FABRICATION OF DYE SENSITIZED SOLAR CELL (DSSC) WITH SYNTHESIS OF COMPOSITE DYE FROM Garcinia mangostana, Celosia cristata, Beta vulgaris rubra AND Musa aromatica AT OPTIMUM VOLUME FRACTION OF TiO$_2$

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Abstract
Efforts to enhance efficiency generated by Dye Sensitized Solar Cell is still continued. One way is by mixing various dye or make layered dye in DSSC which is commonly called by co-sensitization. Besides varying dye, variation in volume fraction of TiO$_2$ also reported to be able to improve the efficiency, based on earlier findings we employed 90:10 anatase-to-rutile volume fraction as the optimum one. This research uses Garcinia mangostana, Celosia cristata, Beta vulgaris rubra and Musa aromatica as sensitizer in which each of them containing anthocyanin pigment (A), betalain pigment (B) and carotenoid pigment (C), respectively. These dyes were characterized by using UV-vis resulting in optimum absorbance at wavelengths of 400, 5 nm and 440 nm for Garcinia mangostana, 387 nm and 475 nm for Celosia cristata, 485 nm for Beta vulgaris rubra and 420 nm, 440 nm, 475 nm and 665 nm for Musa aromatica. From the aforementioned, they were varied as single layer, consisting of more than one dyes or multi layer. TiO$_2$ was synthesized using co-precipitation method. The particle size obtained was 20,06 nm and 69,07 nm for anatase and rutile, respectively. DSSCs were fabricated with 100% anatase and 90% anatase : 10% rutile volume fraction of TiO$_2$. The current-voltage (I-V) characteristic of DSSC employing sample with anthocyanin-carotenoid either as single layer or multi layer dyes have efficiencies of 0,039% and 0,047%, respectively. Variation with additional betalain pigment only resulted in low efficiency caused by the rapid rate of dye degradation.

Keywords: DSSC, single layer composite, multi layer, volume fraction.