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Ultrasound Driven Biofilm Removal for Stable Power Generation in Microbial Fuel Cell

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Supporting Information

ABSTRACT: Anodic biofilm plays a crucial role in bioelectrochemical system to make it sustainable for long-term performance. However, the accumulation of dead cells over time within the anode biofilm can be particularly detrimental for current generation. In this study, the effect of ultrasound on anode biofilm thickness was investigated in microbial fuel cells (MFCs). Ultrasonic treatment was employed for different durations to evaluate its ability to control the thickness of the biofilm to maintain stable power generation. Cell viability count and field emission scanning electron microscopy (FESEM) analysis of the biofilms over time showed that the number of dead cells increased with the increase of biofilm thickness, and eventually exceeded the number of live cells by many-fold. Electrochemical impedance spectroscopy (EIS) analysis indicated that the high polarization resistance appeared due to the dead layer formation, and thus the catalytic efficiency was reduced in MFCs. The stable power generation was achieved by employing ultrasonic treatment for 30 min every 6 days with some initial exception. The low frequency ultrasound treatment successfully dislodged the ineffective biofilm from the surface of the anode. Moreover, the ultrasound could increase the mass transfer rate of the nutrients and cellular waste through the biofilm leading to the increase in cell growth. Therefore, ultrasonic treatment is verified as an efficient method to control the thickness of the biofilm as well as enhance the cell viability in biofilm thereby maintaining the stable power generation in the MFC.