larger than the rest of the data points. In the case of the pine, it was an outlier. Based on these findings, the experiment would be more robust if there were more samples tested to off-set possible human error. Also, understanding what happens to xylem when sapwood is turned into sawdust would be another area to explore. This experiment could be expanded into actual methods for filtering E.coli out of drinking water in third world countries by developing a system to run water through tubes filled with sapwood.

Summary Statement
This experiment tests the use of sawdust to remove E.coli from fresh water supplies.

Help Received
Mrs Hofmann and Ms Hofmann from Baymonte Christian. Samantha Freeman (Mom)

CALIFORNIA SCIENCE & ENGINEERING FAIR
2018 PROJECT SUMMARY

Name(s)
Leia R. Gluckman

Project Number
J1409

Project Title
Empower Powder: Formulating a Body, Teeth, and Hair Cleansing Powder Made from Ingredients Available in a Refugee Camp

Abstract

Objectives/Goals
The experiment tests the effectiveness of the formulation by testing for its effect in absorbing moisture (eg sweat), preventing odor, preventing bacterial growth, and for use as an insect repellent.

Methods/Materials
Bacterial culturing kits, incubator, mosquito netting, and various organic ingredients readily found near the Kakuma refugee camp in Kenya. Incubated culturing kits for 60 hours to test for anti-bacterial properties. Observed for insect attraction at dusk over several days.

Results
Multiple formulations were tested for the variables noted above. One was identified as the most effective across those variables and is being tested further to refine and enhance the effectiveness.

Conclusions/Discussion
The experiment supports the theory that locally available ingredients can be used to formulate a multi-purpose cleansing powder to enhance cleanliness without requiring water which is an increasingly scarce resource.

Summary Statement
I created a multi-purpose personal cleansing powder using ingredients found in an around the Kakuma Refugee camp so that it could be produced and distributed locally.

Help Received
I conceived the product myself and consulted with Pamela Stone of the American Red Cross, Allison Hurst of Safe Place for Youth and Chris from Heifer International.

CALIFORNIA SCIENCE & ENGINEERING FAIR
2018 PROJECT SUMMARY

Name(s)
Sarah I. Gratzer

Project Number
J1410

Project Title
What Materials Block Wi-Fi Signal?

Abstract

Objectives/Goals
The objective of this experiment is to determine which object or building materials would block the wireless signal the most.

Methods/Materials
Wireless router, smart phone with AR Signal Master app, various building and household materials and a human subject. Measured the WiFi signal three times using various materials blocking the router and comparing it to the WiFi signal without any material blocking the router.

Results
Various materials were used to block the wireless router and the strength of the WiFi signal was recorded. The data from each material was averaged based on three trials. This data was subtracted from the average strength of the wireless signal without any material blockage (base) determining its attenuation (gradual loss of signal). The data proved that the human body blocked the WiFi signal the most.

Conclusions/Discussion
This experiment revealed that the human body weakened the WiFi signal the most. I continued doing more research for this experiment and found out that the human body is made up of 45 to 75 percent water. Water is a great absorber of WiFi frequency therefore the reduction of signal strength.

Summary Statement
Most people suffer from poor WiFi signal so I decided to do a study on what materials can possibly block the WiFi signal.

Help Received
None. I conducted this experiment by myself at home.

CALIFORNIA SCIENCE & ENGINEERING FAIR
2018 PROJECT SUMMARY

Name(s)
Charlotte L. Hogan

Project Number
J1411

Project Title
Don't Take Your Kitchen for Granite

Abstract

Objectives/Goals
During this experiment the goal was to find out what common countertop was most stain resistant and durable. My hypothesis was that granite would be the most stain resistant and durable because it is very durable and the least porous. To test this theory I conducted three tests with three different countertop materials, granite, marble, and travertine. By comparing test results the answer to the question, which countertop material is best was found.

Methods/Materials
6 samples of marble # of an inch height
6 samples of travertine # of an inch in height
6 samples of granite # of an inch in height
1 stopwatch
1 black sharpie
1 black crayon
1 ruler
1 empty soup can
2 pairs of safety goggles
1 roll of paper towel

Results
Although travertine is extremely porous it is also dense. Although the hypothesis was that granite would be more durable, travertines dent lengths are on average, slightly longer than granites but granite usually has less dents. As predicted, the granite was the most stain resistant even erasing all signs of sharpie. This is shown by the lack of black (the color used to show granite in the bar graph) on the sharpie bar graph. The table shows calculated averages for dent lengths and number of dents for each material. The bar graphs show inches of sharpie or crayon left and dent lengths.The granite was the most stain resistant but was not the most durable, in that category travertine won.

