Abstract: Science and Engineering Fair of Houston

1109

Metal and Rust

Category:

Chemical Engineering & Materials Science

Christopher Ortega, Joshua Lim, Elijah Tran

Harmony Public Schools - North District/Harmony School of Excellence-Houston

Rust is a problem in modern society as it can damage any object made of metal in our everyday lives like kitchenware like metal utensils and pans , tools like hammers and nails , and the infrastructure of ones home like pipes or frames. Our study shows the formation of rust depends on exposure to oxygen and water so the higher exposure of oxygen and water will lead to rust forming faster while a smaller exposure of oxygen and water will lead to less rust. The results of our study shows the relationship of metal and rust.

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[X] yes [ ] no

Abstract: Science and Engineering Fair of Houston

1110

It's a "Fluid" Situation: Investigating how the density of particles affects the fluidization of a fluidized bed

Ryder Olivier

Tomball ISD/Tomball Int

Category:

Chemical Engineering & Materials Science

To build and test materials of different densities in a fluidized bed to see how it affects the fluidization within the bed.

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Abstract: Science and Engineering Fair of Houston

1111

Fruit VS Vegetable VS Grain Biodegradable Plastics

Sragvi Rajesh

Conroe ISD /York Junior High

Category:

Chemical Engineering & Materials Science

The purpose of this experiment is to make bioplastic out of rice starch, banana starch and potato starch and see which produces bioplastic that is the most biodegradable. The procedure consists of making the bioplastic, burying and observing it over multiple trials. The hypothesis that fruit-based bioplastics would be the most biodegradable was not supported, as potato starch bioplastic showed the highest biodegradability. The results may have been affected by using banana peel powder mixed with cornstarch instead of pure banana starch. This experiment showed that potato starch bioplastic is a better alternative to harmful plastics than banana or rice starch based bioplastic.

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Abstract: Science and Engineering Fair of Houston

1112

How Do Snacks With Artificial Food Dyes Effect Plant Growth

Sonali John

Fort Bend ISD /Fort Settlement Middle School

Category:

Chemical Engineering & Materials Science

Artificial dyes are commonly added to various popular foods in the US. These dyes are made from petroleum sources and millions of people consume artificial dyes from snacks such as the ones tested in this study. Consuming these dyes may be hazardous for our health. I have conducted two successive studies to date evaluating commonly used artificial food dyes. This includes a cost comparison analysis comparing cost of snacks with artificial dyes versus a similar snack without artificial dyes. Generally, similar snacks without artificial dyes were more expensive per unit. This was followed by an experiment watering seeds with artificial dyes versus plain water which demonstrated artificial dyes negatively affected plant growth when compared to the controls. This current project compares the effect of various snack foods (with and without artificial dyes) and the effect on seed sprouting and plant growth. To conduct this experiment both sunflower and basil seeds were planted in 60 planters each. Two common snack foods with and without artificial dyes were added to the planters. The planters were watered every 2 days, and observations for sprouts, stem growth measurements were made daily. For the sunflowers, the control grew the fastest followed by Cheetos and Doritos which grew taller than Simply versions. In the basil planters the only the control sprouted, showing all snacks had a more harmful effect on them. While more testing is needed, the results suggest that feeding plants with artificial dyes is harmful to growth.

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Abstract: Science and Engineering Fair of Houston

1113

Tuberculosis (TB)- InhA - Enoyl ACP reductase-4TRJ

Kendrick Ngo, Alan Nguyen

Harmony Public Schools - South District/Harmony School of Excellence - MS Sugar Land

Category:

Chemical Engineering & Materials Science

Tuberculosis (TB) remains a major global health challenge, and the rise of drug-resistant strains has highlighted the need for new therapeutic options. This study used computational virtual screening to identify potential inhibitors of the InhA enzyme, a critical target in Mycobacterium tuberculosis. A library of 200 natural compounds from Selleck Chemicals LLC was screened against the catalytic site of InhA using AutoDock Vina, and binding affinities were analyzed with custom Python scripts. Compounds were ranked and visualized in tables and graphs to identify the most promising candidates. The study aims to discover novel, effective, and safer molecules that could serve as lead compounds for future TB drug development, demonstrating the potential of computational methods to accelerate the drug discovery process.

