Facile Synthesis of PVP-MnO₂/CNT Composites as ORR Electrocatalyst for an Air-Cathode Microbial Fuel Cell

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doi: 10.20964/2018.08.05

Received: 15 February 2018 / Accepted: 12 April 2018 / Published: 5 July 2018

The cathodic oxygen reduction reaction (ORR) is an influential step in fuel cells for the electrochemical energy conversion. Here we synthesized Polyvinylpyrrolidone incorporated carbon nanotube supported manganese dioxide (PVP-MnO₂/CNT) composite and used as ORR electrocatalyst for air-cathode microbial fuel cell (MFC). The physical and electrochemical characterization of PVP-MnO₂/CNT were performed by using Field Emission Scanning Electron Microscopy (FESEM), Energy Dispersive X-ray analysis (EDX), X-ray Diffraction analysis (XRD), Cyclic Voltammetry (CV) and Electrochemical Impedance Spectroscopy (EIS). The electrochemical characterization results showed that the PVP-MnO₂/CNT possessed the higher ORR catalytic activity with lower charge transfer resistance compared to MnO₂ and MnO₂/CNT. The performance of the electrocatalysts as cathode was evaluated in air-cathode MFC and it was found that the MFC with MnO₂-PVP/CNT electrocatalyst generated a maximum power density of 1365.30 mW/m³, which was higher than that of MFCs with MnO₂/CNT catalyst (1083.98 mW/m³), MnO₂ (540.91 mW/m³) and CNT (438.47 mW/m³). Therefore, the viable synthetic strategy and proposed application of PVP-MnO₂/CNT will broaden up the reality of MFC for power generation.

Keywords: PVP-MnO₂/CNT; Microbial Fuel Cell; Electrocatalyst; Oxygen reduction reaction

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