CALIFORNIA SCIENCE & ENGINEERING FAIR
2018 PROJECT SUMMARY

Name(s)
Acts Avenido; Jackson Bates

Project Number
J1601

Project Title
Filtration Station

Abstract

Objectives/Goals
The objective of this project is to determine a cheap, efficient, effective, and easily accessible way to filter out water for those in developing countries.

Methods/Materials
Rainwater, Coffee Filters, Charcoal, Plastic Bottles, a roll of tape, Petri Dishes, Beef bouillon powder, Incubator, Measuring Cup, 4 Tupperware Containers, Regular Concentrated Bleach, Scissors, fine sand, Coarse sand, Pebbles, Sugar, and Unflavored gelatin. We created 5 different types of cheap, efficient, effective, and easily accessible filters and ran water through them. We then swabbed the water and put it into Petri dishes. We measured and examined the bacterial growth for each of the filters.

Results
Our objective was to find the best cheap, efficient, effective, and easily accessible method of filtration for those in developing countries. We created 5 methods of filtration. Environmental Filter with pebbles and sand, Charcoal filter, Solar Filter, Bleach Filter, and Coffee Filter. We swabbed the water that was run through each filter and put them in Petri dishes. We examined the bacterial growth and we found out that the Environmental filter proved to work the best because it had the least amount of bacterial growth on average.

Conclusions/Discussion
This project can expand the knowledge about the subject because we give a deeper understanding of the efforts on how to make cheap filters. It can aid those in developing countries because it gives them a better way to filter their water and prevent diseases and bacteria from spreading through the water they drink. We now know which cheap method of filtration works the best which is the Environmental Filter which the pebbles and sand because it had the least amount of bacteria growth.

Summary Statement
After filtering water through various filters and studying the bacterial growth of the water of each filter, we can prove and conclude that Environmental filter, which consist of pebbles and sand, works the best.

Help Received
My partner and I developed and did most of the project alone although we would like to give a special thanks to our mother, who supplied us with materials and rides, as well as our science teacher, Mrs. Conrad, who helped us throughout the project.

CALIFORNIA SCIENCE & ENGINEERING FAIR
2018 PROJECT SUMMARY

Name(s)
Gregory E. Eiseman

Project Number
J1602

Project Title
Removing Bacteria with Gum

Abstract

Objectives/Goals
The objective of this study was to see if chewing gum removed bacteria just as well as teeth cleaners did.

Methods/Materials
A doctor,
Up & Up 1.5L mouthwash,
Filtered water,
2x10 ct. Orbit kosher gum w/ xylitol,
30 ct. Bazooka sugar gum,
4 oz. dixie cups,
Cotton swabs,
Latex gloves,
28 Petri dishes with nutrient agar,
Sharpie,
Timer,
Incubator,
Thermometer

Results
The results from this project showed that mouthwash is the best at removing bacteria from the items tested with a decrease of 56.9%, followed by the sugar-free gum with xylitol with a 37.74% percent decrease, and finally water with a 4.6% decrease. Sugar gum actually increased the amount of bacteria by 21.46%.

Conclusions/Discussion
From the results of this project, you can apply it to different areas of study. The first area would be dentists. They would use it by suggesting to their patients to increase their chewing of sugar-free gum. The second area that would use this information would be the head or owners of sugar-free gum companies. By including on the chewing gum packets that this gum helps clean teeth, it would appeal to the public resulting in an increase in the company's value.

Summary Statement
My project is about using chewing gums to remove bacteria from subjects mouths.

Help Received
Since a kid like me is not allowed to take bacteria samples from subjects mouths, my dad helped me, since he is a doctor.

CALIFORNIA SCIENCE & ENGINEERING FAIR
2018 PROJECT SUMMARY

Name(s)
Ruth Hansard; Riley Stubbs

Project Number
J1603

Project Title
Testing the 5 Second Rule: The Safety and Quality of Food Dropped on the Floor

Abstract

Objectives/Goals
The objective of this study is to measure bacteria growth on apples dropped on the floor for various time amounts to test the "5 second rule" which says food is safe to eat if it is removed from the floor in less than 5 seconds.

