**Colors from Nature & Solar Cells – a Photophysical Study of Bleaching Effects**

**Jeroen Hustings**1 , **Dries Vrancken1, Asfaw Negash2, Roland Valcke3, and Jean V Manca1**

*1 UHasselt, X-LAB, Agoralaan D, B-3590 Diepenbeek, Belgium*

*2 Debre Berhan Universty, Department of Chemistry, POBOX 445, Debre Berhan, Ethiopia*

*3 UHasselt, Molecular and Physical Plant Physiology, Agoralaan D, B-3590 Diepenbeek, Belgium*

Dye-sensitized solar cells (DSSC) consist of a dye-sensitized mesoporous TiO2 electrode, a liquid electrolyte, and a counter electrode. Upon absorbing light, the excited dye molecules inject electrons into the TiO2 conduction band. Appealing features of DSSCs, are that they can be fabricated into flexible, semi-transparent modules available in wide color ranges and can lead to a novel class of esthetical solar cells with integrated images. This latter concept coined as ‘photovoltaic photographs’ is currently under development at UHasselt-X-LAB (publication and patent under preparation).

Alternatives for the synthetic dyes – which currently dominate the sensitizers used towards colored DSSCs - are natural dyes (i.e., pigments from fruits, rice...), interesting for their relative abundance, large absorption in the visible spectrum, ease of preparation, cost-effectiveness, and eco-friendliness. However, natural dyes in general suffer from low efficiency and stability issues.

In this study, the focus is on the investigation of bleaching mechanisms occurring in natural pigments in the presence of oxygen and illumination using a variety of spectroscopy techniques (e.g., UV/VIS spectroscopy). To investigate the occurrence of Reactive Oxygen Species (ROS) during the light-induced bleaching process, measurements were performed using Singlet Oxygen scavengers. The natural pigments used for this research were extracted from Black Rice, known to be rich in anthocyanins.

This study indicates that extraction of natural dyes from fruits, rice etc. can contain several compounds, which can have interplaying bleaching effects under illumination, as demonstrated here with the extraction from Black Rice, yielding the photosensitization of Singlet Oxygen by Chlorophyl. These insights on the bleaching of natural pigments can be of interest for several application domains (PV, textile…).