Conclusions/Discussion
My hypothesis that granite would be both the most durable and stain resistant was false but there was more to this experiment than that. During this experiment the goal was to find the best countertop materials but in reality, there is no one star. Since every material is different and everyone has different needs, everyone's ideal countertop is different. However, these studies did help to determine what types of materials are suitable for your countertop.

Summary Statement
This experiment compares different counter-top material's density and porosity.

Help Received
I had help obtaining the material samples. The experiment was executed individually.

CALIFORNIA SCIENCE & ENGINEERING FAIR
2018 PROJECT SUMMARY

Name(s)
Nathan M. Kang

Project Number
J1412

Project Title
Comparing Rates of Decomposition of Different Plastics

Abstract

Objectives/Goals
The objective of this study was to determine which plastic decomposes the fastest. The results of this experiment will help solve an important issue: plastic pollution.

Methods/Materials
In order to conduct this experiment, I first recorded the initial weights for each of the plastic utensils, which were cornstarch-based, wood-based, and petroleum-based plastic. Then, I buried the utensils in three pots containing soil, one pot for each trial. I gave a cup of water each day for about a month to maintain moisture levels. After one month, I removed the utensils from the soil, and recorded the weights of the decomposed utensils.

Results
The outcome was that cornstarch had the best results. The cornstarch decomposed .86% of its average weight. The wood bioplastic decomposed .14% of its average weight. The plastic forks did not decompose at all.

Conclusions/Discussion
Nowadays, plastic pollution has become an increasing issue, and needs to be addressed as soon as possible. Plastic accumulates on both the land and earth, and harms wildlife, wildlife habitats, and humans. In fact, 90 percent of seabirds have plastic in their stomachs. Often, plastics take thousands of years to decompose, and during those thousands of years it releases toxins into the soil and the environment. Also, plastics are made from petroleum, which is a non-renewable resource that contaminates the environment. However, bioplastics are a great alternative to traditional petroleum-based plastic, as it is made from organic, non-toxic materials, and decomposes at a much faster rate. Using the results of this experiment, I plan to raise awareness of this issue, and help companies and businesses take the steps towards developing a cleaner environment. I have tested the use of different materials in the production of plastic, as well as evaluated and compared the rates of decomposition, in order to determine the material that decomposes the fastest. If more and more people make the switch to using bioplastics, we can reduce the amount of plastic in our environment, conserve our non-renewable resources, and save the wildlife.

Summary Statement
In this experiment, I compared the rates of decomposition of different plastics.

Help Received
I would like to thank my mother for helping me with the experiment by buying the materials and taking pictures of me conducting the experiment. I would also like to recognize my teacher, Ms. Sofio, for supporting me all this time. In addition, my brother, Caden, helped me conduct this experiment.

CALIFORNIA SCIENCE & ENGINEERING FAIR
2018 PROJECT SUMMARY

Name(s)
Michael P. Karvelas

Project Number
J1413

Project Title
How Can the Insulation of a Window Be Improved?

Abstract

Objectives/Goals
I was curious to find out if I could improve the insulation of a double pane window by adjusting the spacing between the sheets of glass. I also wanted to know if traditional glass performed better as an insulator than the modern plexiglass. A better insulated window saves a homeowner money on heating and cooling the home. Improving energy efficiency in a home can help reduce fossil fuel consumption and carbon emissions.

Methods/Materials
I constructed a window frame out of wood and placed it on top of a 15in x 15in x 12in plywood box that I also constructed to simulate a room. In the window frame, I added struts with different spacing between them for inserting the double pane glass or plexiglass. I placed the box and window frame underneath a light source, positioned the two panes of glass on the first level of struts with the least amount of space and used a thermometer to measure temperature in 5 minute intervals for a 45 minute period. I then moved the two panes of glass to the next level of struts and performed the same steps. I then performed the same tests with the two panes of plexiglass. I also conducted a control trail with a traditional window, a window with only one pane of glass, to demonstrate the difference in insulation between traditional windows and double-paned windows. Each type of window was tested three times to ensure accurate measurements.

