

Abstract: Science and Engineering Fair of Houston

1176

The Greenhouse Effect

Diamond Smith
Alief ISD

Category

**Earth and
Environmental Sciences**

Have you ever wondered if the greenhouse effect affects the surface conditions of atmospheric temperatures? You can see if it's true by using a surface of water, sand, black soil and carpet grass. Greenhouse effect is caused by all the absorption of heat by greenhouse gasses like carbon dioxide, water vapor, methane gasses and the ozone. The greenhouse effect traps heat and warms the planet. Therefore, conducting this project to find out how different surface conditions affect atmospheric temperatures determines how the greenhouse effect works. This causes too much heat to be trapped within our atmosphere, and consequently, a gradual but certain increase in surface temperatures. The increase of our surface temperatures around the globe is causing climate and weather changes across the planet.

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Abstract: Science and Engineering Fair of Houston

1177

What natural homemade paints are the best and how to make them

Alexandra Mogollon Caraballo

Elin Rodriguez

SST - Champions College Prep - MS

Category

Earth and
Environmental Sciences

Our project topic is "What natural homemade paints are the best and how to make them?". We made this project about trying to make paints in a good and natural way that would not harm the environment, and can be done anywhere, no matter how much money you have. We wanted to make this project because it seemed like a fun project to do, and overall a good topic to talk about, also because it seemed that it could be a fun experience making natural paints, and bringing out the history of making paints. We also chose this project, because we both like to paint a lot so we thought of this idea, and we know that there are people around the world that don't have enough money to spend on paints and we think everyone should be able to experience the beauty of painting no matter their economic situation, and that since paints come in plastic containers it can contribute to trash islands, but if you make natural homemade paints, you can reuse the container you made it in, over and over again. We got information from various different articles about how to make natural paints. They all had different ways on how to make natural paints, but we only chose one way to make the natural paints due to time constraints.

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Abstract: Science and Engineering Fair of Houston

1178

Bio-Concrete: Using Living Bacteria to Create Self-Healing Concrete and perform Carbon sequestration

Ganeev Jaswal

Fort Bend ISD /Fort Settlement Middle School

Category

Earth and
Environmental Sciences

Concrete is the most widely used construction material globally, but it is prone to cracking, which compromises structural integrity and results in costly repairs. Additionally, concrete production contributes significantly to carbon dioxide (CO₂) emissions, exacerbating climate change. This project investigates the development of bio-concrete, a sustainable material that incorporates living bacteria to autonomously heal cracks and sequester CO₂. The study explores the use of *Bacillus subtilis*, a non-pathogenic bacterial strain capable of precipitating calcium carbonate (calcite) in the presence of calcium lactate or calcium nitrate. A nutrient-enriched bacterial culture was prepared and introduced into a concrete mix to create self-healing bio-concrete samples. The experimental bio-concrete specimens were compared to traditional concrete in terms of crack healing efficiency, mechanical strength recovery, and CO₂ absorption. Cracks were induced in cured samples, and their healing was observed under controlled conditions by submerging the specimens in water to activate bacterial calcite precipitation. Carbon sequestration was evaluated by measuring CO₂ levels before and after exposing the bio-concrete to a controlled atmosphere. Preliminary results suggest that bio-concrete exhibits superior crack-healing efficiency, enhanced durability, and a measurable reduction in atmospheric CO₂ compared to conventional concrete. This innovative approach not only extends the lifespan of infrastructure but also addresses environmental concerns associated with the construction industry. The findings demonstrate the potential for bio-concrete to revolutionize sustainable construction by reducing repair costs and contributing to climate change mitigation through carbon sequestration.

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Abstract: Science and Engineering Fair of Houston

1179

Silent Killer

Medaly Castillo
Alief ISD

Category

**Earth and
Environmental Sciences**

This experiments purpose was to determine if acid rain also has adverse effects on aquatic ecosystems, just like it does with land ecosystems. In the hypothesis, it stated that the plants that were sprayed with the highest amount of the acid rain solution would show adverse effects in the shortest period of time, while the ones with the least amount of sprays would grow at a slower rate, and the ones which were not sprayed with acid rain solution would continue to grow at a constant rate. Meanwhile this experiment took place, it was observed that the hypothesis was correct, showing that the least exposed plants grew the most, while the ones that were exposed the most showed strong, negative results that were not doubtful since the origination.

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Abstract: Science and Engineering Fair of Houston

1180

Metro is Everywhere, So is Air Pollution

Kennedi Lewis

Houston ISD /BCM Academy at James D Ryan - MS

Category

**Earth and
Environmental Sciences**

I chose to do my project on air pollution in the Third Ward of Houston and surrounding areas. During my research, I found that diesel exhaust contributes to air pollution in a major way. The exhaust contains chemicals such as formaldehyde, carbon monoxide, and volatile organic compounds (VOC). These pollutants can affect the respiratory system. Causing heightened asthma symptoms, shortness of breath, and throat irritation. To collect my data, I drove around to certain locations within Third Ward to METRO's bus stops. I used an air quality monitor and waited for 5 minutes and wrote down my data. I did this process 10 times at 10 different places, 5 at residential areas, 5 at metropolitan areas. During my testing, we went to a transit center with 7 METRO buses parked with the engine on. When I got my results back, the monitor said that the formaldehyde and TVOC levels were at 0 mg/³ (milligrams per cubic meter). When comparing this information to areas outside of the Houston area, the levels are significantly lower. For example, at the Sienna Plantation in Fort Bend County, Tx, there is a massive coal plant that is polluting the air of surrounding neighborhoods. There are no coal plants in Third Ward, so there would be lower levels of air pollution in that area than areas outside of Beltway 8. Because of this recent discovery, I think that the Texas Commission of Environmental Quality could pass laws to reduce this problem in a timely manner.

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Abstract: Science and Engineering Fair of Houston

1181

Microplastics in Texas Rivers

David Blazheski

Conroe ISD /McCullough Junior High

Category

Earth and
Environmental Sciences

Microplastics, tiny plastic particles less than 5mm in size, are widespread in the environment and can affect ecosystems and human health. My study examines the concentration of microplastics in three Texas rivers: San Jacinto, Trinity and Neches. The research question focuses on how much microplastic levels change as the river flows from its source. I am collecting samples from different locations at varying distances from the sources of the rivers. Through careful sampling, measuring using a homemade spectrometer, and data analysis, this project will provide insight into the distribution of microplastics in the three rivers. The findings will help us understand better how plastic pollution disperses through freshwater systems and guide us on how to clean and protect our environment.

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Abstract: Science and Engineering Fair of Houston

1182

The Dangers Of Global Warming and Its Consequences

Victoria Cruz

Deseray Parker

School of Science and Technology, Houston - MS

Category

**Earth and
Environmental Sciences**

The main purpose of our project is to make global warming a known issue. Many people know what global warming is but they don't exactly understand what global warming is. We did research and found out global warming is made from harmful gas and oil, like burning fossil fuel. The more fossil fuels we burn the worse global warming will get which will be catastrophic. Global warming killed over half a million people in the year of 2024 specifically during the summer time. Our hypothesis is if humanity can cut back on using fossil fuels and start using more renewable energy then global warming won't be as bad as it is now. We have found out the four different types of renewable energy that can be used: hydroelectric power, bioenergy, solar power, and wind turbines. They all have their pros and cons but they will be able to fix the current problem of global warming.

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Abstract: Science and Engineering Fair of Houston

1183

Earthworms Affectivity on Plants

Hayden Savio

Houston ISD /BCM Academy at James D Ryan - MS

Category

**Earth and
Environmental Sciences**

Farmers are the building blocks of America. My project is on how the number of Earthworms affect the plant and how to remove pests that come with the Earthworms. My project is important because it can help farmers decide on whether they should add a lot of worms or a set number of worms in an area. I did this project because I am very interested in how plants grow so I decided to do this. I used gloves for precaution and added soil to the pot then added the seeds then I added the Earthworms, then after 3-5 days I will add the dandelions into the plant then I will measure what happened to the plant before adding the dandelions and after adding the dandelions. The results are that it is best to add around 20-30 earthworms per garden pot, and dandelions repel insects. My conclusion is that a lot of earthworms are not good for the plant. This data can be used to determine how much earthworms you should add per garden pot.

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Abstract: Science and Engineering Fair of Houston

1184

Does Barley Straw Affect Algae Growth

Camden Fletcher

Kai Shavers

Clear Creek ISD /Westbrook Intermediate School

Category

**Earth and
Environmental Sciences**

With the fast-growing rate of algae in warm climates, there is an increased threat to all marine life. When algae dies, it absorbs the oxygen in the water and releases toxins that kill plants and animals. We hope to solve this issue with barley straw, and along the way, find out how it works. We think that the barley straw will decrease the rate of algae growth because some scientists think that decomposing barley straw releases something, without knowing how it works. We did 5 trials with algae and barley straw in 25 containers, observing how the barley would affect the algae over time. We recorded the information for a month, starting when we put the algae in the jars. Our hypothesis was supported because when we weighed the algae at the end of the experiment, the algae in the jars with the most barley grew the least. Weighing the jars ended with a negative result because of evaporation, causing the jars to lose weight, instead of gaining very little weight. An implication of our results is that by learning that barley straw is a safe and effective way to prevent too many algal blooms. We would apply our results to help keeping waterways clean and clear of algal blooms which can be toxic. If scientists figure out how barley straw works, it could help the environment all around

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Abstract: Science and Engineering Fair of Houston

1185

Which biome can a human most likely survive in?

Aurora Diaz

Kassandra Zaharatos

SST - Champions College Prep - MS

Category

Earth and
Environmental Sciences

The purpose of our project is to determine which biome can a human most likely survive in between three biomes, which are rainforest, tundra, and desert. We came into a conclusion about which one is more survivable by gathering information about all three of the different biomes and proceeding to see which one a human can get more comfortable living in, all three of them have their pros and cons. And they all have a reason on why a human should live in each one of them. One of the many significant results I found while doing my project was disclosing and finding out how all three biomes have something unique about them and how it would be amazing to live or visit each one of them. In conclusion we chose this project for the reason that we wanted to investigate and try to understand which biome is better, during this project we found out the pros and cons of the biomes, why people would most likely live there and what's unique and special about each of them. There are multiple other reasons why we chose this project, we find it very interesting how each of them have their own reason why someone would move there. There are multiple different types of biomes, we chose tundra, desert and rain forest because we thought that each of them at least had a problem on why a human cannot survive in each one of them. But to sum it all up I'm glad we chose this project out of many other ones.

