A Cocktail of Natural Dyes as Photosensitizers for Dye-Sensitized Solar Cell

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Dye-sensitized solar cells (DSSCs) are solar cell devices that convert light energy to electrical energy. It makes use of a photoelectrochemical system similar to photosynthesis in plants. The highest power conversion efficiency of DSSCs has been achieved by using ruthenium-based sensitizers which can reach a 12% power conversions efficiency. However, ruthenium is an expensive rare metal which increases the production cost of DSSCs. On the other hand, DSSCs with natural dye pigments is relatively environmental- friendly and low-cost, however there remains a problem that the absorption spectra of these natural dye pigments are relatively narrow compared to that of ruthenium-based sensitizers resulting in poor performance of these DSSCs. In this research, we hypothesized that DSSCs with mixed dye sensitizer could broaden the absorption spectrum for light harvesting and hence boosting the photocurrent generated. This paper examines the possibilities of using a mixture of natural dye pigments as the sensitizer in order to improve the performance of DSSCs. Natural pigments extracted from spinach leaves and oolong tea leaves were mixed in the ratio of 1:1 (v/v). DSSCs with this mixed dyes showed the synergic performance of 1.7-4.7 times increase in short-circuit current than that sensitized with any single dye. Flexible DSSCs fabricated by 10nm TiO_2, ITO-PET electrodes and the mixed dyes produced a maximum voltage and current of 45mV and 69μA. Due to the simple preparation technique, widely available and low-cost natural dye as an alternative sensitizer as well as the bendable and transparent properties of ITO-PET films, DSSCs are becoming viable contender for small scale future solar energy portable converters.

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