Results
The results of my experiment demonstrated that the average temperature of the room with a glass window and with a 10 cm gap (10 cm was the largest gap used between two panes) was 84 degrees Fahrenheit which was 2 degrees lower than a glass window with a 5 cm gap, 3 degrees lower than a plexiglass window with a 10 cm gap, 4 degrees lower than a plexiglass window with a 5 cm gap, and 8 degrees lower than the traditional window.

Conclusions/Discussion
The results of my experiment verified my hypothesis. My experiment demonstrated that windows made of glass and with the greater distance between two panes are better insulators.

Summary Statement
My project is about using simple mechanics to improve the insulation of a window and testing whether traditional glass is a better insulator than modern plastic alternatives.

Help Received
Ray Fernnett, our family contractor, helped me build the window frame and box for this project. Dr. Jain helped proof read my report and gave me valuable suggestions to make it better.

CALIFORNIA SCIENCE & ENGINEERING FAIR
2018 PROJECT SUMMARY

Name(s)
Sofia Kvaternik

Project Number
J1414

Project Title
The Effect of Different Hurricane Wind Categories on Different Building Materials

Abstract

Objectives/Goals
The objective of my project is to find the most convenient material for building structures in a hurricane danger zone

Methods/Materials
I tested balsa wood, basswood, aluminum, brass and plywood against 3 different hurricane wind categories. I used a leaf blower and leaf blower attachment nozzles with a different area for the wind to exit in order to create higher wind speeds

Results
The plywood had the highest flex in the wind categories 5 and 3, balsa wood had the highest flex in category 1, and brass had the lowest flex in all of the wind categories. The material that had the most average flex in all three categories was the basswood.

Conclusions/Discussion
This experiment demonstrated that basswood would be the most convenient option for building out of the materials I tested because it has a sturdy structure and a flex that would not cave in on you.

Summary Statement
To find the most effective material for construction in hurricane danger areas

Help Received
My teacher who helped me create and edit my writing pieces and my father who helped me carry out my experiment.

CALIFORNIA SCIENCE & ENGINEERING FAIR
2018 PROJECT SUMMARY

Name(s)
Skylar Y. Li

Project Number
J1415

Project Title
Natural vs. Artificial: Which Is the Best Insulator?

Abstract

Objectives/Goals
The objective of this experiment is to test and determine the best heat insulating material out of a variety of natural and artificial materials.

Methods/Materials
Plastic bowls, plastic cups, plastic lids, super glue, duck fat, pork lard, bird feathers, aluminum foil, styrofoam, plastic bag, hot and cold water, digital stopwatch, digital thermometers, and data book.

Results
I tested the heat insulating properties of the materials by their ability to retain the heat of hot water at 5 different time intervals over a 15 minute period. Based on my results, the natural materials helped to maintain the hot water at the high temperature losing on average of 39.3F versus 42.0F for the artificial materials. Specifically, I found that the bird feathers was the best performing thermal insulating material helping the hot water to only lose 39.0F after 15 minutes.

Conclusions/Discussion
Repeated trials of testing showed small differences in temperature change but still a drop none the less. It is concluded that the best thermal insulator tested was the bird feathers. This makes sense because you can commonly find duck down in jackets and blankets. You can also look in nature. Penguins live in freezing temperatures and swim in frigid waters! They have two types of feathers. The inner layer of feathers fluff up, meaning that the air occupies the space around the feather strands. This creates a layer of trapped air around the penguin keeping it warm. The outer layer of feathers are slick and straight. They are meant to help penguins swim efficiently and quickly in the water. This also prevent the inner layer of feathers from getting wet.

Summary Statement
As measured by the temperature loss of the water at each time interval, I found that bird feathers were the most effective insulator.

Help Received
I performed all of the experiment design, testing, and recording of data myself. My science teacher gave me a few suggestions on how to improve the experiment.

CALIFORNIA SCIENCE & ENGINEERING FAIR
2018 PROJECT SUMMARY

Name(s)
Jaden A. Luna

Project Number
J1416

Project Title
Subsidizing Cement with the Utilization of Bio-Waste Materials to Create a Superior Concrete

Abstract

Objectives/Goals
The purpose of my project is to find how the addition of waste materials effects the superiority of concrete.

