



**CALIFORNIA STATE SCIENCE FAIR  
2013 PROJECT SUMMARY**

<b>Name(s)</b> Max Halabi; Gregory Lum	<b>Project Number</b> <b>S0311</b>
<b>Project Title</b> <b>The Effect of Dye Viscosity on the Power Output of Dye Sensitized Solar Cells</b>	
<p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives/Goals</b> The purpose of this experiment was to determine if the viscosity of the dye used in the dye sensitized solar cells (DSSC) had an effect on the cells power output. It was hypothesized that the cells with the middle viscosities would have the highest power output because they would have enough anthrocyanins to power the cell and be thick enough to prevent leaking but thin enough to prevent inhibition of currents.</p> <p><b>Methods/Materials</b> The dye sensitized solar cells were first created by making TiO(2) paste from 6 grams of TiO(2) powder and adding 9mL of vinegar 1mL at a time. The raspberry dyes were made by mashing raspberries in a bowl and adding different amounts of distilled water to create the different dyes. The viscosity was then measured with the formula: viscosity = grams/ (cm*sec). TiO(2) paste was spread on the conductive side of a glass slide that was then sintered on a hot plate and soaked in a dye solution. Another glass slide was passed through a flame conductive side down creating a carbon coating and the 2 glass slides were then binder clipped together and the electrolyte was added. The completed DSSC was then connected to a multimeter and data was recorded. The materials used in this experiment were: conductive glass slides, frozen raspberries, TiO(2) powder, vinegar, iodide electrolyte, binder clips, hotplate, candle, multimeter, 50 watt lightbulb, mortar and pestel, beaker, electronic scale, and a timer.</p> <p><b>Results</b> It was found that the DSSC dyed in 40% viscosity raspberry solution had the overall greatest average energy output of all the DSSC, with an average of 401.9 millivolts. Overall, the data showed trends from having rather high outputs at 100%, then decreasing until 50%, then exponentially increasing at 40%. which appeared to be the optimal viscosity for the DSSC, with a viscosity of 0.020g/(cm*sec).</p> <p><b>Conclusions/Discussion</b> Based on this experiment, it was concluded that the findings supported the hypothesis that the dyes with the middle viscosities would have the greatest energy output. The DSSCs with low viscosities had low energy outputs possibly because there were problems with leaking since the solution was very thin. The DSSC dyed in 40% viscosity raspberry solution appeared to be the optimal viscosity for the DSSC, with a viscosity of 0.020g/(cm*sec) possibly because the dye was thick enough to prevent leaking and there was enough water to sustain a current.</p>	
<b>Summary Statement</b> The purpose of this project was to determine the effects of the viscosity of the dye used in dye sensitized solar cells on the cells energy output.	
<b>Help Received</b> Father helped buy materials	