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Biofouling inhibition and enhancing performance of microbial fuel cell using silver nano-particles as fungicide and cathode catalyst

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Abstract

Morphological analysis of biofouling developed on cathode surface in an air-cathode microbial fuel cell (MFC) was performed. For sustaining power production and enhancing Coulombic efficiency (CE) of MFC, studies were conducted to inhibit cathode biofouling using different loadings of silver nanoparticles (Ag-NPs) with 5% and 10% Ag in carbon black powder. In MFC without using Ag-NPs in cathode (MFC-C), cathode biofouling increased the charge transfer resistance (R_{ct}) from 1710 $\Omega.cm^2$ to 2409 $\Omega.cm^2$, and reduced CE by 32%; whereas in MFC with 10% Ag in cathode R_{ct} increased by only 5%. Power density of 7.9 ± 0.5 W/m^3 in MFC using 5% Ag and 9.8 ± 0.3 W/m^3 in MFC using 10% Ag in cathode was 4.6 and 5.7-folds higher than MFC-C. These results suggest that the Ag-NPs effectively inhibit the fungal biofouling on cathode surface of MFCs and enhanced the power recovery and CE by improving cathode kinetics.

Keywords: Biofouling; Cathode potential; Fungus inhibition; Microbial fuel cell; Silver nanoparticles