CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Sara K. Davis

Project Number
J1008

Project Title
Nanocrystalline Dye-Sensitized Solar Energy II

Abstract

Objectives/Goals
This project is further to my 2009 science project. The objectives were: (1) to compare the photovoltaic energy generation capabilities of conductive glass-based and conductive polymer film-based Graetzel solar cells; (2) to determine if a polymer film solar cell generates more energy from exposure to sunlight than from lamplight; and (3) to see if a polymer film cell is capable of sustained energy generation over a several-day period.

Methods/Materials
I made several Graetzel solar cells from conductive polymer film, with filtered juice from dark red flower petals as the primary reactive agent. Then I conducted a series of experiments to measure photovoltaic energy generation from those cells when exposed to lamplight compared to sunlight. Next I compared the energy generation data from my 2009 science project (which involved conductive glass-based solar cells) with the results from this year's project (using conductive polymer film-based cells). Then I conducted a series of experiments over three consecutive days to see if conductive polymer film-based cells could sustainably generate photovoltaic energy.

Results
A conductive polymer film-based cell produced a stronger electric charge, when exposed to either lamplight (263% more energy) or sunlight (51% more energy), than a similar solar cell made with conductive glass. Polymer film cells produced from 18.1% to 47.5% more energy when exposed to sunlight than to lamplight. When three sets of polymer film cells were exposed to sunlight over several days there was an increase in energy generation by anywhere from 142% to 211% from day 1 to day 2, with those levels generally sustained through day 3.

Conclusions/Discussion
I learned: (1) that conductive polymer film-based Graetzel solar cells generate measurably more low-level electrical voltage than conductive glass-based photovoltaic cells when exposed to either artificial lamplight or natural sunlight; (2) that polymer film-based cells generate more energy when exposed to sunlight than to lamplight; and (3) that conductive polymer film cells, when exposed to sunlight, are able to generate energy on a sustainable basis for a minimum of several days. The results of this second project indicate that further, longer-term research into the comparative efficiency, durability, and sustainability of conductive polymer film cells versus conductive glass cells could be helpful and illuminating.

Summary Statement
Generation of electricity from simple conductive polymer film-based photovoltaic solar cells, using plant juice.

Help Received
Mother supervised experiments, and helped construct backboard; father proofread and edited logbook.