

Organic Dye based sensitized solar cells: A performance study

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ABSTRACT

Dye-sensitized solar cell (DSSC) which is an alternative to the conventional p-n junction devices. The key difference of the DSSC over traditional single junction solar cells is the use of an organic dye, which enhances the absorption rate of the wide band gap semiconductor and thereby increases the efficiency of the working electrode. Natural dyes as sensitizers are emerging sources due to their availability, low cost and environmental safety. Moreover, the absorption field of the dye and their adherence to the surface of the nanostructured TiO₂ are important parameters related to the efficiency of the cell. To have uniformity of layers and precision, the cells are manufactured in-house using fully automatic special purpose machines. Ferreira et al, 2020 explains fresh daisy flowers namely Yellow Daisy, Purple Daisy and Wine Daisy based organic dyes were utilized, attaining an efficiency of 0.88%. Najm et al, 2019 utilized pinang fruit crusts crushed in a grinder, 400 mL of ethanol based DSSC were tested and attained 0.118% efficiency. Chaudhari et al, 2020 manufactured the DSSC using an automated special purpose machine and evaluated the performance of glass based synthetic dye solar cells. This study examined the performance of DSSC by using organic dyes with organic and synthetic electrolytes. For testing, natural dyes were extracted from dried black currant, Java plum as both this fruit contains a large amount of Anthocyanin which is responsible for the absorption of light. Parsley extract was also added to both the fruits as it has an excellent amount of Chlorophyll which helps in the absorption of sunlight as in natural photosynthesis. The concentration level of black Java, Black currant and parsley were added in the ratio of 2:2:1. The counter electrode used was graphite and the electrolytes used were concentrated Vinegar as organic electrolyte and ethylene glycol-potassium iodide as synthetic electrolyte. The performance characteristics of both DSSCs were observed throughout the day of the cell. The performance parameters such as power output and maximum efficiency and corresponding fill factor are plotted and analysed.

Keywords-dye sensitized solar cell, organic dye, solar energy, non-conventional energy

References:

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 Engg.

Joint Conference of ICTACEM 2021, APCATS 2021, AJSAE 2021 and AeSI 2021



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