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# ABSTRACTS

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# DEVELOPMENT OF ACTIVATED COCONUT SHELL CHARCOAL AND CARBON NANOTUBES COMPOSITE AS COUNTER ELECTRODE FOR DYE-SENSITIZED SOLAR CELL APPLICATIONS

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Dye-sensitized solar cells (DSSCs) are the potential candidates for low-cost third generation photovoltaic devices, and they have attracted increasing attention. Typically, a DSSC device comprisesthree major components: a dye-sensitized semiconductor photoanode, an iodide electrolyte, and a counter electrode (CE). The CE significantly influences the photovoltaic performance of DSSCs, serving as a conducting layer with electrocatalytic functions to catalyse the redox couple regeneration reaction and collect electrons from the external circuit. Generally, Platinum (Pt) CE is the preferred material due to its high electrocatalytic activity in redox reactions and good conductivity. However, since Pt is a noble metal, there is a need to develop low-cost alternatives with high conductivity and excellent electrocatalytic activity. Considering these properties, carbonaceous materials emerge as promising candidates for CE materials comparedwith theother types of CEs. In this study, a composite consisting of activated coconut shell charcoal (ACSC) and carbon nanotubes (CNTs) was studied as a potential CE material for DSSCs. This ACSC/CNTs composite CE was fabricated using the spray method and used as an alternative to Pt CE. During the fabrication of composite CE, the amounts of ACSC and CNTs were optimized for device performance. The photovoltaic performance of the DSSCs were studied using I-V measurements under the 100 mW $cm^{-2}$ (1.5 AM) light illumination. The best performance was exhibited by the composite made with 0.3 g ACSC and 0.2 g CNT added to the composite CE. The solar cell efficiency increased from 4.03 % for pure ACSC and5.49 % for the optimized composite electrode, which is comparable to the efficiency of 6.41 % obtained for Pt electrode. This impressive increase in efficiency can be attributed to the highly porous nanostructure of the ACSC/CNT composite, providing more electron pathways and reaction sites for triiodide ion reduction, as confirmed by Scanning Electron Microscopy, X-ray diffraction, and Raman spectroscopy. The excellent electro-catalytic activity exhibited by the new CE is confirmed by Electrochemical Impedance Spectroscopy and Cyclic voltammetry, further supported by Tafel plot analysis. This result provides a cost-effective method to fabricate efficient CEs for DSSCs.

Key words: *Dye-Sensitized Solar Cells, Counter Electrode, Activated Coconut Shell Charcoal, Carbon Nanotubes*