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Solid State Nanoporous TiO_2 Solar Cells Sensitised with Natural Dyes

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Dye-sensitized nanoporous TiO_2 solar cell is a promising system for cost-efficient solar energy conversion application. In these solar cells, Ru-based dye molecules, adsorbed on the surface of a nanoporous sintered TiO_2 film, are used to absorb visible light and to inject electrons into the TiO_2 conduction band. I^-/I_3^- redox couple in a liquid electrolyte is used to regenerate the photo-oxidized dye molecule. Efficient dye-sensitised solar cells utilising several natural dyes have been reported.

Here we report the relative photoluminescence(SPEX 750M) and UV-VIS absorbance of nanocrystalline TiO_2 films coated with either commercial Z907 [cis-bis(isothiocyanato)(2,2'-bipyridyl-4,4'-dicarboxylato)(2,2'-bipyridyl-4,4'-dinonyl) ruthenium (II)] dye or natural dye, containing anthocyanin, extracted from grape (Vitis vinifera) fruit coat, Jambolan (Eugenia jambolana) fruit, beetroot (Beta vulgaris) and white yam (Dioscorea alata) tuber. Adsorption of these natural dyes on the nanoporous TiO_2 film is similar to commercial Z907 dye. The grape fruit coat extract displays an excellent sensitising behaviour among other natural dyes. This may be attributed to the strong interaction between the surface of TiO_2 nanoporous film and the carbonyl and hydroxyl groups of anthocyanin molecule on grape fruit coat extract. Current-voltage and external quantum efficiency spectra measurements of these dyes-sensitized samples were obtained under solar simulator(Sciencetech) with AM 1.5 spectral filter. We compare the photoluminescence spectra and the photovoltaic performances of dyes coated TiO_2 samples. The studies show that the performance of the natural dyes is similar to the commercial dye.

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