Methods/Materials
Part 1:
Collect waste materials, coffee grounds, almond hulls, peach pits, eggshells, oyster shells and fly ash.
Part 2:
Burn waste materials to an ash using burn pit, blow torch and lighter fluid. Add ash into concrete mix.
Part 3:
Place one of each brick in view of heat lamp. Allow to sit for time. Remove from heat lamp and record temperature using surface reading thermometer. Allow to sit for time. Record temperature.
Part 4:
Place three of each brick on scale. Weigh all three and record the average (mean).
Part 5:
Tested in CSUF materials testing lab, with assistance from Dr. Kimberly Stillmaker. Place one of each brick in compression machine (Test Mark CM 3000) at a time. Allow to be compressed until deemed broken remove and record highest PSI load.
Part 6:
Place one of each brick in glass of deionized water. Record ph of water before bricks were added. Allow bricks to set for time. Record ph of water.

Results
I found that the bricks with charred eggshells performed the best in the compression and heat retention tests. The heaviest concrete was the almond hull ash and the lightest weight concrete was the fly ash. The brick with the most effect on the ph of the water was the almond hull ash.

Conclusions/Discussion
In my research I found that the most desirable concrete was the charred eggshells. Performing best in the compression and heat tests. It also was fairly lightweight and moderately changed the ph of the water

Summary Statement
My project is about creating a not only stronger, but creating a superior concrete using waste materials.

Help Received
I collected and burned my waste materials with adult supervision, I mixed my concrete and tested the weight, PH and heat retention portions of my project alone, I had help testing my compression strength of my concrete from Dr. Kimberly Stillmaker in the materials testing lab at California University of Fresno

CALIFORNIA SCIENCE & ENGINEERING FAIR
2018 PROJECT SUMMARY

Name(s)
Sanjna Mizar

Project Number
J1417

Project Title
Keep the Noise Down

Abstract

Objectives/Goals
The objective of this study was to test which common insulating material would absorb sound the most effectively.

Methods/Materials
R13 fiberglass insulation, 15" hardboard box, corrugated foam, ceiling tiles, acoustic meter, alarm. This project measured the amount of decibels of sound emitted from the hardboard box using different insulators.

Results
The amount of decibels emitted from the insulated box was compared to when the box was not insulated. The findings showed that R13 fiberglass most effectively insulated the box. Ceiling tiles insulated it the second most effectively, followed by corrugated foam.

Conclusions/Discussion
R13 fiberglass absorbed sound the most effectively because it was the thickest material. This is the reason why it is commonly used as a source of soundproofing for buildings.

Summary Statement
As I conducted this project, I found that the thickness of materials contributes greatly to its ability to acsorb sound.

Help Received
I received assistance in creating the hardboard box but conducted the research and experiment independently.

CALIFORNIA SCIENCE & ENGINEERING FAIR
2018 PROJECT SUMMARY

Name(s)
Derek M. Nasalroad

Project Number
J1418

Project Title
Effects of Various Materials on Wi-Fi Signal Speed

Abstract

Objectives/Goals
The objective of this study is to determine which of the tested materials can most efficiently increase the speed of a Wi-Fi signal.

Methods/Materials
Wi-Fi router, parabolic reflector covered with various materials, smartphone with speed test app. Tested the speed of a Wi-Fi signal when reflected by different materials.

Results
Not any one material consistently showed the greatest increase in Wi-Fi signal speed, though some increased the speed more than others in certain spots. The speed of the signal when reflected by a certain material varies depending on distance from the router.

Conclusions/Discussion
Repeated trials with multiple materials determined that my hypothesis was only partially correct; the aluminum did not always show the greatest increase in signal speed. It is concluded that the effectiveness of materials when improving Wi-Fi signal speed is impacted by the distance from the router.

Summary Statement
I showed that the speed of a Wi-Fi signal can be improved when reflected by certain materials.

Help Received
While I completed most of this experiment myself, suggestions were provided by my science teacher. My English teacher and my parents helped me evaluate my choice of words in my writing.

CALIFORNIA SCIENCE & ENGINEERING FAIR
2018 PROJECT SUMMARY

Name(s)
Crystal L. Neilsen

Project Number
J1419

Project Title
Wick Be Nimble, Wick Be Quick

Abstract

Objectives/Goals
The objective of this study is to determine which colored birthday candle burns quicker.

Methods/Materials
6 different color candles, timer/stopwatch, lighter/matches, and something to hold up the candles. After burning the first set of candles, I rotated through the 6 colors, and found which colored candle burned the quickest.

Results
Several tests were conducted, 6 different colored birthday candles were lit at the same time and the time to find out which candle burned quicker were recorded. Repeated trials were ran to determine which color birthday candle burned quicker.