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Abstract: Science and Engineering Fair of Houston

1114

Coat of Armor

Nicole palazzi

Clear Creek ISD /Seabrook Intermediate School

Category:

Chemical Engineering & Materials Science

This project investigated adding chemicals to car paint to enhance scratch resistance. Scratches on vehicles, an issue, often resulted in the use of cheap paint by manufacturers to control costs. If different paint additives are tested, then the Silicon Dioxide with be the most scratch resistant. The experimental method involved pouring paint into separate containers and adding eight ounces of silicon dioxide to 236.59 mL of paint. This was repeated for other test chemicals. A paintbrush was dipped into the silicon dioxide mixture, and striped onto a piece of car metal using five strokes. After a 24-hour drying period, the procedure was repeated for the remaining chemicals on fresh metal pieces. A wood block was dragged across each paint strip, and a car paint thickness meter measured the depth of each scratch. The testing process was repeated four times. Research and testing revealed that titanium dioxide resulted in the deepest scratches, while silicon dioxide created the greatest scratch resistance. Potential sources of error included uneven paint on the strips and an insufficient number of trials. Future work could focus on ensuring uniform paint thickness and exploring additional chemicals for enhanced automotive paint durability. The hypothesis, if different paint additives are tested, then the Silicon Dioxide with be the most scratch resistant, was confirmed. Silicon dioxide made paint thicker, reducing susceptibility to scratches. This finding offers a practical real-world application, allowing vehicle owners to use silicon dioxide for scratch prevention. Automotive service technicians and mechanics can use these results.

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Abstract: Science and Engineering Fair of Houston

1115

Do It Yourself Bioplastic

Category:

Chemical Engineering & Materials Science

Avik Devarapalli

Conroe ISD /York Junior High

The making of tradition plastics using fossil fuels can harm the environment. However, there are more eco-friendly alternatives like biodegradable plastics. The research looks into how the amount of glycerin affects the flexibility and strength in a bioplastic. Three samples of these bioplastics were made, each containing the same amounts of water, cornstarch, and white vinegar, but with different amounts of glycerin. After those ingredients were mixed, they were put on a gas stove with medium heat and was stirred continuously until it became more thick. Then it was left to cool for about 1-2 minutes. After it cooled for a bit, the samples were poured onto aluminum sheets, spread out thin, and was left there to dry there for three days. When it was done, the samples were bent to measure flexibility, and weights were put on top of the plastics to measure strength. Testing showed that when the amount of glycerin increased, the flexibility of the bioplastics increased, while its strength decreased. The research supported that the glycerin amounts changed the properties of the bioplastics. These plastics could offer a better alternative to traditional plastics in the future.

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Abstract: Science and Engineering Fair of Houston

1116

Category:

Chemical Engineering & Materials Science

From Garbage to Growth: Using Organic Waste to Create Hydrophilic Biopolymers for Water Conservation and Agricultural Purposes

Aria Allen

Spring Branch ISD/Spring Branch Academic Institute

More than 700 million people worldwide annually face hunger, partly caused by water scarcity. Hydrophilic biopolymers can be created to absorb and retain water for agricultural purposes. This project aims to determine the optimal ingredient ratio of a waste-based biopolymer, made from common ingredients (including corn husks, cardboard, cellulose, banana peels, water, vinegar, and glycerin) for improved water absorption and retention. Twenty-four different biopolymer ingredient ratios were prepared, with five repeated trials each, and distributed across 120 plant pots to determine which hydrophilic biopolymer ratio is most effective in water absorption and retention. Each pot was then subjected to a one-minute soak and one-minute drain process. The weight of each pot was measured and recorded over time to determine the initial water absorption and retention period. The results gathered showed that ratios with a corn husk base absorbed the most amount of water and had the longest water retention time, followed by cardboard. The goal of finding optimal hydrophilic biopolymer ratio that is able to help reduce water scarcity in agricultural applications through this experiment was achieved. The optimal ratio contained: 30g of corn husk base, 180mL of water, 10mL of vinegar, 15mL of glycerin, and also absorbed around 19 times as much water as desert soil and 3 times as much as regular potting soil.