Methods/Materials
Petri dishes, nutrient agar, apple wedges and stopwatch. Tested the taste and amount of bacteria present on apple slices dropped on floor for various amounts of time.

Results
Apple wedges were dropped on the floor to test the amount of bacteria present after each trial. Various trials were run to determine if the increase in amount of time on the floor corresponds to the increase of bacteria found on the apple. The bacteria growth varied directly with the amount of time spent on the floor, however the taste was unaffected.

Conclusions/Discussion
An apple slice was dropped on the floor for five seconds. The surface of the apple was swabbed and collected in a petri dish to study the amount of bacteria present. The apple was also tested for taste. Although there was no significant change in taste, the amount of bacteria found on apple's surface increased with the amount of seconds left on the floor.

Summary Statement
Although the taste did not change, we found the growth of bacteria collected from food dropped on the floor proves the "5 Second Rule" is false.

Help Received
None, we designed and executed the experiment by ourselves.

CALIFORNIA SCIENCE & ENGINEERING FAIR
2018 PROJECT SUMMARY

Name(s)
Marie G. Huitt

Project Number
J1604

Project Title
Walnut Crown Gall: The Effect of Removal and Treatment

Abstract

Objectives/Goals
My objective is to determine if I can cure walnut crown gall with a chemical method or by using a natural torch sterilization method without harming the environment and getting my walnut trees back to full production, and healed from any galls growing back.

Methods/Materials
During the course of this two-year study, I observed 20 Chandler walnut trees that had been damaged with root and crown galls formed. One half of the trees(10) had galls cut and burned using the natural torching sterilization method, the other (10) trees had chemical Gallex applied. I removed the dirt away from the crown and roots using an air compressor to not harm the trees. I cut galls off with an ax and pruning knife back to the new wood so the bacteria won't spread to new tissue. When trees were free of galls I replaced original soil that had Agrobacterium Tumfaciens with a sterilized peat around the roots and crown.

Results
After a 2 year study the best results I had were by using the hot propane natural sterilization torch method and by first cutting off all the root and crown galls with an ax and pruning knife, then torching a 2 inch ring past the gall area into the new wood. This sterilized the area so no bacteria spread to the surrounding tissues. I had a 95% success rate with the torch method and 40% using Gallex a bacterial application that produces antibiotics toxic to the pathogen and kills it. I observed galls kept returning where I used Gallex.

Conclusions/Discussion
In conclusion this experiment after 6 months showed that by using the natural sterilization torch method I had a 95% cure rate, especially if galls were found early and treated. The chemical Gallex was expensive and had to be reapplied many times as the galls kept returning even though I painted and overlapped the chemical so it penetrated into the bark to kill the bacteria. Early detection and treatment had the best success rate. All treatments were done in spring during growing season so the tissues could callus and heal. On average torching method calluses closed 7.5 inches in 6 months, Gallex 4.5 inces in 6 months. I removed contaminated dirt and replaced it with sterilized peat which stopped reinfections. This was a safe, easy, inexpensive and effective method to remove crown gall without putting harmful chemicals into the tree, ground or ground water supply.

Summary Statement
I tested if natural torch sterilization or chemical method was the most effective way to treat and cure crown galls and get your walnut trees back to full production.

Help Received
My mother provided the walnut trees and helped me to apply the Gallex and supervise use of the propane torch.

Name(s)
Jason Khan; Kurrun Sethi

Project Number
J1605

Project Title
Determining the Effectiveness of Aloe Vera Gel as a Mold Growth Inhibitor on Various Fruits

Abstract

Objectives/Goals
The purpose of this project is to investigate how different quantities of Aloe vera (A. Barbadensis miller) gel applied on different types of fruits affect the growth of mold on them.

Methods/Materials
Four different types of fruits, Aloe vera leaves, utensils, trays, camera, spray bottle, blender.
Measured mold growth in a moist, dark environment, over time using grid photography, on four different types of fruit coated with various amounts (None, 1.5 tbsp, 3 tbsp) of Aloe vera gel.