Conclusions/Discussion
After 6 tests, the green candle burned the quickest out of all the 6 colors. The blue candle burned the second quickest, then orange, then yellow, then pink, and white burned the slowest.

Summary Statement
I conducted this experiment 6 different times, and I found out that the green birthday candle burned the quickest.

Help Received
None. I designed and conducted the experiments myself.

CALIFORNIA SCIENCE & ENGINEERING FAIR
2018 PROJECT SUMMARY

Name(s)
Alexandra B. Olivar

Project Number
J1420

Project Title
Testing the Insulation Properties of Different Jacket Materials

Abstract

Objectives/Goals
The objective of this experiment is to find out which jacket material out of cotton, Sherpa, Mylar, neoprene, and feathers is the most effective in retaining heat.

Methods/Materials
Timer, thermometer, refrigerator, insulation materials (waterfowl feathers, cotton, Sherpa, Mylar, and neoprene), external and internal pouches made of polyester. I placed one insulation material in between the external and internal pouches. I then measured the temperature of the air inside the internal pouch after it had been in the fridge for a specified amount of time. I repeated this process with the other insulation materials using the same external and internal polyester pouches.

Results
After testing all of the insulation materials, I found the waterfowl feathers to be the most effective insulator, as the thermometer in the pouch with the feathers had the highest temperature after coming out of the fridge. The Sherpa was the second best insulator, followed by the cotton, then the Mylar, and lastly, the neoprene.

Conclusions/Discussion
I concluded that the waterfowl feathers are significantly better than the other materials in terms of insulation. With the knowledge gained from this experiment, I can look at the material that a jacket is made of and determine whether or not it will be effective at keeping me warm. Others can also benefit from my experiment because they will be able to determine the value of the jacket based on the material, which will help them decide which jacket to buy.

Summary Statement
After testing the insulation properties of various jacket materials, such as cotton, Sherpa, Mylar, neoprene, and feathers, I found that feathers are the most effective in retaining heat.

Help Received
While I did design and perform the experiment by myself, my mother helped me construct some of the necessary materials.

CALIFORNIA SCIENCE & ENGINEERING FAIR
2018 PROJECT SUMMARY

Name(s)
Luke A. Pannell

Project Number
J1421

Project Title
Projectile Protection: Deflective Properties of Non-Newtonian Fluids

Abstract

Objectives/Goals
This project was designed to test whether various mixtures of non-Newtonian fluids would deflect small projectiles.

Methods/Materials
A fixed slingshot was used to propel ¼ inch metal pellets into a sandbag target 0.61 meters away. A thin baggie was filled to a 4mm thickness of each mixture and placed as a shield against a sandbag, held by a layer of cotton jersey. Ten different combinations of oobleck, slime, polyethylene glycol, and silica were tested, with water being the control.

Results
Eight of the mixtures did not stop the projectile, which broke through the baggie entirely and lodged into the sandbag. However, two mixtures of silica particles suspended in slime deflected the shot, which partially punctured the baggie but bounced off the target and into the grass. Experiment was repeated several times with identical results.

Conclusions/Discussion
The slime/silica combination performed the best, which was unexpected. Perhaps the polymers in the slime aided spring in some way. Such a property could be explored further for the manufacture of flexible body armor.

Summary Statement
I discovered that a suspension of slime and silica nanoparticles deflected metal shots traveling at 800 feet per second.

Help Received
I mixed, ground and prepared all the mixtures. My dad supervised my set-up and the firing of the projectiles.

CALIFORNIA SCIENCE & ENGINEERING FAIR
2018 PROJECT SUMMARY

Name(s)
Milan I. Pete

Project Number
J1422

Project Title
Fruit Electricity

Abstract

Objectives/Goals
The object of this study was to test and determine the type of fruit that has the most electricity when motionless.

Methods/Materials
Multi meter, apple, pear, lemon, grapefruit, orange, zinc screw, alligator clip wires(red and black), copper coin. Inserted the zinc screw into one end of the fruit and the copper coin into the opposite end. Attached the alligator clips, black to the zinc screw and the red to the copper coin. Connected the clip wires to the multi meter.

Results
The fruits were tested and readings from the multi meter were recorded. Repeated process multiple times with each fruit for more accurate answer.

Conclusions/Discussion
The repeated process with each fruit helped determine that the pear produced the most electric charge/electricity.

Summary Statement
I determined which fruit produced the most electricity while not in motion.

Help Received
My family supported me by helping me conduct my experiment. I received help at school by providing time to complete my research and project display.