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Abstract: Science and Engineering Fair of Houston

1117

The Carbornator

Aleena McMillan

Galveston ISD/Crenshaw School of Environmental Studies

Category:

Chemical Engineering & Materials Science

Carbon Recapture is here to stay. My project is about reusing carbon for other things, like oil. Car are one of the main causes for climate change. What if you could reuse the carbon that comes out of cars for oil? I set up an experiment that showed that the production of carbon dioxide from everyday uses such as cars and other vehicles can be recaptured and put to good use. There will be less air pollution and more recycling of carbon. That's what my project is about!

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Abstract: Science and Engineering Fair of Houston

1118

Alternatives to Modern Plastics

Category:

Chemical Engineering & Materials Science

Vedant Balaji

Fort Bend ISD /Quail Valley Middle School

Plastic pollution has become a critical environmental issue due to the persistence of conventional plastics such as polyethylene and polyethylene terephthalate, which are non-biodegradable and accumulate in ecosystems for centuries. This project investigates starch-based bioplastics as a sustainable alternative to modern plastics by evaluating their durability and biodegradability in water. A bioplastic sample was synthesized using corn starch, water, vinegar, and glycerin, heated until gelatinization occurred, then dried into a 2-inch square sheet. Comparative samples of low-density polyethylene (LDPE), high-density polyethylene (HDPE), and polyethylene terephthalate (PET) were prepared in equal dimensions. Each plastic was submerged in 750 milliliters of water for 16 hours, with observations recorded every four hours. Initial and final masses were measured to determine the extent of dissolution and degradation. The hypothesis predicted that the starch-based bioplastic would fragment and lose mass significantly compared to industrial plastics, while maintaining comparable flexibility and strength due to the presence of glycerin as a plasticizer. The results showed that LDPE, HDPE, and PET retained nearly all of their mass and structural integrity, while the bioplastic exhibits visible fragmentation and a measurable reduction in mass from the largest observable fragment, confirming its susceptibility to degradation in aqueous environments. These findings support the potential of starch-based bioplastics as an environmentally friendly alternative to conventional plastics, offering biodegradability while maintaining functional durability. The experiment demonstrates that bioplastics can reduce long-term pollution, though further research is needed to enhance their strength and resistance for broader applications.

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Abstract: Science and Engineering Fair of Houston

1119

Iron Nails in Salt Water

Maira Momin

Clear Creek ISD /Brookside Intermediate School

Category:

Chemical Engineering & Materials Science

The purpose of this project was to determine which protective coating would minimize corrosion on iron nails over a period of 10 days. This project involves the engineering aspect of material selection and protection, specifically by testing various coatings for their ability to prevent corrosion of iron nails in underwater applications (e.g., water filters). The goal is to determine the most effective coating solution for maximum nail protection and longevity. The hypothesis stated, that "If the nails are coated with different coatings, then the nail with the paint will show the least amount of corrosion." To test this, 15 nails were coated in paint, nail polish, WD-40, Castor Oil or uncoated, then put in saltwater where rust coverage was measured at the end of the testing period. The uncoated nails were covered in 80% rust, the painted nails 75%, the castor oil nails 70%, the WD-40 nails 50% and the nail polished nails 10%. The data showed that nails polish created the most effective barrier against corrosion.