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Abstract: Science and Engineering Fair of Houston

1186

Measuring the effectiveness of hurricane management strategies

Moosa Mbow

Abdou Diagne

SST - Champions College Prep - MS

Category

Earth and
Environmental Sciences

Hurricanes are very destructive natural disasters, being able to destroy houses, buildings, and roads. However, many people do not know how to well prepare for them and suffer the consequences. We made this project in the hopes of finding the best strategies to manage hurricanes. We will survey many people on how they prepare for hurricanes and see which of their strategies are the most effective and which strategies are most used. According to our data, many people had strategies for hurricanes, however some people did not. For the people that did not have a strategy, only some of them actually worked. The most popular strategy was to have a list of meals, supplies for food, water, electricity, and activities. There are many ways to be prepared for a hurricane and almost everyone has different ways to prepare. By our survey, the most popular way to prepare is to have a list of meals, supplies for food, water, electricity, and activities.

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Abstract: Science and Engineering Fair of Houston

1187

Solar Desalination

AKSHAY CHINTAMANENI

THE HONOR ROLL SCHOOL - MS

Category

**Earth and
Environmental Sciences**

Every day, the typical American home uses around 180 gallons of water. Every day, Americans are wasting 30 gallons. And all of the water being consumed and wasted together is freshwater. And what makes our situation better is that only 3% of earth's water is freshwater, and to make it an even more dire stimulation is that only 1% of that is actually usable by humans. The reason why this is the case is that firstly, ocean water is out of the question as each 250 ml of ocean water contains 8,000 mg, which totally shatters the healthy amount of salt intake per day that humans could take, which is 2,300 mg of salt according to the fda. Secondly, 68% of our earth's freshwater is locked in glaciers, and melting them would raise the entire oceans level, potentially even flooding coastal waters. Although our situation looks bad, there are a couple of solutions. Some of them include improving irrigation and agricultural practices, recycling wastewater which sounds nasty in a way, or inventing new water technologies. But these will all take so much time, cooperation of multiple people with totally different perspectives, and some serious sacrifices. Or, a much simpler way is that we could take our ocean, around 352 quintillion gallons of water and purify some of it of salt to provide an almost infinite water source, which is known as desalination, which could be the future of water distribution.

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Abstract: Science and Engineering Fair of Houston

1188

Where Do Nurdles Hurtle the Tide

Sofia Schweighofer
Weis Middle School

Category

**Earth and
Environmental Sciences**

My science fair project was determining if there are varied amounts of nurdles on Galveston Beaches. My rationale for this was that beach ecosystems and marine life need to be protected. Identifying nurdles and figuring out ways to lessen the damage they cause can help many animals and beaches. I hypothesized that the beaches closer to the ship channel would have more nurdles, since companies in Houston use nurdles to make plastic. I collected nurdles according to the training video on nurdlepatrol.org on 6 different beaches in Galveston: along the ship channel, Poretto Beach, 15th St., 45th St. 61st St., and 81st St. My data I showed that my hypothesis was correct: out of all the six beaches tested, the ship channel had the most nurdles. This could be because when ships are transporting goods, plastic and pollution can leak or contaminate the water. The shorelines then collect that pollution which destroys our ecosystem. The companies in Houston might also leak the nurdles into the water, and they then collect on our beaches. When more people act as "citizen scientists" by collecting nurdles and reporting how many they get, we can hopefully reduce the amount of nurdle pollution on our shores.

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Abstract: Science and Engineering Fair of Houston

1189

How does the form of barley straw affect algae?

Mandy Cai

Conroe ISD /McCullough Junior High

Category

Earth and
Environmental Sciences

Barley Straw is a type of natural algaecide that can prevent algae by releasing hydrogen peroxide as it decomposes. These can come in many different forms such as extract, raw straw, and flakes to name a few. The goal of this experiment is to find the most effective product and see how much better it is compared to the other options. This project requires shining a flashlight through tubs of water containing extract, straw, flakes, and the control with nothing added. With a Lux Meter underneath the containers, the amount of light coming through would be measured. This will determine the amount of algae that each tub has. This procedure will be repeated every other day with three trials that last ten days each. The data will then be converted into percentages using the Lux divided by 300 times 100 with 300 as the completely clear water. Throughout this experiment, Barley Straw extract has shown to be the most effective by around 16%. This experiment will help owners of local water sources recognize that there are different alternatives to algaecides that can be safer and more efficient. This data can also be used as a guide for people willing to give Barley Straw a try.

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Abstract: Science and Engineering Fair of Houston

1190

AutIS using a Arduino Uno R3 as a Microcontroller and a Diitao Resistive Soil Moisture Sensor

Rishik Sharma

Tomball ISD /Creekside Park JH

Category

**Earth and
Environmental Sciences**

The researcher created a machine called the AutIS, which utilizes many advanced manufacturing parts. The purpose of the machine is to prevent plants from dying to overwatering and underwatering. How the machine works is that the researcher will dip a Soil Moisture Sensor into a pot of soil, and it will report the moisture levels of the soil to the Microcontroller. Then the Microcontroller will tell the Water pump whether it should pump water or not. The researcher learned about several different Microcontrollers, and found that the Arduino Uno R3 microcontroller, would best suite the researchers purpose as the Arduino Uno R3 was a reliable Microcontroller that had a large amount of voltage output. The researcher's next point of research was to see what was the best Soil Moisture Sensor to use, a Capacitive Sensor or Resistive Sensor. A capacitive soil moisture sensor measures the change in capacitance caused by soil moisture to estimate the humidity of the soil. A resistive soil moisture estimates the soil moisture based on the resistance detected between the two contacts. After the researcher finished building the model he plugged in and tested both of the 2 different sensors to see which one was more efficient. The researcher reached a conclusion that the Resistive Soil Moisture Sensor is more accurate than the Capacitive Soil Moisture Sensor, as the Capacitive Soil Moisture Sensor only made the water pump keep on pumping water until, the sensor was filled to the top with water.

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Abstract: Science and Engineering Fair of Houston

1191

microplastics

Harper Damian
Jaydence Christensen
Weis Middle School

Category

**Earth and
Environmental Sciences**

What location around Galveston has the most microplastic in the sediment? If the amount of micro- and nano-plastics appearing in Galveston waters has been increasing each year, then we believe that the beach area underneath the Pleasure Pier Amusement Park will be teeming with microplastics. Our research supported our hypothesis that the Pleasure Pier location would have the most microplastics of all the locations we searched.

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Abstract: Science and Engineering Fair of Houston

1192

What is the effect of the wavelength of light on the amount of carbonate in water.

Elizabeth Kirkland

Clear Creek ISD /Brookside Intermediate School

Category

Earth and
Environmental Sciences

This experiment was targeted towards researching different variations of wavelength on the growth of carbonate. It was hypothesized that if the wavelength of light is lowered to a lower wavelength, the tank would gather more carbonate growth. Tanks were set up to look like a normal aquarium with one feeder fish in each tank. Carbonate level was measure twice per day over the course of five days using test strips measuring in ppm. The results indicated that if the lights wavelength is lower, then there will be less carbonate growth measured, proving the hypothesis to be incorrect. These findings highlight the effect that wavelength levels can have in carbonate growth, offering insight valuable for people living with aquatic pets and marine biologists.

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Abstract: Science and Engineering Fair of Houston

1193

What Natural Substances Reduce Iron from Water?

Chetan Kodali

Conroe ISD /Knox Junior High

Category

Earth and
Environmental Sciences

Iron contamination in water threatens human health and requires effective removal methods. This research tested six treatments: eggshell powder, activated charcoal, sand gravel, coco coir sand, water softener salt, and chlorine. Among all these, chlorine was the most effective treatment, removing iron completely. Eggshell powder reduced iron to 0.25 mg/L, while charcoal, water softener salt, and sand gravel lowered it to 0.4 mg/L, 0.4 mg/L, and 0.5 mg/L, respectively. Coco coir sand was not as effective, bringing down iron levels to just 1 mg/L. The results show that the natural methods help, but still chemical treatment with chlorine is most effective.

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- human participants potentially hazardous biological agents
 vertebrate animals microorganisms rDNA tissue

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- yes no

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- yes no

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- yes no



Abstract: Science and Engineering Fair of Houston

1194

Is More Green Better? Does Littoral Vegetation Enhance Habitat Suitability of Local Retention Ponds?

Caden Pohlkamp

Clear Creek ISD /Brookside Intermediate School

Category

Earth and
Environmental Sciences

League City and Friendswood, Texas have regulations that when new buildings and parking lots are constructed, a water control plan for the displaced surface area of land must also be created. Retention ponds are a good method for controlling water that also replace lost natural habitats. Vegetation on the littoral (shoreline) of a pond provides both advantages and disadvantages and the ideal amount is different for each geographic region. This project determined the ideal amount of non-grass vegetation in the littoral of retention ponds in League City and Friendswood by measuring nine water qualities and determining the trophic index of 12 different ponds from August to November, 2024. This project is important to enable cities to construct retention ponds which are suitable habitats for marine life. Collected data showed the ideal littoral was ~15-30% non-grass vegetation. These ponds had the highest amount of dissolved oxygen (DO, >6.0 mg/L) and ideal levels of alkalinity (95-150 ppm) and pH (7.5-8.5). Data also showed a fountain provides significant advantages. Every pond with a fountain had DO above 6 mg/L, including one hypertrophic pond. Most of the ponds without a fountain had a negative biochemical oxygen demand, which indicates the presence of lots of algae that can lower oxygen levels for marine life. Temperature, phosphorus, electrical conductivity, total dissolved solids, and turbidity were also studied. Water samples were collected from the surface and bottom of each pond using a custom designed and built ROV. Results from this experiment were communicated to local City Officials.

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Abstract: Science and Engineering Fair of Houston

1195

Galveston Tap Water Testing

Eros Contreras
Manuel Cardenas Carvajal
Weis Middle School

Category

**Earth and
Environmental Sciences**

The purpose of this experiment is to find out if there's lead in Galveston TX tap water. First we collected tap water from three different parts of Galveston, then we stored them in separate containers. After that we tested the tap water and we found out the results. Our results were that there isn't any lead in Galveston tap water. So now we wouldn't have to worry about consuming lead in Galveston tap water.

