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Title: Substrate Crossover Effect and Performance Regeneration of the Biofouled Rotating Air-Cathode in Microbial Fuel Cell

Authors: Patil, Sunil A. (/jspui/browse?type=author&value=Patil%2C+Sunil+A.)

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Abstract: In case of conventional two-dimensional air-cathodes in microbial fuel cells, biofouling usually covers the catalytic-layer side after a long-term operation and results in performance decrease mainly by obstructing the transfer of OH⁻ ions. This study on a biofouled three-dimensional rotating air-cathode (bio-RAC), demonstrates that besides the OH⁻ effect, substrate crossover acts as a key hindrance to the air-cathode performance. MFC operation and cyclic voltammogram results revealed that about 35% performance decrease of the bio-RAC performance was caused by the obstruction of oxygen and OH⁻ transfer. It decreased further by 26.8 and 52.7% in the presence of 3 and 10 mM acetate, respectively, thereby clearly suggesting the impact of substrate crossover on the oxygen reduction reaction at the bio-RAC. In particular, high substrate concentrations exceeded the effect caused by obstruction of oxygen and OH⁻ transfer on the oxygen reduction catalysis. A simple approach of applying a high-speed rotation of about 500 rpm to the biofouled air cathode was proved to be able to recover 85% of the initial performance of the bio-RAC.

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