CALIFORNIA SCIENCE & ENGINEERING FAIR
2018 PROJECT SUMMARY

Name(s)
Thoya Raman

Project Number
J1423

Project Title
Improving the Durability of Natural Dyes on Cloth

Abstract

Objectives/Goals
The objective of this study is to determine ways to prevent natural dyes from fading on cloth. Although it is known that chemical dyes are toxic to health and the environment, they are still being used extensively because natural dyes fade very easily.

Methods/Materials
Untreated canvas cloth, natural dyes, various additives of different pH values, pretreatment additives, bleach, detergent, water, and a laptop computer with image analysis software ImageJ were used. Cloth was dyed with turmeric and then soaked in either water, detergent, or diluted bleach to test for color stability, and respective color intensities were measured using ImageJ. Dyed cloth was exposed to solutions of a range of pH values before being treated with bleach to determine if the dye was more or less stable with the additive. In addition, cloth was also pretreated with egg white prior to dyeing and tested for color stability.

Results
In comparison to water, bleach led to a greater reduction in color intensity than detergent. Turmeric dyed cloth exposed to acidic solutions showed greater color stability compared to basic solutions, but on repeated bleach or detergent exposures, they started fading. When beet, blueberry, and henna dyes were tested on cloth, however, they produced very weak colors. But it was also noticed that they stained human skin very well. Since skin is made up of a protein called keratin, the hypothesis is that the protein on skin is making the dye stick better. In order to test this, cloth was pretreated with egg white prior to dyeing with turmeric. This greatly increased the color stability to both detergent and bleach conditions and stayed consistent in repeated exposures.

Conclusions/Discussion
Lemon and orange juice, acidic solutions, prevented the loss of color, but ammonia, a basic solution, made it worse. These results suggest that acidic pH can make the dye last longer. Pretreatment of cloth with egg white, prior to dyeing, improved the durability to repeated bleach or detergent exposure. This suggests that the protein in the egg white may help to strengthen the dye binding to the cloth. In conclusion, these experiments demonstrate that eco-friendly additives can be used to improve the durability of natural dyes on cloth.

Summary Statement
I found that using protein as a pretreatment, prior to dyeing with turmeric, helps prevent the loss of color when exposed to bleach or detergent, even after repeated exposures.

Help Received
I designed and performed the experiment myself. I got help from my father, a professional biologist to analyze my data. I also received help from a chemist at a biotech company in order to understand the chemistry behind why the reactions between the dye, the additives, and the cloth were occurring.

Name(s)
Ava P. Rothenberg

Project Number
J1424

Project Title
The Decellularization of a Spinach Leaf by Perfusion and Submersion of Detergent Solution

Abstract

Objectives/Goals
My objective was to decellularize a leaf using sodium lauryl sulfate (SLS), leaving only its extracellular matrix with an intact vascular system. If completely decellularized, this new scaffold could be infused with animal cells, and turned into transplantable tissue. I also wanted to discover whether perfusion or submersion of SLS would decellularize more efficiently.

Methods/Materials
To decellularize through perfusion, I inserted an IV into the stem of a spinach leaf. The IV was set on a drip to perfuse detergent solution (2.2% sodium lauryl sulfate and distilled water) through the vascular system. To decellularize through submersion, I soaked a leaf in the same detergent solution. The control group was soaked in only water. A fully decellularized leaf is transparent or white, therefore, I measured opacity/color.

Results
After a 42 day trial (for all groups), the submerged leaf lost color, and was translucent with an intact vascular system/scaffolding. Once placed in the isopropyl alcohol intended to preserve the leaf, it turned white. A faulty IV prohibited data collection from the perfused leaf. The control group was more transparent than the soaking group, but fell apart when removed from water.

Conclusions/Discussion
My results disprove my hypothesis because sodium lauryl sulfate didn't complete decellularization though either method. The SLS removed cells while leaving an intact scaffolding, and worked better than water, but didn't remove all cells. Next time for perfusion, I'll use a smaller, secured needle, and air pressure relief in the IV tubing. Next time for submersion I'll try isopropyl alcohol.

Summary Statement
I tested if perfusion or sumbersion of detergent soultion would best decellularize a leaf, leaving an intact scaffolding and vascular system, and found sumbersion did.

Help Received
When my perfusion group failed, I reached out to (emailed) Joshua Gershlak at Worcester Polytechnic Institute and he explained that before decellularization can commence, I had to first open the stomata on the leaves.