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Abstract: Science and Engineering Fair of Houston

1196

Bioluminescence: Will it Glow?

Sophia Manuel

Conroe ISD /Irons Junior High

Category

**Earth and
Environmental Sciences**

How will changing the amount of light given to dinoflagellates affect the amount of bioluminescence it produces? This experiment can help others, like marine biologists, by providing them with more information about tiny plankton called dinoflagellates. The hypothesis of this experiment is that if the amount of light given to dinoflagellates is changed, then the dinoflagellates will produce a different amount of bioluminescent light. In this experiment, the dinoflagellates will be separated into 3 groups, and the amount of light given to each group will be changed. Each day, rate the amount of bioluminescent light the dinoflagellates produce from a scale from 1 to 4. Record what is seen and record the data. For the dinoflagellates that were only in the dark, the amount of light produced stayed at a 1 until they died, and the light produced turned into a 0. For the dinoflagellates that were only in the dark, it usually remained at around a 2 or 3 on the scale. For the dinoflagellates that were normal, it stayed at a 4 on the scale. The things learned in this experiment were that the amount of light given to dinoflagellates changes how much light it produces. This experiment displays that the dinoflagellates all produced a different amount of light, supporting my hypothesis.

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- yes no



Abstract: Science and Engineering Fair of Houston

1197

Growing algae in saltwater and freshwater

Isabella Hensley
Weis Middle School

Category

**Earth and
Environmental Sciences**

Will algae grow better in saltwater or freshwater? Algae is a great food source and can be a biofuel. If I am right, we could have large sources of algae for the future.

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Abstract: Science and Engineering Fair of Houston

1198

Is It Working? Examining Policies Fighting Light Pollution In America's Biggest Cities

Vaidehi Kapur

Houston ISD /BCM Academy at James D Ryan - MS

Category

Earth and
Environmental Sciences

Light pollution is the excessive use of artificial light at night, with wide ecological and human impacts. My project examined whether light pollution policies in those cities actually affect the amount of light pollution. Studies show that the light pollution policies that are implemented generally do have an effect on the community and do reduce artificial light. I started by finding light pollution policies for each city between January 2012 and September 2024. Then, I collected data from an open source light pollution map and calculated the change in light levels in three major parks in each city over the same time period. Finally, I found patterns that correlated and connected the light pollution policies to the change in light pollution over time. I was able to find that light pollution policies do have an effect on light pollution reduction, but only temporarily. Major metropolitan areas in the United States have limited published and implemented policies directly addressing light pollution, and the limited number of policies only decreased light levels over a few months before light peaks again during the winter. My results suggest that light pollution policies in major cities may not have enough effects on light pollution to be effective or that these policies are not effectively implemented. It is important to reinforce strategies for controlling light pollution and mitigate its negative impacts.

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- yes no



Abstract: Science and Engineering Fair of Houston

1199

Edible Water Bubble

Leyla Ozkilic

SST - Champions College Prep - MS

Category

**Earth and
Environmental Sciences**

The purpose of this experiment is to address pollution by introducing Edible Water Bubbles as an alternative to plastic water bottles. These bubbles are biodegradable, free from harmful chemicals, and designed to work in harmony with nature. By replacing plastic bottles, Edible Water Bubbles aim to significantly reduce plastic waste and its harmful impact on the environment. To create Edible Water Bubbles, three bowls are required: two filled with tap water and one with clean drinking water. Sodium Alginate is added to one bowl of tap water and mixed thoroughly, while Calcium Lactate is added to the second bowl of tap water and mixed. Both mixtures are left to rest for 10-15 minutes. Using a circular spoon, spoonfuls of the Sodium Alginate mixture are gently placed into the Calcium Lactate solution, where the bubbles form. The formed bubbles are removed with a slotted spoon and rinsed in the clean drinking water. For storage, the bubbles can be placed in biodegradable materials and last up to six weeks. Edible Water Bubbles have multiple benefits. They reduce pollution by eliminating single-use plastic bottles, are free of harmful chemicals, and provide pure hydration. Additionally, they cost less, easy to produce, and safe for consumption. This experiment demonstrates that Edible Water Bubbles are an eco-friendly and practical solution to plastic waste. Their adoption could lead to a cleaner planet, healthier hydration options, and reduced costs, making them a promising innovation for a better future.

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Abstract: Science and Engineering Fair of Houston

1200

UV Rays, Isn't is Fabric-ulous?

Lyana Yu
Spring Branch ISD

Category

Earth and
Environmental Sciences

The purpose of this experiment was to find which material or fabric for clothing would be the most reliable and diffuse the greatest amount of light and ultraviolet radiation. In this experiment, different pieces of fabric were placed into separate petri dishes. Indicator strips were underneath each of the various fabrics. These objects were underneath the sun at 12:00 pm. The results ended clearly and accurately. My hypothesis was inconclusive because it states that the ultraviolet protective fabric would absorb the most ultraviolet radiation, but according to the results, the cotton fabric absorbed more. Through this testing, I was able to conclude that the cotton fabric was the best used for absorbing ultraviolet radiation compared to the other fabrics. People in tougher hot climates could have accurate clothing which could protect their skin from ultraviolet radiation and live in comfort. Project Category

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- yes no



Abstract: Science and Engineering Fair of Houston

1201

Soil Composition and its Effects On Plants

Eliza Argyle

Conroe ISD /York Junior High

Category

**Earth and
Environmental Sciences**

Soil Composition and Its Effects on Plants The researcher's project answers the question of whether soil composition affects plants, reveals truths about fertilizer, and shows data to support the results. During the experiment, six cabbage plants were grown. Three of the cabbage plants were fertilized, while the other cabbage plants were left as they were. The researcher began by measuring out soil equally for each pot, then planted the seeds into holes of the same depth. After labeling the cabbages, a small amount of fertilizer was added to three of six pots. The shoots were then measured every evening to collect data, and the following key results were found. The average final height of the fertilized cabbages was 0.9cm whereas the average height of the plants without fertilizer was 2.7cm. The student observed that the cabbage's leaves darkened as it matured, going from a yellow green to a dark green surrounded by a ring of purple. The researcher's conclusion states the hypothesis that if different soil compositions are used, then the modified soil composition will grow the tallest plant. The conclusion describes how the data did not support the hypothesis due to the cabbages without fertilizer having more average growth than their fertilized counterparts. Lastly, the conclusion explains what can be improved in future experiments, as well as elaborating on things that were learned while doing the experiment, such as how fertilizer can change plant growth and how letting seeds germinate before planting them speeds the growing process.

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Abstract: Science and Engineering Fair of Houston

1202

Clear Solutions; Emergency Water Filtration Survival

Methods

Olivia Ferguson

Clear Creek ISD /Seabrook Intermediate School

Category

**Earth and
Environmental Sciences**

We all could experience a situation that requires water boil notices. For example, during the freeze, they had boil water notices because the water supply was not safe to drink directly. This experiment was made compare the effectiveness of different emergency water filtration methods in removing contaminants from water. This study analyzed the level of bacteria, heavy metals, and potential contaminants after filtration, helping to determine which method is more reliable for emergency survival. During the experiment, lake water was gathered and tested before filtration. Different filtration methods were used and then after 48 hours the water was retested. The hypothesis was incorrect because Sawyer Straw was the cleanliest results with Life Straw in a close second. Aqua Tabs had a 5 on zinc, 7.85 on pH, 425 in hardness, 2.7 in alkalinity, 20 in chlorine (highest chlorine rate on the charts), all 0s on iron, copper, lead, and mercury. Meanwhile, the best performance by Sawyer Straw with .3 in zinc, 7.2 in pH, 425 in hardness, 42.7 alkalinity, and 0s in chlorine, iron, copper, lead, and mercury. This was a project that helped grow in understanding for safety in emergency and water.

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Abstract: Science and Engineering Fair of Houston

1203

Tornado Stopper

Karla Barry

Clear Creek ISD /Seabrook Intermediate School

Category

**Earth and
Environmental Sciences**

The question is what chemical works best to stop/slow down a tornado? What we will happen if different chemicals are placed into the tornado, then baking soda stopped the tornado the best. In this project there is baking soda, calcium chloride, and silica gel that is placed inside of the homemade tornado. The box was created with cardboard and slits on the side and a fan on top. There was dry ice and warm water that was placed inside of the box and the fan was turned on. The chemicals were placed with the dry ice before the fan was turned on. That would create the tornado then data would be recorded, from the amount of time the tornado was working. In the 3 different chemicals, used to slow down the tornado baking soda succeed the best. All of the chemicals reduced the tornadoes time. Baking soda had an average of 1.12, Silica Gel had an average of 1.2, Calcium Chloride 1.51, and Control 2.2. There 10 trials per chemical and control. The hypothesis that if different chemicals are placed into the tornado, then the baking soda would stop the tornado the best. This hypothesis is correct because baking soda made the tornado stop the fastest.

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- yes no



Abstract: Science and Engineering Fair of Houston

1204

Erosion, Erosion, Breaking stuff in Motion

Ethan Flores

SST - Champions College Prep - MS

Category

**Earth and
Environmental Sciences**

The purpose of this project is to test erosion rates on certain natural ground material from floods, rivers, and ice, for geological, paleontological, and agricultural purposes. In this project, The samples will be placed into a custom made container to test them by placing them inside, and pouring water on top, or placing a block of ice at the top. After each round of testing, we will gather the results, and test the next material. The most significant discoveries that I found was how the 9 different materials reacted to sheet erosion (floods), gathering useful information for agriculture. In conclusion In this project we tested a total of 9 different ground substances, (soil, sand, silt, clay, loam, peat, much, pea pebbles (gravel), and chalky soil. Each substance went through 5 rounds of testing, each round testing an erosion property, and in the end, collected a staggering amount of data that can be used for a multitude of purposes, (geology, paleontology, and agriculture). One example of using our data is in agriculture, you can use a top layer of gravel or mulch to prevent erosion of soils underneath that are much more prone to erosion such as clay, or silt. If this project continues, I will expand it to other erosion factors and geological processes, and go more in depth into ground substrates.