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Abstract: Science and Engineering Fair of Houston

1120

KEEPING YOUR HOUSE COOL: ADDING CALCIUM PHOSPHATE IN WHITE PAINT REDUCES INTERNAL TEMPERATURE OF CLOSED SPACES

Michael Ohaji

Houston ISD/BCM Academy at James D Ryan - MS

Category:

Chemical Engineering & Materials Science

This project is about how I used white paint and calcium phosphate to cool down some boxes that illustrated a house. My testable question is "Will adding ground up bones in white paint outside a box affect the internal temperature inside a box?", and the control variable was the size of the box, color, shape, and the initial start time of the experiment. My independent variable was changing the type of the combination of white paint, white paint with calcium phosphate, just calcium phosphate, and leaving it blank. My dependent variable was the temperature which I was measuring every 15 minutes. For my hypothesis, I predicted that the white paint with calcium phosphate would help cool down the box the most and to my understanding my hypothesis was correct because my line graph showed us that the average temperature every 15 minutes for the combination of white paint and calcium phosphate had the lowest temperature every 15 minutes, compared to the control box that had one of the highest temperature for 30 minutes. My procedures were fairly simple. I paint the boxes, I put them out in the sun to dry first, then I measure the temperature every 15 minutes for a complete hour. After all that I record it and restart the process over again till i have completed each of the four boxes five times. To answer my testable question, calcium phosphate with white paint helped cool down the box the most.

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Abstract: Science and Engineering Fair of Houston

1121

Let The Dust Go!

Irem Bektas

Clear Creek ISD /Seabrook Intermediate School

Category:

Chemical Engineering & Materials Science

As space technology advances, like exploring the Moon, there are new problems appearing to be solved. One of those problems is Moon dust. As much as dust seems like a little problem at first, Moon dust is a health hazard and can stop machines from functioning. This project was designed to test the hypothesis, if different types of fabrics are tested, then there will be the least amount of dust left on the Cotton Polyester fabric. Five fabrics were tested, Cotton Polyester, Gore-Tex, Kevlar, Nylon, and Satin. A picture of the fabrics was taken before it was dusted. Then, the fabrics were dusted with lunar regolith simulant and later a steel marble was dropped on the fabric two times. After that, a final picture was taken and using a website the two main colors and the percentages of those colors on the fabrics were analyzed. The difference of the percentages of the colors between the two pictures of the fabrics were calculated. The dust that was used was a different color than the fabrics, changing the appearing color of the fabric when it was added. So, the least amount of change of color percentage would mean less dust. Cotton Polyester had the least amount of color percentage change, with a change of 9.41. The hypothesis, if different types of fabrics are tested, then there will be the least amount of dust left on the polyester fabric was therefore supported.

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Abstract: Science and Engineering Fair of Houston

1122

Let it Rot

Category:

Chemical Engineering & Materials Science

Mercy Oyewole

Alief ISD/Holub MS

At first, I was unaware of the existence of plastics that could break down quickly, but when I found out about them, I began to wonder why they were not used more frequently. It turns out that not much research has been done regarding the plastics, so people have not been inclined to actually use them. I thought that if others were more informed, especially about whether and how they would work, they could be used. The main problem that needed to be solved was not knowing which type of biodegradable plastic would work most effectively. To find the best answer for this, I did the most logical thing and put the plastics to the test, in the ground. Then I would see what was left behind of the types of plastics: PHAs, PLAs, and starch-based blends. As a result, I found that PHAs broke down the most, with an average loss of 29.4%. The starch blends had an average loss of 7.4%. The PLAs had not lost anything at all. Although the particular reason these were the results was not acquired, they did exhibit that the PHA plastics would be the most biodegradable and the best for the environment. The microorganisms in the everyday ground were able to break down that type of plastic the most, and that is part of the reason it ended up being the best biodegradable plastic.

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Abstract: Science and Engineering Fair of Houston

1123

Yarn Showdown: Testing the Strength of Synthetic vs. Natural Yarns After Environmental Exposure

Angy Kenfack

Charter/SST - Champions College Prep - MS

Category:

Chemical Engineering & Materials Science

My project Yarn Showdown, was all about finding out which yarn can actually handle real-world conditions the best. I tested acrylic, cotton, and rayon by leaving them in water or sunlight for three days then rubbing each strand on an edge to see how long it took to break. I originally thought acrylic would be the strongest, but that was wrong. Rayon ended up being the toughest overall, and cotton was the strongest when it stayed in water. In the end I learned that rayon, which is a mix of natural and synthetic fibers holds up the best and makes a really durable yarn.

