

Utilization of saffron (*Crocus sativus* L.) as sensitizer in dye-sensitized solar cells (DSSCs)

ABSTRACT

Photoelectrodes of dye-sensitized solar cells (DSSCs) have been prepared using nanosized titanium dioxide that have soaked in a solution of different saffron (*Crocus sativus* L.) spice content in ethanol. The optimized polyacrylonitrile (PAN)-based gel polymer electrolyte with 40.93 wt.% ethylene carbonate, 37.97 wt.% propylene carbonate, 4.37 wt.% tetrapropylammonium iodide, 9.86 wt.% PAN, 1.24 wt.% 1-butyl-3-methylimidazolium iodide, 4.35 wt.% lithium iodide and 1.28 wt.% iodine has been used as the electrolyte for DSSC. The electrolyte has conductivity of 2.91 mS cm⁻¹ at room temperature (298 K). DSSCs were also sensitized with saffron solution that has been added with 30 wt.% chenodeoxycholic acid (CDCA) co-adsorbent and designated as DSSC P4. The solar cell converts light-to-electricity at an efficiency of 0.31%. This is 29% enhancement in efficiency for the DSSC without addition of CDCA in the saffron-ethanol solution. The DSSC exhibits current density at short-circuit (J_{sc}) of 1.26 mA cm⁻², voltage at open circuit (V_{oc}) of 0.48 V and 51% fill factor. DSSC P4 also exhibits the highest incident photon-to-current density of more than 40% at 340 nm wavelength.

Keyword: Saffron; *Crocus sativus* L.; Dye-sensitized solar cells; Gel polymer electrolytes