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Abstract: Science and Engineering Fair of Houston

1205

Making Galveston Clean

Mark Pinard

Weis Middle School

Category

**Earth and
Environmental Sciences**

A. The purpose is that the project shows how us humans recycle and how we don't. I think it may cause more civilians to save our mother earth. B.I took family and friends, and I got them to recycle for one whole week. The day after, I get the results, put them down, and that's how I did it. C.The most important and least common I found were a total of 5 LBS of recycling. Which was my hypothesis. Everyone would have at least 5 Lbs of recyclables. D. As a conclusion I found, everyone has a different amount of people in their family, and they might, or not, have a diet so that's also different.

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Abstract: Science and Engineering Fair of Houston

1206

Cleansing Everyday Tap Water From PFAS

Sophia Luna

Houston ISD /BCM Academy at James D Ryan - MS

Category

**Earth and
Environmental Sciences**

In my project I will be testing two different tap water sources with 3 different tests of charcoal, water tablets, and boiling the water in hopes to cleanse the water of PFAS. My testable question is does the type of filter and water affect the amount of PFAS removed? My independent variables are the type of water and type of water and my dependent variable is the amount of PFAS removed. I measured using a drinking water test strip test and documented my results onto a graph. My results were that for the first household, the water tablets cleaned the water the best, however for household 2, the charcoal had cleaned the water the best. In conclusion, the type of filter and type of water affect the amount of PFAS removed.

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Abstract: Science and Engineering Fair of Houston

1207

How to grow with less H2O

Ayanna Sodhi

Conroe ISD /Irons Junior High

Category

Earth and
Environmental Sciences

Growing food can use a lot of water and the climate in many places people don't have enough water needed to grow food. In this project. Hydrogels are jelly like substances that soak up water. The gels that I will be making are made from food safe ingredients and are biodegradable made from Agar, Hydroxyethyl cellulose (HEC), and agar with HEC. This will determine if hydrogels retain water in soil and decrease the amount of water to grow food. If agar and HEC are combined in a hydrogel, then the soil will retain more water than agar and HEC hydrogels alone. Three Hydrogels made from Agar, Hydroxyethyl cellulose (HEC), and agar+HEC were tested to see how much water they would retain and how much they would lose over 14 days. These same three hydrogels were placed in soil to determine if soil alone vs. soil with a hydrogel will retain more water. The HEC+Agar absorbed the most amount of water. The Agar and Agar+HEC lost the least amount. The hydrogels all retained more water than the soil. The HEC+Agar lost the least amount of water. The hydrogels in soil help maintain water longer than soil alone. My hypothesis was correct, HEC+ Agar absorbed the most amount of water and lost the least amount. There was variation in the data that might be due to the Hydrogels not mixing well. The HEC Hydrogel clumped together making it hard to mix.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

human participants

potentially hazardous biological agents

vertebrate animals

microorganisms

rDNA

tissue

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no

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yes

no

4. This project is a continuation of previous research.

yes

no

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yes

no



Abstract: Science and Engineering Fair of Houston

1208

Inanimate vs Natural CO₂ Removal

David Qi

Eli Pulmano

Fort Bend ISD /Fort Settlement Middle School

Category

**Earth and
Environmental Sciences**

The purpose of this study is to evaluate how well plants and inanimate solutions remove carbon dioxide (CO₂) from the atmosphere. The research will ascertain whether the strategy is more sustainable and effective by examining CO₂ absorption rates, long-term sustainability, environmental impact, and economic costs. By using different unnatural methods, we can average them out for a precise calculation of their success. The results will help guide policy choices and improve climate change mitigation tactics.

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- yes no



Abstract: Science and Engineering Fair of Houston

1209

Microplastics Everywhere

Jazmyn Ruiz

Houston ISD /BCM Academy at James D Ryan - MS

Category

**Earth and
Environmental Sciences**

Microplastic pollution has become a significant environmental issue, spreading through ecosystems and affecting both wildlife and humans. This project investigates how different types of water, including tap water, filtered water, and water contaminated with microplastics (from bottled water, styrofoam, and plastic), affect the growth of Lima bean plants. It explores the potential negative impacts of microplastics on plant growth, including disruptions in water and nutrient uptake, soil structure, and root development. Over a 26-day period, Lima bean plants were watered with various types of water, and growth was measured. Results showed that plants watered with bottled water, water containing microplastics, and tap water did not survive, with seeds turning brown and dying. However, plants watered with filtered water grew to 9 inches, demonstrating healthy root and leaf development. These findings support the hypothesis that microplastics adversely affect plant growth, confirming that microplastic contamination in water can impair plant health. This research highlights the potential risks posed by microplastics to agriculture and food security, urging further investigation into their environmental impact. Understanding how microplastics affect plant growth is critical for informing environmental policies and ensuring the sustainability of ecosystems and food production.

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Abstract: Science and Engineering Fair of Houston

1210

Battle of the Ovens

Madeline Meadows
Keiona Rollins
Weis Middle School

Category

**Earth and
Environmental Sciences**

Our project was about solar ovens between regular ovens, and how and can it save energy, money, and time. We took the solar powered oven outside to bake cinnamon rolls and cookies three different times, doing this we had compared the regular and solar over to see what was the fastest and which one saves energy. We also do some research on how it might help with people too. The solar over took a long time to cook while the regular oven was faster but we had problems because of the weather.

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Abstract: Science and Engineering Fair of Houston

1211

What Produces More Energy From a Hydrogen Fuel Cell, Freshwater or Saltwater?

Olivia Foley

Conroe ISD /Knox Junior High

Category

Earth and
Environmental Sciences

The purpose of this experiment is to determine if saltwater or freshwater produces more hydrogen energy from a fuel cell. The hypothesis for this experiment states that if a hydrogen fuel cell is used with saltwater, then the fuel cell will have more energy because saltwater is more dense with electrolytes and has a higher conductivity. Developing this way of energy could help the world. It would help climate change because it doesn't release natural gas into the air. In this experiment, there were two glasses of different types of water. One was saltwater and one with freshwater in it. Next a model of a hydrogen fuel cell was built using wires, tape, popsicle sticks, a voltage meter, and a 9-voltage battery. Then using the hydrogen fuel cell, saltwater was attached and the voltage was measured. The same thing happened with the freshwater. The experiment was done three times with each type of water to get accurate results. In conclusion, the saltwater created more energy from a hydrogen fuel cell than the freshwater. The hypothesis was supported by the results of the experiment. This information will help in future because it gives information about hydrogen energy. It would also help not use so much freshwater for so many things and to use more saltwater.

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 vertebrate animals microorganisms rDNA tissue

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- yes no

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- yes no

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- yes no



Abstract: Science and Engineering Fair of Houston

3155

Controlling Clouds through the Use of Sound Waves

Arjun Karapakula
Karthik Veeramallu
Tompkins - HS

Category

**Earth and
Environmental Sciences**

Water operates as a continuous cycle and appears to be an uncontrollable necessity. Yet, humans in an attempt to control this resource, have created technologies to accomplish control. Furthermore, as climate change takes an increasing toll each year, it becomes increasingly important to address modern technologies in a larger attempt to control the weather. One technology attempting to control precipitation is cloud seeding, a technique that utilizes the pouring of chemicals in clouds to increase rainfall, but it is pollutive and financially unfeasible. Seeing the failure of cloud seeding, our research analyzes the transmission of sound waves to clouds with the goal of precipitation control. In a cloud chamber, we create a cloud of consistent characteristics over a multitude of trials. We employ rain gauges and high-speed cameras to collect data regarding the total rainfall and rainfall distribution over the period of time. We conduct trials first without the integration of sound waves and then with. In the use of sound waves, we conduct multiple trials with varying frequencies and lasting time. We conduct a statistical analysis of the differences in data in the multiple sound wave comparing the data of the control without sound waves and with sound waves. We attempt to show statistical significance in the different sound wave conditions, indicating the sound waves' consistent impacts. Building on previous studies of precipitation control with soundwaves, we conduct the experiment with varying sound wave conditions, but most importantly, we attempt to decrease or limit rainfall temporarily, a completely new goal providing cost effective control over rain timing and building sustainability for countries in managing their water sources.

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- yes no



Abstract: Science and Engineering Fair of Houston

3156

Catch Your Breath: Innovative Methods for Carbon Capture and Storage

Rhea Chidambaram
The Village School

Category

**Earth and
Environmental Sciences**

Climate change remains one of the most pressing global challenges of the 21st century, primarily caused by human activities such as fossil fuel combustion, deforestation, and industrial processes that release greenhouse gases into the atmosphere. Atmospheric CO₂ concentrations have risen, surpassing 400 ppm, a level not seen in at least 800,000 years (NOAA, 2020). Carbon capture and storage (CCS) technologies have been developed to remove CO₂ from emission sources or the atmosphere. However, efficiency, scalability, and economic viability remain barriers. This study evaluates various materials for their CO₂ adsorption capabilities, including eggshell powder solution, biochar soaked in alkaline solution, biochar, activated carbon, zeolites, silica gel, functionalized chitosan, crosslinked biopolymer beads (alginate and calcium chloride), and a gel matrix with agar embedded with spirulina. Each material was exposed to a controlled CO₂ environment generated via a yeast fermentation process. I recorded the CO₂ concentration and material weight at regular intervals to assess the performance. The research demonstrated that the crosslinked biopolymer beads made from alginate and calcium chloride, coated with activated carbon, worked the best. Activated carbon's high surface area allowed it to adsorb more CO₂, while the alginate provided structural stability and the calcium chloride crosslinking enhanced durability. As climate change continues to threaten the future of our planet, finding efficient and sustainable ways to reduce CO₂ is more urgent than ever. This research addresses one of the most critical challenges of our time, offering a potential solution to combat global warming and reduce atmospheric CO₂.