Results
By the end of the testing period, the apples and oranges with no gel showed 1% mold growth while both the 1.5 and the 3 tablespoon fruits had no mold growth . The tomatoes with no gel had an average of 20% mold growth, while the tomatoes with 1.5 and 3 tablespoons of gel showed no mold growth. The strawberries with no gel showed onset of mold growth first, and ended up at at an average of 79% mold growth. The strawberries with 3 tablespoons of gel showed onset of mold growth next and ended up with 100% mold growth, but the strawberries with 1.5 tablespoons of gel showed onset of mold growth last and ended up with an average of 60% mold growth.

Conclusions/Discussion
The hypothesis was not definitively supported by the results. The data did show that all fruits with no Aloe vera gel began developing mold growth before the same type of fruit with Aloe vera gel applied, so the Aloe vera did appear to inhibit the onset of mold growth. But the amount of Aloe vera gel applied was not inversely proportional to the amount of mold growth. The fruits with 3 tablespoons of Aloe vera gel applied did not consistently show less mold growth than the fruits with 1.5 tablespoons of Aloe vera gel applied.

Summary Statement
The application of Aloe vera gel to fruits inhibited the onset of mold growth, but the amount of gel applied was not always proportional to mold growth resistance.

Help Received
We designed, built, and performed the experiments ourselves. Our Math teacher, Pam Durkee, helped us select an appropriate formula for calculating the area of an irregular shape.

CALIFORNIA SCIENCE & ENGINEERING FAIR
2018 PROJECT SUMMARY

Name(s)
Lily M. Landeros

Project Number
J1606

Project Title
How Much Bacteria Is on Your Reusable Bag?

Abstract

Objectives/Goals
The purpose of my project was to discover how much bacteria is growing on new and used reusable plastic grocery bags. What happens if you spill liquids? My hypothesis was that spilled liquids will cause the most bacteria to grow and chicken liquid would cause a lot of bacteria to grow.

Methods/Materials
I took 3 new and 3 used plastic grocery bags, applied liquids, let them dry and then stored the bags for 2 days. I then swabbed the bags and grew bacterial samples in agar petri dishes. To measure the bacterial count, I took photographs of each petri dish and used the software ImageJ(Developed by National Institutes of Health) to count the bacterial colonies.

Results
My hypothesis for my experiment was if different liquids are spilled on bags, more bacteria growth will occur. I thought that the chicken liquid would grow the most bacteria because it is a raw meat and it would develop more colonies. This hypothesis was partially correct. Spilled liquids on both new and used bags caused higher bacterial counts on both new and used bags compared to the control bags. The new bag control had an average bacterial count of 60 units. This indicates that brand new bags have lower bacteria counts to begin with but when liquids are spilled the bacterial count increases. This also partially occurred for used bags. The used bag control had an average bacterial count of 296.67 and upon spilling juice and milk in the used bags, the count increased to 321.00 and 349.33. However for chicken and grape the bacterial count was lower.

Conclusions/Discussion
I don't believe that my experiment conclusively proved the effects of spilled liquids on bacteria contamination, but in general used bags were dirtier than new bags, and spilling liquids increased the bacteria count. Spilling juices on used grocery bags caused the most bacterial growth. I was surprised the chicken meat liquid did not cause the most bacterial growth. My petri dishes also grew fungi and mold indicating the presence of other foreign contaminants.

Summary Statement
My project was about measuring bacterial contamination in reusable plastic grocery bags and investigating what liquids would cause the most bacterial growth.

Help Received
Dr. Belluzzi (Santa Barbara City College) reviewed the agar petri dishes to help determine when maximum bacteria growth had occurred and also explained the difference between bacterial, mold, and fungal growths.

CALIFORNIA SCIENCE & ENGINEERING FAIR
2018 PROJECT SUMMARY

Name(s)
Maille R. Mansbridge

Project Number
J1607

Project Title
Bacteria on Turf and Grass Soccer Playing Surfaces

Abstract

Objectives/Goals
The experiment was to measure which soccer playing surface (artificial turf, grass) cultured the most bacteria in a petri dish containing nutrient agar. It was expected that artificial turf fields would culture more bacteria as they are cleaned less often and the temperature they have is hotter and more suited to bacteria.

