

Fabrication of Solid State Dye Sensitized Solar Cell Using Red Sandalwood as Natural Sensitizer

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Commercially available dye-sensitized solar cells contain synthetic-metal centered dyes as a sensitizer. Natural dyes obtained from plants are a cheaper alternative for high cost synthetic dyes. The Main objective of this research is extraction of a natural dye which has wide availability with minimal chemical procedure to reduce cost of production and toxicity. The study intended in developing a solid-state-dye-sensitized solar cell by sandwiching red-sandalwood pigments in between porous TiO₂ and CuI films. TiO₂ films were prepared on conducting glass substrates by using two different methods to obtain two different thicknesses and their morphologies were studied. According to the absorption spectra, presence of multiple layers increase the intensity of absorption of thicker (>10 p,m) TiO₂ than thinner (<10 [tm) TiO₂ film. Optical microscopic images of different TiO₂ films show that thicker (>10 p.m) TiO₂ film has no cracks present. Due to the absence of cracks in thicker TiO₂ film, solid electrolyte cannot reach to glass substrate and therefore, no short current occurs. Red-sandalwood dye extracted to three different solvents (ethanol, acetone, acetonitrile) using soxhlet extraction and rotary evaporation. In each solvent three major electron transitions observe for red-sandalwood extractions. Therefore, these three solvents are acceptable for extraction of red-sandalwood to use as sensitizer. A significant red shift in the absorption spectrum can be observed after chelating red-sandalwood pigments with TiO₂ compare to that of dye in solutions. Formation of red sandalwood-Ti complex may be the reason for the observed red shift in the absorption spectrum. The bond formation between TiO₂ and natural red-sandalwood pigments was confirmed by FTIR measurements. The deposition of hole-transfer (CuI) was eliminated problems encounter with the liquid electrolyte in photovoltaic cells. The morphology of CuI layer was studied. This demonstrates that triethylamine-hydrothiocyanate can control the formation of crystals of CuI by acting as a surfactant.

Key words: Red-sandalwood, Solid-state dye sensitized solar cell, TiO₂, Soxhlet extraction