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Abstract: Science and Engineering Fair of Houston

3157

Water Filtration System

Joi Johnson

Fort Bend ISD /Hightower High School

Category

**Earth and
Environmental Sciences**

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Abstract: Science and Engineering Fair of Houston

3158

The Effects of Various Microplastic Fiber Exposure on Phytoplankton

Tamila Pavlova

Ashley Fong

Conroe ISD /AST: Academy of Science and Technology

Category

**Earth and
Environmental Sciences**

Microplastics are all around us: they are in the food we eat, the air we breathe, and every corner of the world. When ingested, they can lead to immense negative effects on human health. In more recent years, marine ecosystems around the world have seen microplastics build up on shores and in oceans, with a majority of them being microfibers from runoff wastewater due to washing machines and textiles factories. Within these oceans are phytoplankton: arguably the most important organisms due to their role in providing a majority of Earth's oxygen. In this experiment, the student researchers conducted a test to determine the varying impacts of different microfibers, specifically acrylic, polyester, and polyamide material, exposed to phytoplankton, focusing on the pH and dissolved oxygen levels. Four trials were conducted, each including four different containers full of a ratio of phytoplankton to water. Three containers were subject to the three types of microfiber material, with the fourth as a control. Overall, the data collected shows that the presence of microfibers in water has a negative impact on the productivity of phytoplankton in water, and therefore would have a negative effect on marine ecosystems. Out of the types of microfibers tested, it is best to avoid using nylon fabric especially, due to its greatest impact. In order to strive toward a cleaner world, it is crucial to first understand the effects that factors such as everyday wear have on the environment.

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Abstract: Science and Engineering Fair of Houston

3159

From Skin to Sea: The Unseen Cost of Sunscreen - The Next Wave

Johanna Mastache-Urbina

Nadia Salinas

Fort Bend ISD /Willowridge High School

Category

Earth and
Environmental Sciences

Sunscreen is used by many people throughout the entirety of summer to protect their skin from harmful UV radiation. Often times, people don't think about how they are harming the environment around them while protecting themselves when they get into the water. In this project, we analyze how much UV absorbing chemicals end up in the water by using math formulas. We will create our own formula, add on to store-bought sunscreens, and use regular store-bought sunscreen to test which is the best alternative.

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Abstract: Science and Engineering Fair of Houston

3160

Evaluating the Toxicity of Cosmetics in Aquatic Environments

Yilin Guo

Conroe ISD /AST: Academy of Science and Technology

Category

**Earth and
Environmental Sciences**

Cosmetics can enter aquatic environments through beach runoff, sink and shower drainage, and improperly disposed or leaking products, highlighting the urgent need to assess the environmental impact of their ingredients. This study evaluates the toxicity of glycerin, dimethicone, and non-nano zinc oxide—common cosmetic ingredients—on *Daphnia magna*, small freshwater organisms used as bioindicators for aquatic health. I hypothesized that dimethicone would be the most harmful to *Daphnia magna* due to its low density, allowing it to create a thin film on the surface and coat organisms. This would limit the *Daphnia magna*'s mobility, disrupt physiological processes, and block oxygen. I hypothesized that non-nano zinc oxide would be the least harmful to the *Daphnia magna* because of its environmentally friendly reputation and particle size, which is non-nano and thus too large to be ingested by the *Daphnia magna*. *Daphnia magna* were exposed to increasing concentrations of each chemical, and mortality rates were monitored over 72 hours. T-tests and Probit analyses were conducted to determine the toxicity of each cosmetic chemical and calculate their LD50 values. Results showed that glycerin had negligible toxicity with an LD50 of 2.68g/mL, whereas dimethicone and non-nano zinc oxide exhibited significant toxicity with LD50s of approximately 0g/mL and 0.0472 g/mL, respectively. Overall, these findings highlight the need for eco-friendly alternatives to harmful cosmetic chemicals and the importance of accurate labeling to ensure that "eco-friendly" claims align with their actual environmental impact, particularly for products containing dimethicone and non-nano zinc oxide.

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- yes no



Abstract: Science and Engineering Fair of Houston

3161

Acid Waves

Christy Do
Alief ISD

Category

**Earth and
Environmental Sciences**

Sunscreens on the market contain oxybenzone. This infamous chemical has been linked to several damages to our marine environments. One of them being a factor of ocean acidification. Ocean acidification is the fact that the pH levels of ocean waters are declining over time due to pollutants. This issue has sparked my interest in studying the effects of oxybenzone further to see how drastic the changes in saltwater can be with the presence of sunscreen containing oxybenzone. I hypothesized that if saltwater was exposed to sunscreen containing oxybenzone, then the pH levels of saltwater would decrease. In my experiment, I displayed samples of saltwater to 10 mL of sunscreen containing oxybenzone. I then measured the pH over 0 hrs, 12 hrs, and 24 hrs. After conducting three trials, my data shows that my hypothesis was supported as oxybenzone is a contributing factor to decreasing pH levels.

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- yes no



Abstract: Science and Engineering Fair of Houston

3162

Environmental Effects on the Degradation of Polylactic Acid and Polyhydroxyalkanoates

Felicia Xu

Allison Zha

Conroe ISD /AST: Academy of Science and Technology

Category

**Earth and
Environmental Sciences**

Biodegradable plastics, plastics that can break down into natural substances, may become toxic to the environment if left in unfavorable conditions, ultimately causing harm to the natural world. This study investigates which biodegradable plastic—PLA, PHA, and a blend of the two—will degrade the fastest and which environment of four environments it degrades the fastest in. The four environments were a small container with soil placed outside, a large gardening pot with soil placed outside, a small container filled with soil placed inside, and a large trash can filled with tap water left to natural elements. The plastics were placed in their respective environments and left to degrade over 33 days. After degradation, the percent mass loss was calculated. The results showed that the fastest degradation occurred in the small container placed outside with an average of about 7.36% mass loss. PHA was the fastest type of plastic to degrade with an average of 4.42% mass loss. By identifying the ideal environmental conditions for these three different bioplastics to degrade in, people can make better decisions on how to use and dispose of biodegradable plastics.

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- yes no



Abstract: Science and Engineering Fair of Houston

3163

Plant-Cellulose Based Biodegradable Hydrogels & Their Benefits

Samiksha Dhar Roy

Clear Creek ISD /Clear Lake High School

Category

**Earth and
Environmental Sciences**

The purpose of this experiment was to evaluate the effectiveness of plant-cellulose based hydrogels regarding water retention and seed growth rates when compared to carboxymethyl cellulose (CMC) and agar hydrogels. Three test groups were created (G1, G2, and G2), each with four cups with seeds. One cup was for the control and the other three each had one type of hydrogel. G1 received water every 3 days, G2 every 5 days, and G3 every 7 days. The cups were observed for 14 days, and their masses were measured each day to track water retention. Photos were taken to track germination and growth. Overall, hydrogel containing cups showed better water retention than the controls, but agar hydrogels showed the best water retention altogether. Regarding germination and growth, an interesting finding was in G3, where only the agar hydrogel and plant-cellulose hydrogel cups germinated, showing their benefit as the control did not germinate at all. Further, G3's plant-cellulose cup was taller compared to G3's agar cup, demonstrating its greater benefits in improving growth rates. In G1, all cups germinated, but the agar cup and plant-cellulose cup had the tallest plants, further demonstrating their positive impact on growth rates. To conclude, plant-cellulose hydrogels were found to be effective as in G3 they demonstrated prowess over the control and agar, but it cannot be concluded that they are the best overall, as in G1 and G3, their success was similar to the agar cup.

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Abstract: Science and Engineering Fair of Houston

3164

Dinoflagellates: A New Way of Glow

Jennifer Phan
Alief ISD

Category

**Earth and
Environmental Sciences**

Temperature indeed affects the bioluminescence of dinoflagellates, marine plankton. The organisms emit light as they undergo a chemical reaction with the enzyme luciferase and luciferin. The reaction that they pass through is constrained by temperature. The optimum temperatures usually lie between 20 C - 25 C, enabling the maximum amount of bioluminescent activities by the dinoflagellates. On the other hand, temperatures outside this range can reduce the amount of light produced. High temperatures would accelerate metabolic processes and burn up the luminescent substrates while lower temperatures would retard the enzyme action necessary for light production. The reasons for temperature and bioluminescence in dinoflagellates are important for ecological studies because ocean temperatures are changing. In sum, from the experimentation, dinoflagellates are not efficient in sensing stains.

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- yes no



Abstract: Science and Engineering Fair of Houston

3165

Blame It On The Rain

Talia Padilla

Quinn Abbott

Aubrey Barton

Conroe ISD /ASHP: Academy for Science and Health Prof

Category

**Earth and
Environmental Sciences**

Precipitation patterns play a crucial role in shaping the world's ecosystems and environments. (1) Depending on its frequency, duration, and confidence intervals, precipitation can have either positive or negative impacts. Therefore over time the levels of precipitation vary. (2) One of the main negative impacts can be heavy rainfall leading to flooding/hurricanes and even home destruction, reducing the biodiversity of ecosystems or resulting in vulnerability to ecosystems. (3) Extreme changes in precipitation can even result in different water cycle regulations and a plentiful or sparse amount of water availability. (6) In this study the large amounts of rainfall brought in by Hurricane Harvey along with several other tropical storms around 2020 helps represent the greater rainfall Montgomery might experience. The purpose of the experiment is to analyze the VC Star Weather Station website to collect data based off of the precipitation of each month in the years 1990 and 2020. The 30 year difference is used to gather data from two different climate ranges. Using the website, the data that is collected will be put into an independent T-test to discover the statistical differences between the precipitations of specific time periods. Since the test is complete, the null hypothesis is rejected and the alternative hypothesis fails to be rejected. The findings indicate that there is a statistical difference between the amounts of precipitation of the years 1990 and 2020. The rainfall increases by 8.5 inches, which is 20%. Resulting in an increase of rainfall from 1990.

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Abstract: Science and Engineering Fair of Houston

3166

Beads of Hope: How microalgae can be used to remove excess nitrogen and phosphorus from wastewater

Mahika Pakal

THE JOHN COOPER SCHOOL - HS

Category

Earth and
Environmental Sciences

Excess nutrients in wastewater coming from municipal, industrial, and agricultural sources threaten scarce freshwater resources, leading to eutrophication and disruption of aquatic ecosystems. Wastewater treatment research is testing microalgae-based bioremediation, however, these methods are still in development. Recent studies show sodium acetate (NaAc) and iron chloride (FeCl₃) can accelerate nitrogen and phosphorus removal in growth cultures. In this study, microalgae beads (*Chlorella pyrenoidosa*, *Scenedesmus quadricauda*) were kept in flasks containing sterilized municipal wastewater, and supplements (sodium acetate, 2 mg/L; iron chloride, 0.05 mg/mL) were added to various flasks. Changes in pH, nitrate-N levels, nitrite-N levels, and phosphate levels were measured using commercially available test strips over the course of four days. Flasks were kept inside a grow tent with controlled temperature and an 18:6 light-dark cycle. Results showed that sodium acetate (2 mg/mL) greatly increased the speed of nitrogen and phosphorus removal, while iron chloride (0.05 mg/mL) as a supplement proved ineffective. Similar removal results were obtained with 50% of the sodium acetate (1 mg/mL) in a second experiment, thereby showing that less is required to obtain the same result. This study revealed that sodium acetate can be used in wastewater treatment facilities as a rapid, efficient supplement to remove excess N/P compared to just microalgae alone. The microalgae used in this study took the form of immobilized "boba-style" beads instead of the typical free-floating microalgae, which suggests that the beads could more easily be integrated into existing wastewater treatment processes.

