ENHANCEMENT OF PERFORMANCE OF DYE SENSITIZED SOLAR CELLS USING ANTHOCYANIN DYES WITH L-ASCORBIC ACID

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The natural pigments extracted from Jamson (*Carissa carandas*) fruit and petals of Erabadu (*Erythrina fusca*) flowers which are enriched with anthocyanins were used as sensitizers in dye sensitized solar cells (DSSCs). This study was mainly focused on studying the performance of dye sensitized solar cells in the presence of L-Ascorbic Acid with anthocyanin dyes. Working electrodes of dye sensitized solar cells based on TiO_2 were constructed by introducing ascorbic acid to the dye sensitizer by following three different methods. In the first method, sensitizer was coated on the TiO_2 surface by using a solution containing above dyes and ascorbic acid. In the second method, TiO_2 films were dip coated with dye molecules and then treated with the ascorbic acid. In the last method, TiO_2 electrodes were first treated with ascorbic acid and then dip coated with the dye molecules.

The highest photovoltaic efficiency was obtained from the solar cells with photoanodes coated using the mixture of ascobic acid in Erabadu dye solution, which was 1.19 %. Devices fabricated with the TiO_2 electrodes, which were first coated with the dye from Erabadu and then dipped in ascorbic acid solution delivered 1.04% efficiency with 8.4 mA cm^{-2} photocurrent density.

The solar cells fabricated with TiO_2 photoanode immersed in a mixture of ascorbic acid and dye obtained from Jamson showed only 0.762 % of efficiency. The efficiency of the cell coated only with the dye from Jamson showed a lower efficiency of 0.38 %. The dye extraction from Jamson already contains ascorbic acid which gives the sour taste to the fruit. Therefore, one of the reasons for lower efficiency in DSSCs sensitized by the mixture of ascirbic acid and dye extracted from Jamson could be attributed to the higher concentration of the ascorbic acid in the dye solution.

The enhancement in the efficiency of DSSCs using anthocyanin dyes with ascorbic acid could be mainly due to the following reasons. One is the suppression of recombination due to dye quenching by ascorbic acid surrounding the anthocyanin dye molecules. The other reason is ascorbic acid when chelate with TiO_2 turns to yellow in colour which itself absorbs light in the UV region to generate a photocurrent. Therefore, further studies are essential to fully understand the performance of the cell in terms of the effect of ascorbic acid concentration and the soaking time of the photoanode in the dye solution consisting of ascorbic acid.

Keywords: Dye sensitized solar cells, Ascorbic acid, Anthocyanin, Photovoltaic efficiency

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