

Investigation of Green Dye-Sensitized Solar Cells Based on Natural Dyes

Authors : M. Hosseinnzhad, K. Gharanjig

Abstract : Natural dyes, extracted from black carrot and bramble, were utilized as photosensitizers to prepare dye-sensitized solar cells (DSSCs). Spectrophotometric studies of the natural dyes in solution and on a titanium dioxide substrate were carried out in order to assess changes in the status of the dyes. The results show that the bathochromic shift is seen on the photo-electrode substrate. The chemical binding of the natural dyes at the surface photo-electrode were increased by the chelating effect of the Ti(IV) ions. The cyclic voltammetry results showed that all extracts are suitable to be performed in DSSCs. Finally, photochemical performance and stability of DSSCs based on natural dyes were studied. The DSSCs sensitized by black carrot extract have been reported to achieve up to $J_{sc}=1.17 \text{ mAcm}^{-2}$, $V_{oc}= 0.55 \text{ V}$, $FF= 0.52$, $\eta=0.34\%$, whereas Bramble extract can obtain up to $J_{sc}=2.24 \text{ mAcm}^{-2}$, $V_{oc}= 0.54 \text{ V}$, $FF= 0.57$, $\eta=0.71\%$. The power conversion efficiency was obtained from the mixed dyes in DSSCs. The power conversion efficiency of dye-sensitized solar cells using mixed Black carrot and Bramble dye is the average of the their efficiency in single DSSCs.

Keywords : anthocyanin, dye-sensitized solar cells, green energy, optical materials

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