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Abstract: Science and Engineering Fair of Houston

1124

Fire and Ice: Examining The Endurance of Construction Materials Under Different Temperatures

Melanie Villagomez

Houston ISD/BCM Academy at James D Ryan - MS

Category:

Chemical Engineering & Materials Science

For my science project, I wanted to learn how different building materials affect the strength and safety of a structure. I focused on two types of concrete: 3500 psi and 4000 psi. "Psi" stands for pounds per square inch, which measures how strong the concrete is. The higher the number, the more pressure the concrete can handle before breaking.I looked at shingles and plywood, which are important materials used in roofing and walls. Shingles protect buildings from rain, wind, and sunlight. Plywood is a strong type of wood made by gluing thin layers together. It's used to support walls, floors, and roofs. The thickness and quality of plywood can change how sturdy a building is. My testable question is "How does pressure and varying temperatures during curing affect the bond strength and durability of concrete, plywood and shingle under thermal cycling?"The data I collected was measured by psi and temperature C°. It was measured for 24 hours. I experimented on which type of concrete,plywood and shingle would be more durable and stronger if exposed to thermal cycling. The amount of concrete I used is 3 lbs, 4 pieces of plywood and 4 pieces of shingle. I experimented on the concrete 2 times for 3500 psi and 4000 psi, plywood 2 times and for shingle 2 times for timberline HDZ.Overall, my results answer my testable question by showing that both pressure and temperature during curing do affect how well construction materials can hold under thermal cycling.

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Abstract: Science and Engineering Fair of Houston

1125

Tough Trees: Testing the Efficacy of Cellulose based Composites

Matthew Baine

Clear Creek ISD /Seabrook Intermediate School

Category:

Chemical Engineering & Materials Science

Known for their unique and useful properties, composites are simply alternating layers of materials, combining the properties of both to make some of the most lightweight yet resistant substances on earth. This project was designed to create a paper-based composite and see how well it would hold up in the real world. Different adhesives were chosen to glue layers of standard printer paper together resulting in 20 layers. There were 5 stacks for each of the five adhesives, which were then tested by dropping a weight on it in order to simulate an impact, dropping said weight from ever increasing height until it broke. It was believed that the composite made with phenolic resin would withstand the impacts the best, and this was proven to be false. After repeated testing, the wood glue composite withstood all impacts with no signs of cracking and was the only one to not experience catastrophic failure. The resulting information of this experiment and others like it would be useful to thousands of people around the globe, from architects to aerospace engineers, varying kinds of composites are useful in almost every form of construction. While the results of this project are informative, there were some major limitations to the data, with the main one being time.

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Abstract: Science and Engineering Fair of Houston

1126

Oobleck's Impact

Ana McBride

Alief ISD/Albright MS

Category:

Chemical Engineering & Materials Science

I want to test how well oobleck can handle the impact of an object. This is important because things break too much causing productivity being wasted and much more. The hypothesis is that dropping the egg any higher than 3 feet the egg will break in the oobleck. The procedure is you basically drop an egg into oobleck at different heights. The results that I had was, none of the eggs cracked or broke when dropped. These results are important because it means that we can put oobleck in packaging materials to help soften any blow taken!

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Abstract: Science and Engineering Fair of Houston

1127

Which liquids causes the most rusting to nails?

Santiago Campos

Houston ISD/BCM Biotech Academy at Rusk - MS

Category:

Chemical Engineering & Materials Science

The purpose of my project is to find out which liquid (lemon juice, vinegar, and tap water) causes the most rusting on steel nails. Rust forms when oxygen reacts with water, but different liquids can make it happen faster or slower. This project helps give people knowledge of which liquids to keep away for metals that have the ability to oxidize. If steel nails are placed in (lemon juice, vinegar, or water) the lemon juice will cause the most rusting over time due to its acidity level compared to the vinegar and neutral water. The results of my experiment showed over time the water gained .03 grams, lemon juice gained .08 grams, and the vinegar gained .06 grams thought the 7 day period. In conclusion, lemon juice caused the most rust compared to water causing the least amount of rust. This experiment supports the idea, that the chemical properties of liquids especially its pH level plays a major role in chemical breakdowns in substances.

