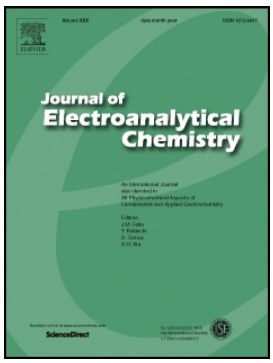

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Swagatika Rout, Arpan K. Nayak, Jhansi L. Varanasi, Debabrata Pradhan, Debabrata Das

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Enhanced energy recovery by manganese oxide/reduced graphene oxide nanocomposite as an air-cathode electrode in the single-chambered microbial fuel cell

Swagatika Rout,[a] Arpan K. Nayak,[b] Jhansi L. Varanasi,[c] Debabrata Pradhan,[b] Debabrata Das[a,c*]

[a]*P. K. Sinha Centre for Bioenergy, Indian Institute of Technology Kharagpur, W. B. 721302, India*

[b]*Material Science Centre, Indian Institute of Technology Kharagpur, W. B. 721302, India*

[c]*Department of Biotechnology, Indian Institute of Technology Kharagpur, W. B. 721302, India*

ABSTRACT

Microbial fuel cells (MFCs) provide an opportunity to harvest electrical energy from biodegradable organic wastes. In air-cathode MFCs, cathode plays an important role at which oxygen reduction reaction (ORR) occurs. Herein, MnO_2 nanorods are demonstrated as a potential air-cathode catalyst in a single-chambered MFC (sMFC). Synthesis of two different MnO_2 morphologies (nanoflakes and nanorods) is demonstrated at room temperature using a simple precipitation method. In order to improve the performance of MnO_2 as ORR electrocatalyst, graphene oxide (GO) is used as conductive matrix instead of carbon black. Furthermore, MnO_2/GO is hydrothermally treated to obtain MnO_2/reduced GO (h-MnO_2/rGO) nanocomposite. The sMFC comprising air-cathode with an optimum loading of h-MnO_2/rGO delivers 2.7 times higher volumetric power density than that of sMFC without a catalyst and comparable to the state-of-art Pt/C. This is ascribed to superior 4-electron ORR pathway by h-MnO_2/rGO and improved charge transport behavior of rGO support as confirmed through detailed electrochemical investigation. This work demonstrates a facile room temperature synthesis process of MnO_2 nanoflakes and nanorods, and their role as air-cathode electrocatalyst for competent power generation in sMFC.

Keywords: microbial fuel cells; nanorods; oxygen reduction reaction; air-cathode; manganese oxide; reduced graphene oxide.