Methods/Materials
Six soccer fields, three grass and three turf, were swabbed and the samples were transferred to a petri dish containing nutrient agar. Each set of grass and artificial turf fields was adjacent and received the same environmental changes. The cultures were placed in an incubator for 48 hours. After 48 hours the cultures were removed, measured, and disposed of properly.

Results
The grass soccer fields cultured more bacteria in the petri dishes than the artificial turf soccer fields after 48 hours.

Conclusions/Discussion
The conclusion is that the more nutrients contained in the playing surface the more bacteria the surface will contain. Grass soccer fields contain soil substrate that acts as a source of nutrients to bacteria while turf soccer fields have no soil and therefore less nutrients.

Summary Statement
I measured the amount of bacteria on turf and grass soccer fields and concluded that grass contains more bacteria than turf.

Help Received
My seventh grade science teacher Robert Calderon was my mentor and allowed me to use his lab.

Name(s)
Lakshmi Menon

Project Number
J1608

Project Title
Effects of Ultraviolet Light on Bacteria Mortality: Bacillus subtilis vs. Micrococcus luteus

Abstract

Objectives/Goals
In my experiment, I wanted to test the effects of UVC light on bacteria. I decided to test two non pathogenic strains, known as Bacillus subtilis, and Micrococcus luteus, to see how sensitive each strain of bacteria was to the UVC lamp (254 nanometers light.) Based on my research, I hypothesized that almost all of the Bacillus subtilis colonies would be killed, in 30 seconds, as this bacteria species is quite sensitive to UV light. I believed most of the Micrococcus luteus colonies would be eliminated at an exposure time of 60 seconds.

Methods/Materials
In my experimental process, I first performed a serial dilution. This step was taken to confirm the tube in which the bacteria grew an amount, that was easily quantifiable. Once the correct dilution for each strain was determined, I pipetted an equal amount of bacteria from each strain into 10 plates for a total of 20 plates. I covered half of each plate and exposed each set of 5 plates under a UV light for different periods of time.

Results
According to the results, Bacillus subtilis reached a 100% mortality rate after being exposed to the UV light for one minute. The Micrococcus luteus, however, achieved 100% mortality only after seven minutes of exposure.

Conclusions/Discussion
It appears sensitivity to UVC light may vary greatly between different species of bacteria. Bacillus subtilis and Micrococcus luteus are both Gram positive bacteria yet the ability to tolerate UVC exposure was strikingly diverse. This suggests other bacteria, including pathogens, may require lengthy exposures to UVC light to achieve 100% mortality.

Summary Statement
In my project, I tested the effects of ultraviolet light on bacteria mortality, and compared the sensitivities of each strain, given the assigned time exposure.

Help Received
Mrs. Roxanne Hunker, Mrs. Amritha Menon, Thermo Fisher Scientific, and Carolina Biological Supply Company.

CALIFORNIA SCIENCE & ENGINEERING FAIR
2018 PROJECT SUMMARY

Name(s)
Jackson T. Moroney

Project Number
J1609

Project Title
Fueling the Future: Chlorella Algae and Inexpensive Photobioreactors

Abstract

Objectives/Goals
The purpose of my experiment was to see what kind of light supported the most growth of Chlorella algae inside of a homemade, inexpensive photobioreactor.

Methods/Materials
- 1 foot of ¼ inch plastic airline tubing
- Silicone
- 1 liter glass mason jar with lid
- Electronic Scale (Only 1 necessary for project)
- 200 watt fluorescent light bulb (Only 1 is necessary)
- Fine strainer (Only 1 is necessary)
- Drill (Only 1 is necessary)
-Digital thermometer in degrees fahrenheit
- Hot glue gun (Only 1 is necessary)
(Building 9 of these)

Although I purchased the materials from a store, I designed and built the photobioreactor myself. I designed and built nine inexpensive photobioreactors and tested three with Chlorella algae under natural sunlight, three under artificial light, and three in complete darkness over a seven day period.