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Abstract: Science and Engineering Fair of Houston

1128

Layer by Layer

Liam Hartmann

Conroe ISD /McCullough Junior High

Category:

Chemical Engineering & Materials Science

My goal with this project was to determine the most efficient parameters for making strong 3D-printed parts. The purpose of this data is to make widely available print profiles for necessary applications of strength. My previous assumption was that a 15% infill gyroid pattern print would be the most efficiently strong. Meaning, it would provide the most strength, whilst requiring a minimal amount of infill, making it less expensive to print. I evaluated the strength of the printed bricks by measuring the size of the depression made by the impact. To create the depression from an impact, I built a modified Charpy impact tester. The printed bricks (81 total) were placed in the vise and held against a wooden board to minimize movement. I implemented a string release system to begin the testing procedure from a safe distance and to ensure I dropped the hammer from a standard height each time. My variables were angle of descent and weight of the swing arm. The hammer would hit the printed brick and create a depression. After I collected and subsequently analyzed the data, it was revealed that in this application, the honeycomb infill pattern was the strongest at all infill percentages. I can apply this data by creating printing profiles that utilize my findings to improve efficiency without sacrificing strength. I hope to be able to share my findings with the 3D-printing community to help everyone produce stronger prints and potentially apply the results to real world applications.

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Abstract: Science and Engineering Fair of Houston

1129

Which Fruits Contains The Most Vitamin C

Category:

Chemical Engineering & Materials Science

Master Reese

Charter/School of Science and Technology, Houston - MS

Ever wonder which fruit packs the biggest punch of vitamin C to keep you healthy and energized? Today, I'm peeling back the science to find out which fruit truly rules the vitamin C game! Vitamin C, also known as ascorbic acid, is essential for a strong immune system, healing wounds, and maintaining healthy skin and tissues. While many people believe oranges are the best source of vitamin C, research shows that other fruits like strawberries, kiwis, and lemons may contain even more. Different fruits have different levels of this important nutrient, which makes it important to test and compare them. This experiment aims to find out which fruit truly has the highest vitamin C content. So, which fruit provides the most vitamin C, and how can we measure it accurately? Understanding which fruits have the most vitamin C can help people make healthier choices in their diets. While oranges are often thought to be the best source of vitamin C, research shows that other fruits like kiwis and strawberries may contain even more of this important nutrient. Vitamin C supports the immune system, helps heal wounds, and protects the body from harmful substances. Learning which fruits are richest in vitamin C can help promote better nutrition and overall health. This information is useful for anyone looking to boost their vitamin intake naturally through everyday foods.

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Abstract: Science and Engineering Fair of Houston

1130

Synthesis of Nano Heat-Shielding Materials

Category:

Chemical Engineering & Materials Science

Kuan Ju Chen

Fort Bend ISD /Fort Settlement Middle School

In this project, I studied a new nano-material called cesium tungsten bronze (Cs_xWO_3) to see if it can block heat better than normal glass. First, I made the material by mixing tungsten oxide and a cesium compound, then heating it with the help of my supervisor. After grinding and mixing it with a clear coating solution, I spread it onto glass to form thin films. I tested each film with a halogen lamp and measuring how fast the temperature increased inside a small box. I also measured how much visible light could pass through. The results showed that the Cs_xWO_3-coated glass allowed visible light to pass but reduced heat much more than plain glass. This means the nano-material has good potential for heat-blocking window films that keep rooms and cars cooler while staying clear.

