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**Highly efficient betanin dye based ZnO and ZnO/Au Schottky barrier solar cell**Aparna Thankappan<sup>1,2\*</sup>, S. Divya<sup>1</sup>, Anju K Augustine<sup>1</sup>, C.P Girijavallaban<sup>1</sup>,P. Radhakrishnan<sup>1</sup>, Sheenu Thomas<sup>1</sup>, V.P.N. Nampoori<sup>1</sup><sup>1</sup>International School of Photonics (ISP), Cochin University of Science and Technology<sup>2</sup>Inter University Centre for Nanomaterials and Devices (IUCND), Cochin University of Science and Technology, Kochi, India

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**Abstract:**

Performance of dye sensitized solar cells based on betanin natural dye from red beets with various nanostructured photoanodes on transparent conducting glass has been investigated. In four different electrolyte system cell efficiency of 2.99% and overall photon to current conversion efficiency of 20 % were achieved using ZnO nanosheet electrode with iodide based electrolyte in acetonitrile solution. To enhance solar harvesting in organic solar cells, uniform sized metal nanoparticles (gold (Au) of ~8 nm) synthesized via microwave irradiation method were incorporated into the device consisting of ZnO. Enhanced power conversion efficiency of 1.71 % was achieved with ZnO/Au nanocomposite compared to the 0.868 % efficiency of the bare ZnO nanosheet cell with ferrocene based electrolyte.

Keywords: betanin

**Introduction**

Since Grätzel et al. in 1991 developed a type of solar cells, viz. dye-sensitized solar cells (DSSCs) [1]; they have drawn considerable attention due to their several attractive properties like DSSC's an environmental friendly and excellent low-cost alternative to conventional inorganic photovoltaic devices. A typical DSSC consists of a redox electrolyte sandwiched between a working electrode and a counter electrode. Platinum film is widely used in fabricating a high performance DSSC since it has good catalytic activity. In these systems a semiconductor film is sensitized with a monolayer of dye molecules. Photo excitation takes place in the dye molecules, and fast electron transfer occurs through

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