Results
I found that the natural sunlight supported the most growth of Chlorella algae, more than doubling its population. The artificial light also caused the algae population to grow, however, it was not a significant increase compared to the algae under natural sunlight. The entire algae population in complete darkness almost completely died off. Therefore, natural sunlight supports the most growth of Chlorella algae

Conclusions/Discussion
I built nine photobioreactors to see what kind of light supported the most growth of Chlorella algae. Repeated trials reveal that natural sunlight supports the most growth of Chlorella algae compared to artificial light and complete darkness.

Summary Statement
I found that natural sunlight supported the most growth of Chlorella algae in an inexpensive photobioreactor, as opposed to artificial light and complete darkness.

Help Received
My parents financially supported this project and a family friend, Mr. James Butler, helped me calculate my results. However, I completed the entire project myself.

CALIFORNIA SCIENCE & ENGINEERING FAIR
2018 PROJECT SUMMARY

Name(s)
Aarya Mukherjee

Project Number
J1610

Project Title
Microbes on Meats

Abstract

Objectives/Goals
To understand the types of bacteria humans are exposed to through consumption of meat purchased from grocery stores

Methods/Materials
Organic and non-organic chicken meat from 3 grocery stores and water as control was cultured using Tryptic Soy Broth (TSB) and Macconkey agar plates. Matrix assisted laser desorption ionization time of flight (MALDI-TOF) mass spectrometry was used for bacterial identification. Siemens Microscan for used for antibiotic sensitivity testing

Results
This study tested microbial presence on organic and non-organic chicken meat from 3 grocery stores. All samples had polymicrobial presence after 24 hrs of growth. There was no significant difference in number, type or amount of bacterial growth between organic and non-organic meat. Similarly, there was no difference in bacterial antibiotic resistance between organic and non-organic meat. Pre-packaged meat had less bacterial contamination than butcher meat. In addition, washing meat decreased bacterial growth. Most bacteria grown were non-pathogenic and are known environmental contaminants, but some bacteria found are known to cause infections in immunocompromised hosts.

Conclusions/Discussion
My study shows that all chicken meat samples from grocery stores had microbial presence. No significant difference in number of bacteria, degree of growth, type of bacteria or bacterial antibiotic resistance was noted between organic and non-organic meat. Bacteria were mostly environmental contaminants, but some potential pathogens were also found. Bacteria that FDA monitors- Salmonella, Campylobacter, E.coli were not found in the samples. These findings need to be confirmed by testing multiple samples. In my study,only one bacterium from each meat sample was tested for antibiotic resistance. Testing all pathogenic bacteria may alter findings on antibiotic resistance patterns.

Summary Statement
What types of bacteria are present on chicken meat from grocery stores, and are they influenced by antibiotics in chicken feed.

Help Received
Phong Pham, CLS, Sr. Supervisor, Microbiology Division, Zuckerberg San Francisco General Hospital was my mentor for the project. He guided me through the whole process. He helped me with inoculating plates, identifying bacteria, using the MALDI TOF machine and the Siemens MicroScan. My Mom,

Name(s)
Themi D. Perera

Project Number
J1611

Project Title
The Effects of Anthropogenic Environmental Disturbances on the Soil Microbial Community

Abstract

Objectives/Goals
The effects of carbon dioxide pollution, forest fires, and industrial chemical pollution on soil microbes are likely to be frequent in Southern California. To investigate whether environmental disturbances influence the productivity of microbial communities, we designed an experiment to quantify respiration (carbon dioxide output) as an indication of metabolic productivity and to measure colony forming units (CFUs) in soils from four different locations in Los Angeles, California.

Methods/Materials
Respiration measurements were executed using a Vernier CO2 gas sensor which was placed in and sealed to an open-bottomed container pushed 1 cm into the soil. Measurements were taken every minute for fifteen minutes from three sites within 1 m^2 for each location. CFUs were calculated using a dilution series in which soil samples with concentrations of 10^-4, 10^-5, 10^-6, and 10^-7 were cultured and their counts averaged.