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Abstract: Science and Engineering Fair of Houston

3167

Pesticide Purge

Julliette Mayorga

Aqsa Faheem

Grace Filson

Conroe ISD /ASHP: Academy for Science and Health Prof

Category

**Earth and
Environmental Sciences**

This project aims to promote a safer agricultural environment by addressing pesticide runoff, which contaminates water sources. While pesticides are commonly used by farmers to control pests, these chemicals often end up in nearby water, posing environmental and health risks. This project aims to eliminate pesticides using *Pseudomonas putida*, a bacterium that breaks down harmful chemicals. The experiment used a spectrophotometer to measure pesticide levels in Ortho Home Defense, which contains the active ingredient bifenthrin. Bifenthrin is harmful to humans, causing skin and eye irritation, respiratory issues, and long-term health risks. Pesticide levels were measured before and after applying the bacteria to the soil, with observations made over a week. This approach could help protect water quality, support sustainable farming practices, and reduce the health risks associated with pesticide exposure. This project gave us the results that *Pseudomonas Putida* that accurately break down Bifenthrin.

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human participants

potentially hazardous biological agents

vertebrate animals

microorganisms

rDNA

tissue

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yes

no



Abstract: Science and Engineering Fair of Houston

3168

Impact of Freshwater Acidification on Pollutant Toxicity using Daphnia as Bioindicators

Elizabeth Nguyen

Katelyn Dang

Alief ISD

Category

**Earth and
Environmental Sciences**

Acidification and exposure to pollutants are two of the increasing environmental issues with potentially great impacts on aquatic ecosystems. This study focuses on the impact of acidification and pollutants on survival and heart rate of *Daphnia magna*, one of the most common freshwater bioindicator species. The *Daphnia* were exposed to different pH values, control at pH 7 and acidified conditions at pH 6.5, 6, 5.5 and 5, in order to evaluate the effects of mortality and physiological stress. The survival rates were recorded in a 80-minute exposure, and heart rates for three *Daphnia* per condition were measured for stress. Initial findings showed that pollutants and extreme acidification drastically increased mortality within 20 minutes, but at moderate levels of acidification, some *Daphnia* survived. Heart rate measures gave further details on stress responses through a decrease of average beats per minute in containers with acidification and pollutants. Compared to the acidification trials, that didn't fluctuate in heart rate and remained stable. This evidence displays the effect of acidification and pollution on aquatic organisms' health, showing the importance of maintaining water quality in preserving ecosystems.

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Abstract: Science and Engineering Fair of Houston

3169

The Unique Properties of Water

Mustafojon Tursunbadalov

SST - Champions College Prep - HS

Category

**Earth and
Environmental Sciences**

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Abstract: Science and Engineering Fair of Houston

3170

Evaluating the Efficiency of Different Green Cobalt Nanoparticle Concentrations in Aiding Aquatic Oil Spills

Kemli Vo
Phuong Le
Alief ISD

Category

**Earth and
Environmental Sciences**

The Deepwater Horizon oil spill in 2010 highlighted the need for innovative and eco-friendly solutions to mitigate the environmental impact of oil spills. Current methods, including hair mats, have limitations in terms of efficiency, reusability, and environmental sustainability. This project explores the potential of green synthesized cobalt nanoparticles as a novel solution for oil spill remediation. These nanoparticles exhibit unique electromagnetic properties, enabling efficient removal of hydrocarbons from water through magnetism. Moreover, the extracted oil can be reused, reducing waste and environmental harm. The nanoparticles can be reused multiple times through centrifugation, making them a reliable and cost-effective solution. Our experiment demonstrates the successful synthesis of green cobalt nanoparticles using *Osimum Sanctum* leaf extract and their ability to form magnetic nano composites. The results support the hypothesis that increasing the concentration of cobalt solution enhances the efficacy of oil removal. In only 15 seconds, the green cobalt nanoparticles were able to absorb 96% of the oil. This innovative approach has far-reaching implications for environmental remediation, offering a sustainable and efficient solution for oil spill cleanup.

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Abstract: Science and Engineering Fair of Houston

3171

A Dirty Deep Dive

Chris Clark-Timmerman

Dylan Francisco

Joseph Bader

Conroe ISD /ASHP: Academy for Science and Health Prof

Category

**Earth and
Environmental Sciences**

Hurricane damage, especially to ill-prepared houses, can be devastating to homeowners. After witnessing a broad range of destruction caused by Hurricane Beryl, the suspicion that land grading could be connected to increased erosion rates arose, as erosion can be linked to increased flooding and decreased soil health. After research at various graded and non-graded sites, it was discovered that there is no statistical difference between the erosion rates at non-land graded sites compared to the erosion at land graded sites. Land graded sites had a standard deviation of 0.064, while non-graded sites had a standard deviation of 0.0636: together, the data had a standard deviation of 0.063, thus showing that there is no statistical difference between the data gathered. While this data doesn't prove a connection between land grading and erosion rates, it allows a redirection of attention towards other possible causes of erosion on different properties.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human participants potentially hazardous biological agents
 vertebrate animals microorganisms rDNA tissue

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- yes no

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- yes no

4. This project is a continuation of previous research.

- yes no

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- yes no



Abstract: Science and Engineering Fair of Houston

3172

Investigating the Effects of *Bacillus subtilis*, *Chlorella pyrenoidosa*, and Thermal Conditions on the Mitigation of Eutrophication

Katherine Liu

Sahana Saravanan

Conroe ISD /AST: Academy of Science and Technology

Category

Earth and
Environmental Sciences

This study investigated the effectiveness of *Bacillus subtilis*, *Chlorella*, and varying thermal conditions on the mitigation of eutrophication caused by agricultural runoff. Agricultural runoff, containing excess nutrients from fertilizers, such as nitrates, phosphates, and glyphosates, negatively impacts the quality and biodiversity of nearby bodies of water, as well as poses a threat to safe drinking water for humans. Bioremediation, using microorganisms such as *Bacillus subtilis* and *Chlorella*, is a promising solution for addressing this problem. For this project, the hypothesis stated that the combined usage of *Bacillus subtilis* and *Chlorella* in a warm condition would perform the most effectively. To test this, 48 samples of simulated agricultural runoff were treated with 4 different methods- *Bacillus subtilis*, *Chlorella*, combined (*Chlorella* and *Bacillus subtilis*), and a control. The samples were put under a range of temperatures to simulate different climates (0°C to 30°C) and the pollutant concentrations were monitored using water testing kits over a course of 10 days. Results showed that the combined method in a warm temperature range (20°C–35°C) achieved the greatest reduction in pollutants, confirming the hypothesis. Moderate temperatures (10°C–20°C) also showed some reduction in pollutant levels, while cold conditions (0°C–10°C) were the least effective. These findings suggest that warmer temperatures enhance the bioremediation capabilities of *Bacillus subtilis* and *Chlorella*, as well as the combined usage of both microorganisms. This research study provides valuable insights for optimizing bioremediation strategies in varying climates, potentially offering scalable solutions to improve water quality and biodiversity in areas affected by eutrophication.

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microorganisms

rDNA

tissue

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yes

no



Abstract: Science and Engineering Fair of Houston

3173

The Effect of Interior Car Temperature on Formaldehyde Release

Emily Zwart

Clear Creek ISD /Clear Lake High School

Category

Earth and
Environmental Sciences

Multiple studies have shown that formaldehyde, a colorless, strong smelling volatile organic compound, is emitted through processed materials like leather seats in motor vehicles and results in the 'new car smell' that consumers love but has been added to the list of carcinogens since 2011. In this experiment I wanted to test different interior temperatures of a car and see if it effects the amount of formaldehyde released, and I predicted that there would be a substantial growth in the amount of formaldehyde when the interior car temperature was above 90 degrees Fahrenheit. I used a volatile organic compound (VOC) meter to measure temperature, HCHO (formaldehyde), and humidity. I placed the VOC meter in a parked car for about 10 hours over 5 different days to get a range of temperatures from 50 degrees to 110 degrees Fahrenheit. I used a graph to show my results and calculated a simple linear regression for each of the days to show how the different temperatures affected the amount of formaldehyde produced in the car. As the temperature went up, the amount of formaldehyde in the car increased and got substantially higher at 0.15mg/m³ after 100 degrees had passed. I am aware that this is not enough formaldehyde to be considered toxic, but it is something to account for in the future especially when your car is sitting outside for long periods of time and HCHO can be reduced by simply opening a window or door before getting in your car.

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Abstract: Science and Engineering Fair of Houston

3174

The Influence of Temperature and Plastic Types on the Degradation Rate of Plastic by *Galleria mellonella* (wax worms) Larvae

Ashley O'Reilly

Fort Bend ISD /Austin High School

Category

Earth and
Environmental Sciences

While the rise of accessible plastics has brought convenience to daily life due to its affordability, versatility, and adaptability, it has also led to increased pollution, posing a threat to organisms across nearly every ecosystem. Traditional recycling methods can often be inefficient and expensive, due to the diverse nature of different plastic types, which has led researchers to try to find other methods. Wax worms have specific enzymes in their saliva, Demeter and Ceres, which operates best at room temperature. This project aims to find a relationship between the temperature wax worms are exposed to and the worm's ability to break down different types of plastic (Low-Density Polyethylene (LDPE), Polystyrene (PS), and Polypropylene (PP)). It was hypothesized that wax worms at room temperature would consume more plastic, particularly LDPE, compared to colder or hotter conditions. Nine petri dishes, each containing wax worms and a specific type of plastic, were exposed to three different temperature conditions (Cold, Room, and Hot). The weight of the plastic samples were measured before and after the experiment to assess the degree of degradation and consumption and a paired t-test was conducted. Styrofoam showed a mean loss of 0.03 grams ($t = -7.98, p < 0.05$), while the spoon head lost 0.01 grams ($t = -22.36, p = 0.065$). These results indicate that higher temperatures increase plastic degradation.

