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OP-02

A LOW-COST AND SUSTAINABLE ALTERNATIVE FOR COUNTER ELECTRODE MATERIAL IN DYE-SENSITIZED SOLAR CELLS: ACTIVATED PALMYRA SHELL CHARCOAL

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Abstract

Dye-sensitized Solar Cells (DSCs) have gained interest as an efficient and cost-effective solar energy conversion device. As a result, the cost of DSCs is mostly determined by the counter electrode (CE) material. Because of the high cost and limited availability of platinum (Pt), which is commonly used as a CE material, researchers have been looking for sustainable and low-cost alternatives. Palmyra palm shells are a biological resource obtained from the Palmyra palm tree's fruit. We report activated charcoal synthesized from Palmyra palm shells that can be utilized to make DSC CEs. First, cleaned Palmyra shells were carbonized by heating at 300 °C for 30 minutes, then activated for 2 hours at 900 °C while passing steam and quenched. Finally, dried activated Palmyra shells were disc-milled to get a fine powder. Activated Palmyra shell charcoal (APSC) based CEs are prepared by spray pyrolysis with polyvinylpyrrolidone binder and isopropanol solvent. Through a series of experiments, APSC was found to be suitable for the manufacture of low-cost and efficient Pt-free DSCs. The DSC utilizing APSC CE produced an energy conversion efficiency of 5.01% using the standard N719 dye and liquid electrolyte (I^-/I_3^-), whereas the Pt-based CE achieved an efficiency of 7.04%. APSC CE had an electrical conductivity of 7.32×10^3 S m^{-1}. Due to the low electrocatalytic activity, the APSC CE-based DSC performs lower than the Pt-based DSC, although the measured efficiency of 5.01% is noteworthy for a Pt-free low-cost DSC.

Keywords: Dye-sensitized solar cells, Platinum, Activated Palmyra palm shells, Counter electrodes