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Abstract: Science and Engineering Fair of Houston

1131

Bioplastic Dry Food Packaging Bag

Category:

Chemical Engineering & Materials Science

William Santoso

Spring Branch ISD/Spring Branch Academic Institute

Plastic is among the world's highest sources of pollution. It comes from petroleum, a non-renewable resource, its production causes air pollution, it is seldom recycled, and it cannot biodegrade. Plastic bags make up a very high proportion of this; 5 trillion are used annually. Because of these issues, an alternative must be found. Bioplastics solve these issues: they are made from biomass, which is renewable; they can be recycled; and they can biodegrade. This project was done to determine what is the best polymer, or material for making a bioplastic bag. The polymers used were corn starch, cassava starch, agar, and gelatin, and each bag was tested on non-stickiness, smoothness, uniform thickness, and smell. The bags were made by first creating a mixture of water, glycerin, and the polymer (vinegar was added if the polymer was a starch); then heating the mixture; pouring it into a mold; and letting it dry for a few days until it was solid. Then it was tested for each of the qualities, and the experiment found that agar was the best material, with an average of 11/3 of the qualities, followed by corn starch with 7/3 of the qualities, gelatin with 11/4, and cassava starch with 4/3.

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Abstract: Science and Engineering Fair of Houston

1132

Ecoplastics

Category:

Chemical Engineering & Materials Science

Lucy Wang, Kura Kulkarni

Stafford SMSD/Stafford STEM Magnet Academy

This science fair project investigated biodegradable plastics made from corn starch, glycerol, and cellulose to determine how different ratios affect decomposition rate and physical properties. The purpose of the experiment was to find a bioplastic formula that balances durability and biodegradability as a potential alternative to traditional plastic. It was hypothesized that the 70:25:15 ratio would decompose the fastest, while the 70:10:10 ratio would produce the strongest plastic. Several bioplastic samples were created using a constant 70 g of cornstarch and varying amounts of glycerol and cellulose. The plastics were buried in soil for three weeks, and decomposition was measured by mass loss and visual observation. Results showed that samples with higher glycerol or balanced ratios decomposed more but were brittle, while the 70:10:10 sample remained flexible and held its shape with minimal decomposition. The hypothesis was partially supported, as the strongest plastic was correctly predicted, but the fastest-decomposing formula was not. Overall, the experiment demonstrated that changing ingredient ratios significantly affects bioplastic performance.

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Abstract: Science and Engineering Fair of Houston

1133

Exploring the Integration of Nitinol in Modern Bridge Engineering to Enhance Resilience Against Natural Disasters and Stress

Iniya Balamurugan

Katy ISD/TAYS Junior High - MS

Category:

Chemical Engineering & Materials Science

Bridges are important and essential structures that support transportation as well as public safety. Although modern-day bridges have gone through many technological advancements, they still suffer major flaws due to permanent deformation: they can be damaged by earthquakes and heavy loads/traffic and bend, remaining permanently deformed. Shape memory alloys, such as Nitinol, have the special ability to recover their original shape after deformation. This raised the question of whether these materials could actually help reduce permanent damage in bridge components, saving bridges from millions of dollars in repairs. Nitinol's 'Shape Memory Effect' is caused by a reversible phase change between martensite, which allows the metal to bend, and austenite, which allows it to return to its 'trained' shape when heated. Researchers have suggested that Nitinol rods could be embedded in a special type of bendable concrete to help bridge columns and joints flex during stress and then return to position. In this project, a Nitinol shape memory wire and a regular steel wire were cut to the same length and bent into identical shapes. The amount of bending was measured by recording the maximum gap height between the wire and a flat surface, and then both wires were heated using hot water over multiple trials to calculate the percent recovery and permanent deformation. The results showed that the Nitinol wire recovered most of its original shape after heating, while the steel wire remained bent with no recovery. These findings support the hypothesis that shape memory metals can reduce permanent deformation, rather than steel. It suggests that Nitinol could improve the safety and durability of future bridge designs.

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Abstract: Science and Engineering Fair of Houston

1134

FOODTASTIC PLASTICS

Category:

Chemical Engineering & Materials Science

Dara Deransburg, Alison Thach

Alief ISD/O'Donnell MS

The point of this experiment is to see how much weight can biodegradable plastics support. To test this, we recreated three different bioplastics out of banana peels, eggs shells, and oranges peels. If we successfully created a bioplastic from each food material, then we predicted that the ones based on banana peels would be able to support the most weight. Each product will be tested three times by creating two slightly elevated surfaces, apart from one another, and supporting two ends of the bioplastic on either side by using objects of varying weights to hold the products down. Then, we will gradually add weight ranging from 20 grams to 1800 grams to the middle where there is to surface directly underneath. Out of the three trials, the egg shell bioplastics held up an average of 296.75 grams and the banana peels bioplastics held up an average of 516.8 grams. However, as for the orange peel bioplastics, we couldn't test them any further past the 1800 grams limit without risking damage to our surroundings or ourselves because of the way our testing method was arranged. In conclusion, out of the three bioplastic materials we made, the orange peel based bioplastic was able to support the most weight, and potentially more if we had a different testing method.

