



**CALIFORNIA STATE SCIENCE FAIR  
2013 PROJECT SUMMARY**

<b>Name(s)</b> <b>Rajiv K. Nelakanti</b>	<b>Project Number</b> <b>J0213</b>
<b>Project Title</b> <b>How Do Different Natural Dyes Affect the Longevity and Power Output of Nanocrystalline Dye-Sensitized Solar Cells?</b>	
<p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives/Goals</b> As new ways for clean energy are introduced, it is important to find out which ways are more efficient and cleaner than others. The purpose of this project is to understand which natural dye produces cells with the best (open circuit) voltage, the best (closed circuit) current and the least degradation over time. I hypothesized that darker dyes like blackberry, raspberry, and blueberry would yield cells with higher voltages and currents. I also hypothesized that cells from lighter dyes from green citrus leaves and spinach leaves would degrade the least over time.</p> <p><b>Methods/Materials</b> In Part 1 of my experiment, I constructed the solar cells using GrA#tzelâ##s method of cell construction. First, I prepared the titanium dioxide (TiO<sub>2</sub>) suspension. Next, I applied the suspension onto conductive glass plates. Afterwards, I soaked raspberry, blackberry, blueberry, green citrus leaf, or spinach leaf dye onto the TiO<sub>2</sub> coated conductive glass plates to form the electrode. Then I carbon coated the counter electrode with a graphite pencil. Finally, I assembled the cell by attaching the electrode to the counter electrode with binder clips. I placed electrolyte between the plates using capillary action. In Part 2 of my experiment, I measured the voltage and current over time for the constructed solar cells by using a multimeter. Here, I controlled the amount of light each cell received. In total, I made 18 solar cells (each dye and negative control in triplicate).</p> <p><b>Results</b> The blackberry dye solar cells produced the best current, the spinach dye solar cells produced the best voltage, and the blackberry dye solar cells deteriorated the least over time. Furthermore, the blackberry cells had the highest maximum power, which was derived by multiplying the voltage by the current. Blueberry dye yielded cells with the worst voltage and current output, and had the worst maximum power of all the dyes. The negative control cells yielded extremely low, and unstable current, and power. Their voltage had ups and downs as well, high in the beginning and low towards the end.</p> <p><b>Conclusions/Discussion</b> The results of my experiment show that blackberry is the best dye to turn to when making the most efficient dye-sensitized solar cells because they produced the highest current and maximum power and degraded the least over time.</p>	
<b>Summary Statement</b> The purpose of this project is to understand which natural dye produces solar cells with the best voltage, current and power and the least degradation over time.	
<b>Help Received</b> My science teacher provided me with some of the materials. My father (advisor) supervised and assisted me with my experiment. My mother helped me with the project board. My brother proofread my procedures.	