



**CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY**

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Project Title The Effect of Organic Dye on Dye-Sensitized Solar Cell Efficiency	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals The objective of this project is to find how different types of organic dyes affect the efficiency of dye-sensitized solar cells in both natural (sunlight) and artificial light (incandescent light). This information can help guarantee our future generations a clean and healthy future!</p> <p>Methods/Materials Step 1: To construct the dye-sensitized solar cell, I created the titanium dioxide (TiO₂) suspension using TiO₂ powder and white vinegar and applied it uniformly onto a conductive glass plate. Then, I dried and annealed the coated plate to form a thin film of TiO₂. Next, the TiO₂ coated conductive glass plate is soaked into the dye (blackberry juice) to form the electrode. Many natural dyes possess a chemical group that can attach to the TiO₂ surface. A layer of dye is absorbed into each particle of TiO₂, which acts as an absorber of light. Place a carbon-coated plate (counter electrode) on top of the electrode plate and binder clips secure the glass plates. This process is repeated 3 more times to make different dye-sensitized cells using different dyes (blueberry juice, raspberry juice and turmeric). Step 2: I placed the solar cells with the TiO₂ side facing the light and measured the voltage and current. I calculated the power by multiplying the voltage and current for all the dye-sensitized cells in both sunlight and incandescent light.</p> <p>Results My hypothesis was partially correct. Per my research, I had hypothesized that only darker dyes would produce higher power as they are dark in color and have high anthocyanin content. The blackberry dye solar cell generated the maximum power, the turmeric dye solar cell produced the second most power, and there was only a 10% variation of their power output. Blueberry dye sensitized cells with the poor voltage and current output, had the least power of all the dyes. In both the lighting conditions, the test results turned out to be similar; there was a 40% drop of power from sunlight to incandescent light for all the solar cells.</p> <p>Conclusions/Discussion In conclusion, the blackberry and the turmeric dyes are the best dyes to turn to when making the most efficient dye-sensitized solar cells (DSSC) because they produce the maximum power due to light absorption or high electron sensitivity. I researched further and found that certain types of natural dyes (e.g. turmeric) have curcumin content that help in electron sensitization to produce higher power.</p>	
Summary Statement The purpose of this project is to understand which organic dye produces dye-sensitized cells with maximum power; it helps us understand how electron sensitization and color of organic dyes play a key role in yielding the maximum power.	
Help Received My Science teachers, Mr. Takemoto and Mrs. Makhijani, reviewed my project and provided me necessary guidance. My family helped me get the materials and provided the supervision throughout the project.	