

## Optimized Dye-Sensitized Solar Cell Using Natural Dye and Counter Electrode from Robusta Coffee Beans Peel Waste

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**Abstract :** Dye-Sensitized Solar Cell (DSSC) is one type of solar cell, where solar cells function to convert light energy become the electrical energy. DSSC has two important parts of dye and counter electrode. Anthocyanin compounds in the coffee beans peel can be potential as natural dye and also counter electrodes as activated carbon in the DSSC system. The purpose of this research is to find out how to isolate Anthocyanin, manufacture of counter electrode, and to know the efficiency of counter electrode produced from the coffee pulp waste in DSSC prototype. In this research we used 2 x 2 cm FTO glass coated carbon paste with a thickness variation of 100  $\mu\text{L}$ , 200  $\mu\text{L}$  and 300  $\mu\text{L}$  as counter electrode and other FTO glass coated with  $\text{TiO}_2$  paste as work electrode, then two FTO glasses are connected to form a sandwich-like structure and add Triiodide electrolyte solution in its gap, thus forming a DSSC prototype. The results showed that coffee pulp waste contains anthocyanin of 12.23 mL/80gr and it can produce activated carbon. The characterization performed shows that the UV-Vis Anthocyanin result is at wavelength of ultra violet area that is 219,50 nm with absorbance value equal to 1,469, and maximum wavelength at visible area is 720,00 nm with absorbance value equal to 0,013. The functional groups contained in the anthocyanin are O-H groups at wave numbers 3385.60  $\text{cm}^{-1}$ , C = O groups at wave numbers 1618.63  $\text{cm}^{-1}$ , and C-O-C groups at 1065.40  $\text{cm}^{-1}$  wave numbers. Morphological characterization using the SEM shows the activated carbon surface area becomes larger and evenly distributed. Voltage obtained on Counter Electrode 100  $\mu\text{L}$  variation of 395mV, 200  $\mu\text{L}$  of 334mV 100  $\mu\text{L}$  of 254mV.

**Keywords :** DSSC, anthocyanin, counter electrode, solar cell, coffee pulp

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