

Color Wave- Investigating the Impact of Organic Dyes on Dye Sensitized Solar Cell Performance

Thomas, Dominique (School: Treasure Coast High School)

A major concern as we approach the future is the use of renewable resources and clean energy. One of the primary viable options has often been solar power. Current solar technology is primarily silicon based. Its difficult fabrication process and incorporation of hazardous chemicals, however, leaves room for improvement. Third generation photovoltaic systems such as DSSCs (dye sensitized solar cells) are quickly emerging due to their affordability and scalability. DSSCs also demonstrate great promise for energy production under low lighting conditions and have proven to be more efficient than other photovoltaic systems. Nonetheless, an improvement in their efficiency would make their implementation more reasonable. In this experiment I tested the impact of various organic dyes on the output of DSSC. One dye was used from each of the three major organic groups including Cyanidin, Chlorophyll, and Beta Carotene. Each dye was used in one cell as well as one that incorporated a combination of all three. Although it was initially hypothesized that chlorophyll would have the highest output, Cyanidin proved to be the most effective with an overall output of 0.163mW. This is likely explained by the low HOMO-LUMO gap in Cyanidin and the fact that it required less energy for the excitation of electrons. Moving forward in investigation one could work to produce a dye with the properties of both Chlorophyll and Cyanidin. A large aromatic structure with a large range of absorption but with greater conjugation to decrease the HOMO-LUMO gap. This hybridized molecule would likely show the most promise for energy output.

Awards Won:

American Committee for the Weizmann Institute of Science: One finalist will be selected to receive a scholarship to attend the Bessie Lawrence International Summer Science Institute. The award will also cover travel expenses.