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Abstract: Science and Engineering Fair of Houston

1135

Thermal Express - tracking heat through materials

Carrigan Locke

Conroe ISD /Peet Junior High

Category:

Chemical Engineering & Materials Science

Purpose of the experiment - The purpose of this experiment is to find out if different density objects have different thermal expansion rates. This could help improve modern buildings so they can withstand many different issues. Experiment Procedure - Place the heat gun behind 5 different materials and watch the heat from the gun spread out through the different materials using an infrared camera. The most significant result - is that the density doesn't matter when it comes to how fast or slow the heat travels through the objects. Though what happened was interesting because even though the aluminum was not the highest density material it spread out the fastest. Conclusion - If solid materials, with different densities, are heated in the middle, then the heat will travel faster through the highest density material. Even though the outcome of my experiment did not prove my hypothesis to be correct, I found out that there are many variables for the conduction and heat transfer through different materials allowing some to spread quickly and in a totally uncontrolled way. (as seen in my charts) Once we learn how to control the variables that need to be controlled everything in heat transfer issues can be controlled.

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Abstract: Science and Engineering Fair of Houston

1136

Using Chemical Reactions for a Reusable Food Warming Device

Ishaan Kulkarni

Conroe ISD /McCullough Junior High

Category:

Chemical Engineering & Materials Science

Will I be able to use chemical reactions and/or renewable energy sources to heat? Can food be warmed efficiently and effectively as a microwave alternative? This project utilizes chemical reactions to develop a reusable food warming device. By using chemical reactions, I can effectively warm food and make it easier to eat. I chose to do this project because I wanted to have a way for everyone to enjoy warm food since it is healthier and better for the body. A commercially available way to use the exothermic reaction of sodium acetate and water is by using reusable silicone heat packs. The packs help me by reaching temperatures of 130*F and can warm up the food to high temperatures. By using conductors such as aluminum, I can make the transfer of heat faster and smoother from the packs to the food. I calculated the internal temperature of the food by using a food thermometer, and all three of the foods that I tried reached a temperature of 110*F every single time. With repeated tests, the warming was very consistent and proved to warm the food in a very consistent way. In the results, the food was getting warmed enough to be considered warm and healthier than regular cold food that is usually at lunch. In conclusion, the warmer is very effective and can warm up food consistently. The warmer will be used more for foods that don't fit in the thermos, and it will work to warm up pizzas and other warm foods. For the future, I want to create this into a product, so it will be easily available for the people who will benefit from The Heat Box.

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Abstract: Science and Engineering Fair of Houston

1137

Investigating the Chemical Stability of Lithium-Ion Batteries in Varying pH Environments

Sahasra Balajepally, Aarushi Kadam, Renusree Raparthi

Fort Bend ISD /Quail Valley Middle School

Category:

Chemical Engineering & Materials Science

Encapsulation has become a popular method to protect sensitive substances or deliver useful materials safely and efficiently, but it is not yet clear which encapsulation processes result in more stable and effective formulations under application conditions. In this project, the influence of various encapsulation techniques on the integrity, protection, and release behavior of the encapsulated substance (our "payload") will be studied. We will then apply various stress conditions (heat, moisture, friction, or simulated real use conditions) that could cause degradation in such encapsulation samples, in order to determine which provides the best protection to the payload and delays its release. One of the encapsulating methods is expected to outperform the others by maintaining structural integrity and minimizing premature release under stress conditions to demonstrate more robust encapsulation. The results may point to not only which technique is most effective, but also provide insight into practical applications-for example, safer delivery systems or more durable protection of sensitive materials.

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