Results
All areas displayed normal atmospheric carbon dioxide levels without significant differences between sites. Colony forming units per ml (CFUs/ml) measured 5.93 X 107, too few to count, 1.78 X 106, and 2.76 X 107, for the professionally managed, burned, desiccated, and agricultural conditions, respectively. The pH measurements of the soils were normal. Spread plates prepared using soil samples from all four sites displayed a wide variety of microbial colony morphologies, colors, and sizes, with fire-affected soils having the least diverse array of colonies.

Conclusions/Discussion
These data suggest that varying environmental disturbances have little to no effect on soil respiration levels and that professionally managed soils have the highest microbial populations per gram of soil.

Summary Statement
By measuring the metabolic productivity and diversity of the microbial population in various soils affected by anthropogenic environmental disturbances, I determined that metabolic productivity does not change but diversity varies greatly.

Help Received
Culturing the samples for calculating colony forming units was performed in the lab of Dr. Gilberto Flores, under the supervision of Tara Mahendrarajah, whom I also consulted with. Equipment was borrowed from Dr. Lawrence McKenna of Framingham State University.

CALIFORNIA SCIENCE & ENGINEERING FAIR
2018 PROJECT SUMMARY

Name(s)
Ashley Schletewitz

Project Number
J1612

Project Title
Determining the Effects of Equisetum hyemale on the Growth Rate of Penicillium italicum

Abstract

Objectives/Goals
The objective of this study is to determine if Equisetum hyemale can inhibit the growth of Penicillium italcium fungi.

Methods/Materials
Potato agar was mixed with Equisetum hyemale in a sterilized inoculation chamber at different concentrations; then poured into petri dishes. Next, the petri dishes were inoculated with Penicillium italicum and observed for seven days. Fungi colonies were then counted using a stem cell grid.

Results
The petri dishes containing higher concentrations of Equisetum hyemale were more effective in inhibiting the growth of the pencillium italicum than those of lower concentrations.

Conclusions/Discussion
Multiple trials revealed that a 13% concentration of Equisetum hyemale was proven to inhibit the growth of Penicillium italicum. These findings are extremely important because they prove a potential for Equisetum hyemale to be used by farmers as a natural organic alternative to the environmentally harmful heavy metals that are currently being used as fungicides.

Summary Statement
I discovered a natural organic solution to a destructive citrus fungus that could potentially save the agriculture industry millions yearly.

Help Received
Sanger High Schools AP Biology teacher, Mr. Aalto, showed me how to prepare the solutions and use his inoculation chamber for my testing. I mixed and performed all testing on my own.

CALIFORNIA SCIENCE & ENGINEERING FAIR
2018 PROJECT SUMMARY

Name(s)
Emiliano J. Vela

Project Number
J1613

Project Title
The Five Second Rule

Abstract

Objectives/Goals
The objective of this study is to test the validity of the Five Second Rule. This rule states that food dropped on the ground will be safe to consume and not covered in germs as long as it is picked up within five seconds. This experiment evaluates whether there is any truth to this theory.

Methods/Materials
10 petri dishes with agar, homemade incubator, 5 slices of lunch mea, 5 cookies, sterile swabs, sterile gloves, face mask, timer, kitchen floor, carpet. I created 8 trials by dropping each food item individually, swabbing each time, then transferred the swabbed samples to the labeled petri dishes.

Results
The results of the experiment showed that no matter how many seconds each food item was on the ground, less than or over five seconds, nearly all contained some bacterial growth in various quantities. Both swabbed food items and the control food items showed evidence of bacterial growth.

Conclusions/Discussion
In the experiment, the original question asked if picking up food from the ground within five seconds prevents the transfer of bacteria. The answer is no. My hypothesis was incorrect. The experiment shows that no matter how many seconds a piece of food is on the ground, bacteria will grow on it. This can potentially cause illness or infection especially if pathogenic bacteria contaminates the food item when dropped then consumed anyway. This experiment debunks the popular myth that food can be consumed safely if it is picked up within five seconds.

Summary Statement
If a piece of lunch meat and cookie are dropped on a kitchen floor and section of carpet, then they will contain no transfer of bacteria if they are picked up in less than five seconds.

Help Received
None. I researched and carried out the experiment independently.