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STUDY OF THE VARIATION OF DYE SENSITIZED SOLAR CELLS WITH DIFFERENT pH OF THE MANGOSTEEN EXTRACT AND COMPARE WITH COMMERCIAL RUTHENIUM DYE

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ABSTRACT

The performance of a dye sensitized solar cell (DSSC) is mainly based on the dye as a sensitizer. Natural dyes have become a viable alternative to expensive and rare organic sensitizers because of its low cost, easy attainability, abundance in supply of raw materials and environmental acceptance. Extracts from various components of plants such as flower petals, leaves and bark have been tested as sensitizers. The aim of this research was to study the dependence of the efficiency of DSSCs made with mangosteen dye on the pH value of the dye extract and to compare it with the commercial Ru dye based cells.

TiO_2 plates were prepared by spreading the TiO_2 paste on fluorine-doped conducting tin oxide (FTO) glass and sintering at 450 °C for 45 min. Dye absorption was carried out by immersing the above plate in mangosteen extract of different pH values, 0.96, 1.51, 2.04, 3.06, 4.15, 4.91, and 6.18 and DSSCs were fabricated by sandwiching the electrolyte between the dye adsorbed TiO_2 electrode and a platinum (Pt) coated FTO glass. The photocurrent–voltage (I–V) characteristics of the cells were measured under the illumination of 100 $mWcm^{-2}$ (AM 1.5). For comparison, the experiments were repeated for cells made with sintered TiO_2 plates immersed in ethanolic dye solution containing Ruthenium dye N719.

The maximum efficiency of 0.66% and maximum short circuit current per unit area (Jsc) of 2.5 $mAcm^{-2}$ occurs at pH 2.25. Since the pH affects the colour of the solution with the bright maroon at pH of 0.96 and becoming light maroon as the pH increases, different light absorption could cause different efficiency values. The pH of the pigment solution has a significant effect on the performance of DSSC. The highest efficiency achieved for the cells dipped in Ruthenium based dye is found to be 2.06% which is higher than the mangosteen based cells.

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