CONNECTICUT SCIENCE & ENGINEERING FAIR

www.ctsciencefair.org

Top Winners in the
2017 Connecticut Science & Engineering Fair

(Student information as of April 2017)

Anika Bhagavatula, Grade 8

Middlebrook Middle School, Wilton, CT

A Novel Method for Oil Spill Cleanup Using Biomass

Connecticut Science & Engineering Fair Awards

* Pfizer Life Sciences Awards --- 1st Place- Life Sciences 8th grade- $300 & trophy and Invite to Compete Broadcom MASTERS
* Environmental Sciences Awards with CACIWC --- 1st Place MS - $300, Trophy, CACIWC gifts
* Sustainable Resources and Practices Awards --- 1st Place Middle School - $500 Cash and Trophy
* Connecticut Science Teachers Association's Marty Tafel Student Research Award --- Life Sciences 8th Grade - $500 and invite to CSTA Award Banquet
* Ricoh Americas Corporation --- Certificate, $25 Amazon gift card given by CSEF
* National Oceanic and Atmospheric Administration --- Certificate and medallion, ,and $25 Amazon gift card given by CSEFF
* Connecticut Invention Convention “Next Step Inventors” --- $50 gift certificate & invitation to present at CT Invention Convention as “CIC Next Step Inventors”

Abstract

Oil spills occur with an alarming frequency and have serious environmental and economic consequences, as witnessed in the BP Deepwater Horizon oil spill and other pipeline leaks. They severely damage aquatic ecosystems, while contaminating water sources. Current remediation solutions include the usage of synthetic sorbents and hard booms, in-situ burning, skimmers and dispersants. These solutions, while effective, are expensive, and have an adverse impact on the environment, as the materials are difficult to dispose.

I investigated the usage of biomass such as pomegranate husk (“PH”) and orange peels (“OP”) as alternative sorbents in booms. To simulate different oil spill environments, I tested oil removal ability in freshwater and saltwater at different temperatures: Cold(37F), Room(68F) and Hot(87F).

I first conducted tests using vegetable oil in freshwater and saltwater to find Optimal: (1)Size and consistency of biomass; (2)Time for maximum oil removal (3)Sorbent weights for PH, OP and PH&OP mix. Using the optimal conditions derived above, I tested motor oil removal ability at different temperatures.

PH, OP and the PH&OP mix removed oil very effectively, averaging about 2x to 3x their weight in freshwater and saltwater. Best results were obtained with ¼inch pieces of fresh biomass after 50 minutes. The PH&OP mix was most effective in removing motor oil, particularly at room and cold temperatures. Vegetable oil was removed most effectively in cold temperatures. All sorbents performed better in saltwater.

Biography

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Rachel Brooks, Grade 8

Christian Heritage School, Trumbull, CT

The fabrication and testing of various fruit juice dye-sensitized solar cells with the addition of preservatives

Connecticut Science & Engineering Fair Awards

* Pepsico Physical Sciences Awards --- Finalist - Physical Sciences 8th Grade - CSF Medallion & Acrylic Award
* Energize CT/eesmarts Alternative/Renewable Energy Awards --- 1st Place Middle School - $300 Cash and Trophy
* United Technologies Corporation Awards --- $500 in UTC Common Stock, Plaque, Backpack, and Annual Report
* Alexion Biotechnology Awards --- 3rd Place- Biotechnology 8th grade- $200 & trophy and Invitation Compete in Broadcom MASTERS
* MIT Club of Hartford K-12 Initiative --- For excellence in science & technology of energy related research, middle school, $100 cash award
* Demos R Us Award --- $150 Cash Award- Clear Execution of Research