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Abstract: Science and Engineering Fair of Houston

3175

Green Guard: Analytics For A Cleaner Earth

Caleb Ajaegbu
Alief ISD

Category

Earth and
Environmental Sciences

Environmental pollution is a critical global issue, with pollutants such as hydrocarbons, petroleum products, organic waste, agricultural waste, pathogens, nuclear waste, medical waste, chemical waste, microplastics, and heavy metals severely impacting ecosystems, public health, and the economy. Current cleanup methods, including mechanical removal and chemical treatments, often fall short in efficiency, leaving residual contamination, harming local communities and environments, or proving economically unsustainable. To address these challenges, I developed Green Guard, an innovative tool that leverages machine learning to optimize pollutant cleanup through bioremediation. Bioremediation harnesses natural biological processes, such as microorganisms or plants, to break down hazardous substances into less toxic forms. Green Guard integrates environmental science with advanced machine learning algorithms to analyze pollutant characteristics and environmental conditions. Using this data, the tool identifies the most effective, eco-friendly bioremediation strategies tailored to specific scenarios. By continuously learning and improving, Green Guard ensures solutions remain adaptable to diverse pollution contexts. This approach is more sustainable, cost-effective, and environmentally friendly compared to traditional methods. Initial testing demonstrated Green Guard's ability to reduce contamination by over 75% while preserving surrounding ecosystems. Additionally, the tool's adaptability allows it to recommend strategies for pollutants in water and on land ensuring broad applicability. By integrating technology and nature, Green Guard offers a scalable, intelligent solution to combat pollution and protect the environment for future generations. This project demonstrates the transformative potential of machine learning in environmental restoration, paving the way for smarter, more sustainable pollution management strategies.

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Abstract: Science and Engineering Fair of Houston

3176

The Impact of Microplastics on Plant Growth

Abirami Balachandran
ST. JOHN'S SCHOOL

Category

Earth and
Environmental Sciences

Microplastics, defined as plastic particles smaller than 5 millimeters, have emerged as a pervasive environmental pollutant, with significant implications for all ecosystems. While much attention has been focused on their presence in marine environments, their infiltration into soil systems put agricultural soil at heightened risk due to the widespread use of plastic mulch, fertilizers including sewage sludge containing microplastic contaminants, and irrigation with polluted water sources. These particles not only alter soil structure and permeability but interfere with essential processes such as water retention, nutrient cycling, and microbial activity. This disruption can have cascading effects on plant health, crop yields, and long-term sustainability of agricultural practices. Moreover, microplastics in soil entering the food chain pose risks to human and animal health. This project aims to investigate the impact of microplastics on plant growth. By understanding how microplastics impact soil ecosystems, this study seeks to inform strategies for recognizing and mitigating their influence and promoting sustainable agricultural practices in the face of growing environmental challenges. We collected data on plant growth in a monitored closed system, controlling for light, humidity, and soil content. Microplastics were created and an equivalent number of microplastic particles were measured and added to the soil. Plant growth was assessed in soils with microplastics and in soils with microplastics and organic compost. The compost was added to counter the expected negative impact of the microplastics on plant growth. Plant growth was recorded in these soils and also in the control. Our result showed that microplastics negatively impacted the plant height and leaf count. We conclude that microplastics in soils can hinder optimal plant growth, but that these effects may be diminished by adding compost to improve soil health.

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Abstract: Science and Engineering Fair of Houston

3177

Acoustic Filtration II: Scaling an Ultrasonic Microplastic Filtration Device and Exploring the Physical Phenomenon of Acoustic Blocking

Victoria Ou

Justin Huang

Conroe ISD /AST: Academy of Science and Technology

Category

Earth and
Environmental Sciences

Microplastics have become a prevalent global environmental issue, with an estimated 75 trillion microplastics in the oceans today. MPs pose dangers to wildlife and cause serious health issues for humans. Existing microplastic removal methods are limited because of high expenses or potentially hazardous chemicals; consequently, a non-invasive, energy-efficient, and cost-effective solution is necessary. Previously, a novel ultrasound filtration system constructed with piezoelectric transducers was able to successfully filter microplastics at speeds of up to 40 mL/min with an acoustic blocking effect, where microplastics would be prevented from passing through the device and clean water would be able to flow through. In this year's study and new experimental setup, the device was upscaled, successfully filtering polyethylene and polystyrene microplastics of sizes 20-200 μm , with 20 μm being ten times smaller than any particle used last year. Tube diameters of 0.96, 2.1, and 3.8 cm were tested with polyethylene as both one-stage and two-stage designs. At flow rates of 40-200 mL/minute, the two-stage 0.96 cm device had filtration efficiencies of 82.5-96.2%. With the two-stage 2.1 cm tube, speeds of 40-300 mL/minute were tested and found to be effective, reaching efficiencies up to 96.5%. Furthermore, the acoustic phenomenon was further explored—the researchers believe that the ultrasonic waves create an increased pressure gradient within the device that blocks particles from passing. With its robust abilities of intercepting source pollution and cleaning contaminated waters, this device can be extended to remove other particle pollutants.

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Abstract: Science and Engineering Fair of Houston

3178

Testing Accessible Water Filtration Materials

Amal Abbasi

Dina Audi

Devika Jith

Harmony South District

Category

Earth and
Environmental Sciences

With the rising cases of waterborne diseases and illnesses resulting from contaminated or undrinkable water, it's increasingly important to have methods of water filtration to return water to consumable levels. Global price increases and decreasing water supply emphasize the need for accessible/affordable filtration methods. Although some research on filtration methods already exists, there hasn't been significant research done comparing filtration methods using highly accessible materials and minimizing costs that takes several sources into consideration. In this project, three sources of water (from water bottles, tap water, and lake water) were collected and tested for drinkability using water testing kits, which quantified levels of common water components, such as alkalinity, pH, iron levels, mercury levels, and more. A total of 16 water contents were tested using the kit, which were used as control values to compare with post-filtration. Four filter materials were collected: semi-fine mesh, cotton fabric, coffee filters, and small sterilized rocks. Then, they were suspended in separate containers and the water sources were poured over to initiate the filtration process. Finally, to evaluate filter effectiveness, water testing kits were used for each container to determine the filter that best returned the water to drinkable levels. The most significant result was that the coffee filter was the most effective at returning all sources to drinkable levels. However, most results from the experiment indicated small changes, rather than major efficiency. It is conclusive that the filtration materials must be harnessed to increase efficiency and yield positive change.

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Abstract: Science and Engineering Fair of Houston

3179

Effects of Using Compost in Flood Mitigation

Jordan Williams

Aldine ISD /Eisenhower HS

Category

Earth and
Environmental Sciences

The purpose of this project is to determine the ratio of compost and soil needed to help mitigate flooding on land by measuring how each mixture of different ratios of compost and soil absorbs and retains water. Total mass of compost and soil mixture used in the investigation was 200 g. The compost-soil mixture was placed inside a ziploc bag, mixed well and then transferred into a 250-ml beaker. To measure water retention, a 100 ml of water was then poured into the compost-soil mixture until water starts overflowing or spilling out of the beaker. The water used before spilling served as the water retention data. Based on the results, the mixture of $\frac{1}{4}$ of compost (50 grams) and $\frac{3}{4}$ of soil (150 grams) has absorbed and retained the most amount of water which was 120 milliliters on average, unlike the other mixtures which barely retained 100 milliliters if not at all. Therefore if we mixed at least $\frac{1}{4}$ the amount of soil with compost it can help retain most of the water which will also help reduce land areas from being flooded for long periods of time. It is recommended that different ratios and different types of soil will be explored as well since they may make a significant impact on water retention depending on the environment, geographic conditions or climate of the area.

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Abstract: Science and Engineering Fair of Houston

3180

The Effects of Ocean Acidification and Photosynthetic Pigments on Algae Ecosystems of Gracilaria parvispora and Caulerpa taxifolia in the Mare Pacificum

Zara Arsiwala

Megan Li

Conroe ISD /AST: Academy of Science and Technology

Category

Earth and
Environmental Sciences

There are many negative environmental phenomena that are occurring in the world, however one less commonly known is ocean acidification. Ocean acidification is the rapid absorption of carbon dioxide into the ocean's water, which lowers its pH levels overtime. This negatively impacts many marine organisms, or for this research, algae. The researchers hypothesized that when the ocean acidity level is higher and the algae is grounded, then the algae will thrive and retain a darker color pigment. To test the effects of this occurrence, the researchers grew two types of algae, one red - Gracilaria Parvispora, and one green - Caulerpa Taxifolia to gain perspective of the effects on a variety of algae types. Both types of algae had different photosynthetic pigments, which are chemicals that allow algae to photosynthesize. This influences the amount of light energy converted in cells, changing the rate of growth in each algae. There were six of each algae strand with 3 of each grounded in sand, to test whether structure influences an algae's health. Each algae was placed in a solution of lower (four), control (seven), or higher (ten) pH. After the six week period of observation the results in pigmentation indicated the decline in condition of the algae in a lower pH solution, supporting the hypothesis. However, the hypothesis that the algae will thrive better when grounded wasn't supported due to inconclusive results. This proves the harmful effects of ocean acidification overtime on marine organisms and its potential harm in the future.

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Abstract: Science and Engineering Fair of Houston

3181

Predicting Future Water Quality with Machine Learning and AI

Rohan Ghosh
Tomball ISD /Tomball HS

Category

**Earth and
Environmental Sciences**

Measuring water quality in natural bodies is complex, and human predictions are often unreliable. In contrast, machine learning models that analyze historical data from similar cases offer a more accurate and reliable approach to forecasting the future condition of water sources. Good water quality is crucial for providing safe drinking water to communities and supporting the health of plants and wildlife. However, it is easy to overlook the origins of the water we consume daily. Ensuring the continued availability of clean water should be a top priority for sustaining future generations. Waiting for water quality problems to manifest before action only leads to unnecessary costs and challenges, often making remediation efforts more difficult or even impossible. This project aims to explore the potential of predictive models to safeguard our water sources and highlight the importance of proactive measures in maintaining clean water for the future. Measuring water quality in natural bodies is complex, and human predictions are often unreliable. In contrast, machine learning models that analyze historical data from similar cases offer a more accurate and reliable approach to forecasting the future condition of water sources. Good water quality is crucial for providing safe drinking water to communities and supporting the health of plants and wildlife. However, it is easy to overlook the origins of the water we consume daily. Ensuring the continued availability of clean water should be a top priority for sustaining future generations. Waiting for water quality problems to manifest before action only leads to unnecessary costs and challenges, often making remediation efforts more difficult or even impossible. This project aims to explore the potential of predictive models to safeguard our water sources and highlight the importance of proactive measures in maintaining clean water for the future.