CALIFORNIA SCIENCE & ENGINEERING FAIR
2018 PROJECT SUMMARY

Name(s)
Jack Smith

Project Number
J1425

Project Title
Constant Comfort

Abstract

Objectives/Goals
The objective of this experiment was to assess if commonly available recycled materials used as insulation would be as effective in maintaining a consistent temperature in a structure as store bought insulation.

Methods/Materials
Materials list: (2) 4 x 8 x ¼inch Plywood Sheets; (18) 8ft x 1 inch x 1½inch wood; 3.1 lbs Shredded paper; 36 Sq ft Corrugated cardboard; 6 Sq ft 1½inch Styrofoam insulation; Staples; Glue; Screws; Drill; Saw (adult supervision); Duct Tape; Scale; Temp recorder x 5; Ruler.

Methods:
· Construct four boxes, 3 containing different types of insulation. One with hollow panels for walls. Mark each box to determine which insulation was used. (Each panel 1.5 inches thick, using a scale to assure equal weights of insulation in each panel.)
· Gather 5 continuous monitoring temperature recorders. Label 4 to correspond with boxes and one outside.
· Place temperature recorders outside for 12 hours to get a baseline reading for each.
· Place temperature recorder in corresponding box, place each box outside in an unprotected location. Place temperature recorder labeled outside next to boxes.
· Close all boxes and seal air gaps between panels with duct tape.
· Leave boxes outside for 4 days.
· Open boxes and remove temperature recorders.
· Remove data strips from each temperature recorder making sure to accurately label each one.
· Correlate data strips to assess effectiveness of insulation.

Results
After looking at the data recorded I found the temperature in the box insulated with corrugated cardboard changed the least. The range from the highest outside temperature to the lowest was 37 degrees. The range inside the box insulated with corrugated cardboard was 26 degrees. The box insulated with paper had a range of 28 degrees and most surprising, the box insulated with store-bought Styrofoam insulation had a range of 30 degrees. Only the hollow core panels did worse with a range of 31 degrees. This proves that using recycled materials could be used as an effective insulation.

Conclusions/Discussion

Summary Statement
As measured by the temperature recorders I used in my project, I found that recycled materials can be used to make insulation as effective as some store bought material.

Help Received
I designed the experiment myself. My father helped with the use of power tools to cut many of the pieces then I built and insulated the boxes. My mom sourced the temperature recorders and taught me how to graph my results.

CALIFORNIA SCIENCE & ENGINEERING FAIR
2018 PROJECT SUMMARY

Name(s)
Rayyan T. Talukdar

Project Number
J1426

Project Title
Bamboo to Use: Making It 100% Biodegradable

Abstract

Objectives/Goals
The purpose of this project is to find a disposable spoon that is 100% biodegradable in natural environment, such as, garden soil.
I hypothesize that bamboo spoons will degrade the fastest among all other biodegradable spoons (wooden, bio-polymer, cornstarch & wheat straw) as bamboo is a natural product.

Methods/Materials
For this project I bought all types of biodegradable spoons that were available in the local markets and online. I had Birch wood (6 count), bio-polymer (6 count), cornstarch (6 count), wheat straw (4 count), bamboo (6 count) and plastic (6 count) as my control. I made the bamboo spoons myself.
The experimental procedure was as follows: I weighed all spoons and recorded their weights in my notebook. Then, I put each spoon under garden soil. I took out the spoons after a month, washed them, dried them and weighed them. I repeated these steps for all spoons on days 60, 90 and 120. I calculated the loss of weight of each spoon from day 1 to day 120. I calculated the percent weight loss or percent degradation for each the spoon and recorded them in my data table.

Results
The data show that after 4 months under garden soil, the bamboo spoons degraded most, ~29%, the wooden spoons ~11% and wheat straw ~6%. Corn starch, and bio-polymer spoons had minimal degradation. Plastic did not degrade at all as expected. The results show that my hypothesis was correct. Bamboo spoons degraded most and most likely it will be 100% degraded within 12-14 months under garden soil.

Conclusions/Discussion
From my experiment I can conclude that even though many commercially available spoons are labeled biodegradable, they are not compostable under garden soil. They need to be degraded in a commercial facility under high heat, high pressure and a lot more moisture. On the other hand, bamboo is a natural product and spoons made of bamboo degraded the fastest under natural conditions. My experiment shows that it would take about 12-14 months for a Bamboo spoon to 100% degrade under natural conditions.

