Development of Non-toxic Photostabilized Phycoerythrin for Application in Dye Sensitized Solar Cells

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Phycoerythrin is a light harvesting phycobilin protein extracted from the red seaweed species Chondrus crispus. Phycoerythrin has the potential to be used as the sensitizer in dye sensitized solar cells (DSSC). DSSC's are cost efficient and absorb more sunlight per surface area than silicon-based solar cells. However, phycoerythrin which is currently sold in the market is photo stabilized with highly toxic sodium azide and rapidly denatures within 72 hours, without stabilization, when exposed to light. To eliminate the toxicity and increase photostability, five solutions were employed with trehalose, myo-inositol, guanidine hydrochloride, a solution of trehalose and guanidine hydrochloride and a solution of myo-inositol and guanidine hydrochloride to prevent denaturation. The solutions were placed underneath ambient light ~210 (lumens). The maximum absorption of the untreated phycoerythrin control group decreased indicating degradation after 72 hours, when compared to the phycoerythrin in the solution of myo-inositol and guanidine hydrochloride maintained photostability beyond 30 days (720 hours). When incorporated to the DSSC, the phycoerythrin generated 1.2 milliwatts while the industry standard technique titanium based control cell generated 0.4 milliwatts. The phycoerythrin based DSSC produced 60% more electrical output than the titanium based control cell. The results indicate that phycoerythrin can be stabilized with non-toxic additives and can be applied as the sensitizer for DSSC. With further research, phycoerythrin could be applied in food dye and ink or other materials that require a non-toxic natural red pigment.

Awards Won:

Fourth Award of $500