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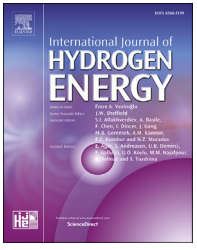

Enhanced oxygen reduction reaction in air-cathode microbial fuel cells using flower-like Co_3O_4 as an efficient cathode catalyst

Ravinder Kumar, Lakhveer Singh[*], *A.W. Zularisam*

Faculty of Engineering Technology, Universiti Malaysia Pahang, 26300 Kuantan, Malaysia

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ABSTRACT

In this study, the potential of mesoporous flower-like Co_3O_4 is investigated for the application of oxygen reduction reaction (ORR) in aqueous air-cathode microbial fuel cell (MFC). The flower-like Co_3O_4 was prepared by a hydrothermal route. The X-ray photoelectron spectroscopy results suggested that flower-like Co_3O_4 contained positively charged ions i.e., Co^{2+}/Co^{3+} on its surface that probably acted as ORR active sites. The electrochemical tests demonstrated that flower-like Co_3O_4 enhanced the electrocatalytic activity of the cathode significantly as the onset potentials obtained in cyclic voltammetry and linear sweep voltammetry were more positive than the bare cathode. Besides, Tafel plots showed that Co_3O_4 increased the electron transfer kinetics and achieved an exchange current density of 2.46 A/m^2, which was ~30% higher than bare cathode. Subsequently, this improved ORR activity increased the power output in the MFC and a maximum power density of 248 mW/m^2 was achieved, which was 6.3 times higher than the bare cathode. The higher ORR activity and improved electric output in the MFC could be attributed to the excellent electrocatalytic activity of Co^{2+}/Co^{3+} and mesoporous nature of flower-like Co_3O_4 that exposed extra active sites for oxygen molecules on the cathode surface.