



505/E1

Utilization of natural henna as a sensitizer in photoelectrochemical solar cells

C N Nupearachchi ¹, T R C K Wijayarathna ² and V P S Perera^{1*}

¹The Open University of Sri Lanka, Nawala, Nugegoda.

²Institute of Fundamental Studies, Hantana, Kandy.

Especially during the past ten years, academic and commercial interests have been directed on dye sensitized solar cells (DSSC) for their high efficiency, potential low cost and simple assemble technology. DSSC is composed of a nanocrystalline semi conductor oxide film coated with a dye deposited on a transparent conducting tin oxide (CTO) glass substrate which acts as the photo electrode, a Pt counter electrode and an electrolyte in the middle. Typically, TiO₂ is used for the semiconductor films and electrolyte is a solution containing I₃⁻/I⁻ redox couple. Dyes serve as the absorber of solar energy in DSSC whose properties will have much effect on the light harvesting efficiency. The ideal sensitizer should be firmly grafted to the semiconductor oxide surface and inject electrons to the conduction band. Its redox potential should be sufficiently high, that it can be regenerated rapidly via electron donation from the electrolyte. In the search for a proper dye, interest is drawn towards the natural pigments since the dye sensitization mimics the natural photosynthesis. The leaves of the henna plant (*Lawsonia inermis*) which contains a natural organic red-orange dye, a naphthaquinone was used in this study to sensitize the DSSC. The pigment was extracted by heating the dried leaf powder of henna in water. TiO₂ coated film which was deposited on CTO glass was then dipped in it. DSSC was made by placing a Pt sputtered CTO glass on the top of the dye coated TiO₂ film and filling the capillary space with an electrolyte containing I₃⁻/I⁻. The cell was characterized by I-V measurements and UV visible spectrum was taken for the pigment extracted from henna leaves.

These cells exhibited a photovoltage and a photocurrent density of 365 mV and 100 μA/cm² respectively. The observed photocurrent is minute because of the light absorption of the henna pigment occurs mainly in the UV region which is with a peak around 280 nm. But when the chromophore of hennatannic acid bonds to carotenes or proteins in human skin and hair, its colour become dark. Therefore, experiments are underway to use this pigment as an efficient sensitizer in DSSCs after structural modifications.

Acknowledgements: Authors acknowledge the N.S.F. for their financial assistant under RG/2007/W&E/03

vpper@ou.ac.lk

Tel : 0718032772