Summary Statement
Bamboo is a natural product and can be used to make 100% biodegradable spoons.

Help Received
I designed my experiment and made the bamboo spoons myself. My science teacher advised me from time to time on how to improve my project.

CALIFORNIA SCIENCE & ENGINEERING FAIR
2018 PROJECT SUMMARY

Name(s)
Ella Villegas

Project Number
J1427

Project Title
What Material Provides the Best Protection for Your Electronic Device?

Abstract

Objectives/Goals
My project was to determine what material provides the best protection for an electronic device when dropped on to asphalt. I believe that the styrofoam cover will provide the most protection.

Methods/Materials
Ten identical calculators (brand, size and shape), and nine different materials provided protection. The nine different materials were 1) an air pouch, 2) cotton, 3) cardboard, 4) neoprene, 5) silicone, 6) styrofoam, 7) leather, 8) foam craft sheet, and 9) plastic. One calculator was left unprotected. Calculators securely covered in the selected materials. Dropped each calculator (face up) ten times from the height of 54 inches over asphalt, to determine which material provided the most protection.

Results
The calculator with the styrofoam cover provided the most protection to physical damage, while the calculator with the plastic cover saw the same amount of damage as the unprotected calculator. The other materials provided varying levels of protection.

Conclusions/Discussion
The protection provided by the styrofoam cover was more effective than the eight other materials tested, leaving the the least amount of signs of physical damage. Further studies in electronic device cases could one day result in a perfect case. for now, and until further research, many still struggle in finding the best case for their electronic device.

Summary Statement
I tested what common materials provided the best protection for your electronic device against everyday situations.

Help Received
I developed and conducted the tests myself, and my science fair advisor (Mrs.Stead) directed me to helpful sources.

CALIFORNIA SCIENCE & ENGINEERING FAIR
2018 PROJECT SUMMARY

Name(s)
Aidin P. Weissler

Project Number
J1428

Project Title
Coatings to Protect Polymers from UV Damage

Abstract

Objectives/Goals
UV resistant polymer formulations pose a threat to the environment. Irreversibly safe from the sun, these plastics may linger for generations. The primary objective of this study is to determine whether removeable coating materials can protect vulnerable polymers(plastics) from UV induced damage. A secondary goal of this study is to observe any differences in the effectiveness of different coatings in protecting more than one type of polymer.

Methods/Materials
This project tested the ability of coatings made from olive oil and Elmer's Glue ("Elmers") alone and in combination with titanium dioxide and zinc oxide to protect three different plastics (Polyethylene Terephthalate Glycol, Polyurethane, and Polystyrene) from UV damage. Coated plastic specimens were placed in non-UV protective glass trays and positioned in a tanning bed where they received UV exposure equivalent to 162 days of tropical summer sun. Coatings were then removed.
I built a testing box using corrugated cardboard, duct tape and adhesive. I mounted photovoltaic cells onto the box's floor. The wire leads passed through the box and connected to a multimeter. Light was shined down through the box, through the sample, onto the cells. Regular calibrating measurements were taken, and the light placement adjusted to maintain consistency. The data gathered was found statistically significant through Chi squared analysis.

Results
The tested coatings protected each of the three plastics from UV light caused damage. Surprisingly, the data showed that each coating's ability to protect a plastic was not consistent between plastics. This suggests that different mechanisms in each plastic were responsible for their UV light vulnerability. Data indicates that Polystyrene is best protected by glue combined with a protectant against both UV A and B while the other two plastics were best protected by isolation from the surrounding air alone.

Conclusions/Discussion
My primary objective was achieved. Under test conditions coatings can protect plastics against UV induced damage. Using coatings plastics can be made safe from UV during their useful life and restored to UV vulnerability by removal of their coatings or shredding of the plastic. Pursuit of my secondary goal revealed that different coatings may be needed for different plastics and that effectiveness of human sunscreen protectants may not correlate to their effective level in protecting plastics.

Summary Statement
I showed that polymers can be protected from UV exposure by using protective coatings and documented that the effectiveness of a coating is dependent on both the coating and the particular polymer protected.

Help Received
Matt Bessler, my Science Teacher, helped me narrow my review of literature and taught me how to use Google sheets to create graphs. Tamar and Joel Weissler, my parents, each helped me with proof reading and understanding statistical significance analysis. San Diego Plastics and E-Plastics helped me chose