Abstract

Dye-sensitized solar cells (DSSCs) have the ability to produce electricity utilizing organic dyes. Though these organic dyes are cost effective and environmentally friendly, power production levels degrade quickly when utilized in a DSSC. The purpose of this experiment was to determine which juice, black currant, raspberry, or strawberry, utilized as a sensitizer in a DSSC produces the most photovoltaic power and, if by adding a preservative to each berry juice, the degradation rate of the solar cell would decrease. It was hypothesized that the berry juice with the highest levels of anthocyanin, a pigment in plants which absorbs sunlight, would produce the most power. DSSCs were fabricated, involving a titanium dioxide coated slide sensitized with berry juice, a carbon coated slide, and an electrolyte. Each cell was illuminated and tested using a multimeter, over a duration of 60 hours. Without preservatives, black currant juice DSSCs produced the most power on average, 287.35 microwatts. However, raspberry juice contains the least amount of anthocyanins, and DSSCs with raspberry juice produced more power than those sensitized with strawberry juice. This could be due to other organic compounds in the berry juices, besides anthocyanins. Concerning preservatives, of the two tested, sodium benzoate decreased the average degradation rate of all DSSCs. It can be concluded that black currant juice is the preferred sensitizer of those tested, and that preservatives effectively decrease power degradation. With further research, sodium benzoate combined with an organic dye could allow DSSCs with organic dyes to be used commercially.

Biography

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(Student information as of April 2017)

Anna Flaherty, Grade 7

St. Gregory the Great School, Danbury, CT

Wind Energy? I'm a Big Fan!

Connecticut Science & Engineering Fair Awards

* Pepsico Physical Sciences Awards --- 2nd Place- Physical Sciences 7th Grade Ind. - $100 & trophy, invite to compete Broadcom MASTERS
* Energize CT/eesmarts Alternative/Renewable Energy Awards --- Middle School Finalist - Medallion, Acrylic Award
* Stanley Lessoff Award for Excellence In Analytical Technique --- $100 Cash and Plaque

Abstract

Imagine seeing wind turbines instead of smoke when you pass a factory! By having more efficient wind turbines, factories all around the world would have another option for energy instead of using fossil fuels. This would improve the economy. It would also reduce greenhouse gasses and acid rain. This experiment was performed to research one "go green" idea. Specifically, does the length of the blades on a wind turbine effect the amount of power it generates? The hypothesis was, if windmills have longer blades (increased surface area), then energy will be produced. This was tested by constructing a scale sized windmill using a 3 volt D.C. Motor, PVC pipes to make the base and pole of the turbine, and card board for the blades. Through the results, it was discovered that blade length is not the only factor impacting energy output. As the length of the blade increases, it becomes heavier and requires more wind to turn. Analysis of the data determined an optimal blade length where the surface area and weight combination produces the most energy.

Biography

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Top Winners in the
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(Student information as of April 2017)

Grace Flynn, Grade 7

St. Timothy Middle School, West Hartford, CT

Green Tea: A Simple Solution for a Bananas Problem?

Connecticut Science & Engineering Fair Awards

* Pfizer Life Sciences Awards --- 1st Place- Life Sciences 7th grade- $200 & trophy and Invitation to Compete Broadcom MASTERS
* Alexion Biotechnology Awards --- 2nd Place- Biotechnology 7th grade- $200 & trophy and Invitation Compete in Broadcom MASTERS
* Meyerand Young Woman Scientist Awards --- $300 cash - Middle School Life Sciences

Abstract

Bananas may become extinct unless ways are found soon to control Panama Disease, which kills banana plants through vascular damage. The purpose of this experiment was to test if a green tea solution could protect the vascular system of a monocot (bananas are monocots). Because it is difficult to grow bananas in the winter in Connecticut, the experiment used wheatgrass, which has a vascular system comparable to the vascular system of bananas.

The hypothesis was that antioxidants in green tea would protect monocot vascular systems. The experiment used salt water, which causes vascular damage, to simulate plant disease in three four-tray trials in which plants were watered twice daily with 20 ml of varying solutions. Tray A was watered with water, tray B was watered with water and green tea, tray C was watered with water and salt water, and tray D was watered with green tea and salt water. Plant height, color, and other observations were recorded twice daily for ten days.

The results of three trials supported the hypothesis that green tea protects monocot plants from damage. The plants watered with green tea (B&D) grew more than the plants that were not watered with green tea (A&C). Significantly, green tea appeared to have a more beneficial impact on plant health in the salt water trays (D versus C) than in the control set where salt was absent (B versus A). Further research is needed to determine whether the protection green tea provided wheatgrass will similarly protect banana plants.

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