

Effect of chenodeoxycholic acid on the performance of dye-sensitized solar cells utilizing pinang palm (Areca catechu) dye

ABSTRACT

This study examined and described the optical and photovoltaic (PV) characterizations of the Fruit Areca catechu (pinang) as a new type of organic sensitizer. Recent reports stated that including chenodeoxycholic acid (CDCA) in the dye improves the performance of dye-sensitized solar cells (DSSCs). The effectiveness of PV dye was investigated by applying it in a DSSC. The absorption spectra indicated that natural dyes with CDCA has an excellent stabilizing ability. The Fourier-transform infrared spectra indicated the existence of carboxylic and hydroxyl functional groups in the naturally extracted dye. These functional groups were responsible for the rapid electron transfer and strong electronic linkages of interactions within the TiO₂ surface. In this study, photoluminescence spectra analysis showed that by narrowing the bandgap, incorporating CDCA as a co-adsorbent in natural dye could generate a significant photocurrent. The overall power conversion efficiency was enhanced by 4.6%. Moreover, the cell efficiency reached up to 0.076% after adding 1.5 mM of CDCA without optimizing the sensitization time. Results demonstrated that the present study contributes toward the improvement of DSSC through efficient electron injection.

Keyword: Areca catechu; Chenodeoxycholic acid; DSSC; Natural dye