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LOW-COST COUNTER ELECTRODE PREPARED USING ACTIVATED CARBON DERIVED FROM RICE HUSK FOR DYE-SENSITIZED SOLAR CELLS

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Dye-sensitized solar cells (DSSCs) have emerged as promising alternatives for efficient and cost-effective solar energy conversion devices. However, the high cost and limited availability of platinum (Pt), traditionally used as a counter electrode (CE) material, has motivated the search for sustainable and low-cost alternatives. This study explored the potential of using activated carbon synthesized from rice husk to prepare low-cost CE for DSSCs. Rice husk is an abundant agricultural waste product, and the present study reveals that the active carbon synthesized from rice husk can be used to prepare DSSC counter electrodes. At first, dried rice husk was carbonized and then activated by heating to 900 °C for 20 minutes and quenching several times. The spray pyrolysis method was used to prepare activated carbon CEs using polyvinylpyrrolidone binder and isopropanol solvent. A series of experiments showed that CEs prepared using activated carbon derived from rice husk are suitable for fabricating low-cost and highly efficient Pt-free DSSCs. With the usual N719 dye and liquid electrolyte (I^- /I_3^-), the DSSC utilizing this biomass-derived active carbon CE achieved an energy conversion efficiency of 5.62%, while that for Pt-based CE is 7.73%. The average open circuit voltage (V_{OC}) and short circuit current density (J_{SC}) of the active carbon-based cell are 0.68 V, 15.90 mA cm^{-2} relative to the Pt-based cell.

Keywords: Activated rice husk carbon, Counter electrode, Dye-sensitized solar cells, Platinum