CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY

Name(s)
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Project Number
S0616

Project Title
The Effect of UV Radiation on the Photoelectrochemical Conversion System of Organic Dye-Sensitized Photovoltaic Cells

Abstract

Objectives/Goals
The purpose of this experiment is to reveal effect of varying durations of UV radiation on the performance of organic dye-sensitized photovoltaic cells; in this study, the juices of raspberry, blueberry, and blackberry were used. This investigation would aid in understanding UV radiation's effect on a solar cell's efficacy in producing electrical energy, and in discovering which organic composition is most resilient to UV radiation and is best fit for possible long term/large scale use.

Methods/Materials
An anode and cathode side of each cell were created on conductive 1x1 inch glass slides. A mixture of titanium dioxide and dilute nitric acid created a paste for the anode side before it heated to strengthen the molecular bonds of the chemicals. The cathode sides were placed over a fire until carbon soot, a catalyst, blackened the slide. Berries were blended and filtered with a mass to water ratio of 1:2, then exposed to various durations of UV radiation with a UV Transilluminator. They were then used to stain the titanium on the anode before offsetting the anode and cathode together and placing a few drops of redox electrolyte to generate an electric current. Voltages were measured and recorded in mV.

Results
Although blueberry cell trials initially had significantly higher voltages than the others, with an average of 191.3 mV, blackberry cells with an average of 173.3 millivolts, and raspberry cells with an average of 160 millivolts, blackberry cell trials was most effective in withstanding the negative effects of UV radiation. Blackberry cell trials had a 91% total decrease in mV upon UV exposure while the blueberry cell trials had a 95% and the raspberry cells with 94%. The blueberry trials ended up experiencing the largest drop in voltage, despite performing best at first.

Conclusions/Discussion
In conclusion, my hypothesis was incorrect. Although the blueberry dye sensitized cell trials performed the best prior to UV exposure, following radiation, it had become clear that such a superior beginning does not necessarily imply a consistent end. Therefore, the levels of antioxidants in the juice of each cell definitely have a factor in determining a DSSC's efficacy. However, perhaps there is another, hidden aspect to the dynamics of the cell and its ability to withstand UV radiation, leaving the door open for future investigation to increase the potential for real-life application.

Summary Statement
Higher levels of antioxidants in a dye-sensitized solar cell does not necessarily correlate to its resilience against UV radiation, indicating the need for further investigation on the dynamics of the cell's efficiency.

Help Received
My teacher, Mr. Cervantes, introduced the idea of the dye sensitized solar cell to me, and I used that as an inspiration to build upon a meaningful focus for my project. He also aided in obtaining the materials needed, while I conducted all of the research, procedures, and data collection on my own.