Environmental Engineering and Management Journal *March 2012, Vol.11, No. 3, Supplement, S85*
http://omicron.ch.tuiasi.ro/EEMJ/

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APPLICATION OF $RU_XMO_YSE_Z$ FOR OXYGEN REDUCTION REACTION IN A MICROBIAL FUEL CELL

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Abstract

One of the actual challenges in microbial fuel cells research consists of the application of new electrochemically active catalytic materials ($Ru_xMo_ySe_z$), such as alternate electrocatalysts to replace the extensive use of the more expensive platinum. Thus, the objective of our work was to evaluate the application of $Ru_xMo_ySe_z$ for oxygen reduction reaction in a new design of a single chamber microbial fuel cell (MFC).

A MFC was based on extended electrode surface (larger ξ, ratio of electrode surface to cell volume) and the arrangement of the anode-PEM-cathode. The cell was built with a plexiglass cylinder, the two extreme circular faces were fitted with PEM-cathod assemblage, i.e., left and right faces. The anode consisted of 65 triangular pieces of graphite (1.4 x 1.8 x 0.5 cm, side x height x thickness). The cathode was made of flexible carbon-cloth containing 1mg/cm^2 $Ru_xMo_ySe_z$ catalyst. The cell was loaded with inoculum and substrate according to the specific literature. The MFC was characterized by linear sweep potential method as reported elsewhere.

First, each face of the MFC was characterized by separate (left and right). Second, the MFC was characterized with the two faces connected in series and parallel. Values of $E_{MFC, OCP}$ obtained from the separate faces were 0.591 and 0.593 V for the left and right face, respectively. Series and parallel connection showed similar potentials. The $P_{V\text{-}max}$ values were 1200, 1125, 1124 and 1829 mW/m^3 for separate faces, and series and parallel connection, respectively. The corresponding R_{int} were 146, 167, 162 and 69 Ω .

The $P_{V\text{-}max}$ of separate face electrodes was high and comparable with the value 1010 of mW/m^3 reported elsewhere. Parallel connection significantly decreased the internal resistance of the cell (69 Ω) and almost doubled volumetric power, due to increased current intensity of 1.8 mA. The results for $P_{V\text{-}max}$ for parallel connection can increase the volumetric power significantly. The internal resistance values in this work were in the low side of the range reported in the literature.

Our results have shown that the application $Ru_xMo_ySe_z$ as a cathodic catalyst for oxygen reduction reaction in a new design of a single chamber microbial fuel cell holds promise.