

Sri Lankan Grapes Used as Sensitizer in Dye-sensitized Solar Cells

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Abstract

Dye-sensitized solar cells (DSSCs) belong to the third-generation photovoltaic technology. The sensitizer development is mainly focused on natural dyes because of low-cost, and environment friendliness. The most significant pigments that give flowers and fruits their colour are anthocyanins. Due to the presence of anthocyanins in the grape skin, the grapes were peeled out and the 2 g of the peels were ground to extract the 0.2 ml of dye without adding any solvent. We created a unique methodology using Sri Lankan grapes grown in Jaffna. The KI/I₂ based electrolyte and carbon counter electrode were the other components of DSSC. The TiO₂ paste was prepared by mixing Titanium Dioxide and Mono ethylene glycol (MEG). TiO₂ thin layer was deposited on transparent Indium doped Tin Oxide (ITO) conductive glass using doctor blade method. The J-V characteristic curves of fabricated cells were analysed. Solar energy conversion efficiency of $\eta = 0.286\%$ was obtained with a short circuit current of $J_{sc} = 1.23 \text{ mA cm}^{-2}$, an open circuit voltage of $V_{oc} = 0.48 \text{ V}$ and a fill factor of 0.48. The large absorption peak of the grape-dye is visible between 400 and 660 nm. The absorbance spectrum demonstrates that the grape-dye molecules and TiO₂ particles formed a charge transfer complex. This study is focused to identify a natural dye that works well as a sensitizer in Sri Lanka that can benefit economically underdeveloped nations. The result shows that, Sri Lankan grapes dye has good potential in future development of DSSC.

Keywords: *DSSC, Sensitizer, Anthocyanin, Grapes*