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Abstract: Science and Engineering Fair of Houston

3182

Water Wizards: Mycoremediation as a Solution to Phosphorus

Ella Mitchell

Alizeh Malik

Conroe ISD / ASHP: Academy for Science and Health Prof

Category

**Earth and
Environmental Sciences**

This project aims to reduce phosphorus pollutants in runoff, which is important for protecting the environment. The goal was to test how mycorrhizae can help lower phosphorus levels and improve ecosystems. We started by setting up garden beds with 3-by-2-foot sections, adding soil, and placed a plastic container every 2 feet. A week before the main experiment, we treated three water hawthorn plants with a 3.3-gram mycorrhizae solution in 15 liters of water. Then we placed the plastic containers in and ran the pumps through, and planted lettuce seeds to represent crops. The plants were watered with 15 liters of water daily, letting the runoff flow into the simulated stream. In the experiment, we placed untreated water hawthorn plants in regular water and treated ones in the mycorrhizae solution. Then tested the phosphorus levels every week over 5 weeks using phosphorus ppm tests. The results showed no significant difference in phosphorus reduction between the treated and untreated plants. Going forward, we plan to improve the testing methods, make the process more precise, and get more accurate data to better understand how mycorrhizae affects phosphorus levels.

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Abstract: Science and Engineering Fair of Houston

3183

Visible-Light Photocatalysis for Innovative Nitrate-Contaminated Water Treatment: Assessing the Efficiency of Molybdenum-Doped Bismuth Vanadate Thin Films Coupled with *Paracoccus denitrificans* for Enhanced Denitrification

Tristan Li

Source: ISD / AST: Academy of Science and Technology

Category

Earth and
Environmental Sciences

Nitrate contamination from agricultural runoff poses significant environmental challenges, including eutrophication and harmful algal blooms (HABs). Conventional remediation methods, such as chemical reduction and physical filtration, are often costly, inefficient, and prone to secondary pollution, necessitating sustainable alternatives. This study investigates a dual system combining biological denitrification by *Paracoccus denitrificans* with photocatalytic enhancement using molybdenum-doped Bismuth Vanadate (BiVO₄) thin films. Photocatalysts with molybdenum doping levels of 0%, 0.5%, 0.75%, and 1% were synthesized with a simple solution process to generate electron-hole pairs under visible light, supplying electrons to *P. denitrificans* in anaerobic conditions to enhance denitrification. Simulated nitrate-contaminated water (60 ppm) was treated for two hours, with nitrate concentrations analyzed using the zinc reduction method. Without photocatalysts, the average final nitrate concentration was approximately 68.9 ppm, likely attributed to incomplete denitrification. Photocatalyst activation significantly improved nitrate removal, with the 1% molybdenum-doped BiVO₄ achieving the greatest reduction to 40.6 ppm under maximum LED illumination. A two-way ANOVA revealed that molybdenum doping levels and light intensity were both significant factors in improving nitrate remediation. The results demonstrated that higher doping levels correlated with more efficient electron transfer, leading to enhanced denitrification. While nitrate reduction slowed at higher light intensities, the reaction remained active, indicating that further optimization of photocatalyst design could yield even greater efficiency. These findings highlight the potential of integrating photocatalysis with biological denitrification as a scalable, cost-effective solution for nitrate remediation, offering promising applications in wastewater treatment and agricultural runoff management.

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Abstract: Science and Engineering Fair of Houston

3184

Air Pollution

Derek Agosto-Liceaga
School of Science and Technology, Houston - MS

Category

**Earth and
Environmental Sciences**

Air pollution is a critical environmental issue, caused by the release of harmful substances like particulate matter (PM), nitrogen oxides (NO_x), sulfur dioxide (SO₂), and carbon monoxide (CO) from industrial activities, transportation, agriculture, and waste. These pollutants significantly impact human health, leading to respiratory diseases, cardiovascular problems, and increased mortality, especially among vulnerable populations. Air pollution also contributes to climate change by emitting greenhouse gases like CO₂ and methane, and harms ecosystems through acid rain, soil degradation, and reduced biodiversity. The global increase in urbanization and industrialization has worsened air quality, with pollutants often crossing borders. Efforts to address air pollution include stricter emissions regulations, the adoption of clean energy technologies, and public awareness campaigns. Despite progress, air pollution remains a significant threat, requiring ongoing international cooperation and innovation to mitigate its effects on health and the environment.

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Abstract: Science and Engineering Fair of Houston

3185

Effectiveness of Moringa and SODIS in Treating Turbid Water

Francisca Natter
Mariana Govea
Aldine ISD /Eisenhower HS

Category

**Earth and
Environmental Sciences**

The purpose of this experiment is to find ways to improve water quality such as clarifying turbid water and making it safer for drinking in resource limited settings with materials that are inexpensive and locally found. Moringa seeds known for its coagulant properties were grinded into powder and mixed with 500 ml of turbid water from the Bayou. It was stirred using a stirrer and left to sit overnight. Suspended particles were removed. After sedimentation, the treated water was then transferred into clean PET bottles and exposed to sunlight for UV irradiation of microorganisms that may be present in the clarified water. Before the water was exposed we got a sample and smeared it on nutrient agar and it was placed in an incubator for 24 hours. After 8 hours the water exposed outside will be brought inside and then also smeared on a different nutrient agar for 24 hours at 37°C. Before the sun exposure, there was more microbial growth. After the sun exposure, there was less microbial growth. It was not 100% eliminated but it was considerably less. This experiment proves that moringa seed and solar disinfection are capable of purifying and clarifying turbid water. It is recommended that more trials using other plant-based coagulants, increased sun's exposure and other methods of disinfecting the water will be explored to verify the current findings and provide better options in making water potable and accessible.

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 vertebrate animals microorganisms rDNA tissue

2. This abstract describes only procedures performed by me/us, reflects my/our own independent research, and represents one year's work only.

- yes no

3. I/We worked or used equipment in a regulated research institution or industrial setting.

- yes no

4. This project is a continuation of previous research.

- yes no

5. My display board includes non-published photographs/visual depictions of humans (other than myself):

- yes no

6. I/We hereby certify that the abstract and responses to the above statements are correct and properly reflect my/our own work.

- yes no



Abstract: Science and Engineering Fair of Houston

3186

The Effect of Residential Cooking on Indoor Air Quality

Hannah Zhou

Clear Creek ISD /Clear Lake High School

Category

**Earth and
Environmental Sciences**

Air pollutants that adversely affect people's health by causing noncommunicable diseases, such as PM2.5 and PM10, can be generated by household cooking. While much importance is placed on outdoor air quality, not many people know about the harmful pollutants created by domestic cooking. The purpose was to determine how much PM2.5 and PM10 was produced by utilizing different cooking methods such as frying, boiling, stir-frying, air frying, and the oven to cook different foods, and if the pollutants generated changed based on the food that was cooked. The hypothesis was that frying food will generate the largest amounts of pollutants overall. The foods (bacon, eggs, chicken noodles, frozen shrimp tempura, frozen chicken nuggets, and beef) were cooked individually with different methods with an air quality monitor about a foot away from the source of pollution. The PM2.5 and PM10 generated was recorded down every few minutes. The data collection was stopped when pollutant concentrations reached relatively low levels. The data showed that boiling and using the oven are safer methods of cooking foods as they generated the lowest levels of PM2.5 and PM10, while frying and air frying foods generated more pollutants in comparison. The food being cooked significantly impacted the amount of PM2.5 and PM10 produced. Due to the dangerous nature of the pollutants and the amount produced by cooking shown in the experiment, using a hood, air purifier, or ventilation is necessary to minimize any possible harmful effects.

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Abstract: Science and Engineering Fair of Houston

3187

Is Air quality equal across Harris County

Rafael Perez

Pasadena Memorial High School

Category

Earth and
Environmental Sciences

This project examines the relationship between green spaces, population density, and air pollution by analyzing PM2.5 levels in various Texas counties, with a focus on Harris and Culberson counties. The study aims to determine whether areas with more green spaces and lower population densities experience better air quality, as green spaces can act as natural air filters while higher populations contribute to increased pollution levels. The motivation behind this research stems from concerns about air pollution caused by Texas extensive oil and refinery industries. Data analysis revealed that Culberson County, with its abundant green spaces and low population, had better air quality compared to the highly populated and industrialized Harris County. The findings highlight the significant impact of urbanization, industrial activity, and population density on air pollution levels.

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Abstract: Science and Engineering Fair of Houston

3188

Assessment of Equine Population Impact on Local Biodiversity of Invertebrates

Esther Levin
Homeschool

Category

**Earth and
Environmental Sciences**

Biodiversity tends to increase the stability of ecosystems, which makes it a lot easier for us to maintain agriculture and be sure that we are not going to starve. In my research I focus on pasture biodiversity. It turns out that in Texas researchers, when measuring biodiversity on pastures, are usually concerned with plant diversity. Unlike many other pasture biodiversity assays, my project was focused on invertebrate animal diversity and not on plant diversity. I did all of my fieldwork from the beginning of September till the middle of October. I picked two pastures, one where every night horses are going to be grazing, (the horse pasture) and another one that had no horses in the prior 5 months (the empty pasture). I set up 4 pitfall traps in each pasture. On both pastures the traps stood for the same amount of days before I checked on them. For the pitfall traps I used clear 20 oz plastic cups. I uploaded the photos to Inaturalist in order to identify the caught invertebrates. I found 52 invertebrates on the horse pasture and only 10 on the empty one. The amount of different species on the horse pasture is greater than on the empty one, however, the number of orders is not significantly different between the pastures. In Brookshire, TX, in September and October, when it is still hot and humid, horses increase the biodiversity of invertebrates, especially beetles and spiders.

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