Biofilm re-vitalization using hydrodynamic shear stress for stable power generation in microbial fuel cell

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ABSTRACT

Viable electroactive biofilm formation, allowing considerable conversion capacity and opportunities for extracellular electron transfer (EET) is essential for sustainable and long term stable power generation in microbial fuel cells (MFCs). However, over the time, the anodic biofilm can be particularly detrimental for electrogenesis due to the accumulation of more dead cells and that increases the charge transfer resistance as well as reduces the electrocatalytic efficiency. In this study, flow induced shear stresses (4.38, 9.34 and 14.92 mPa) were employed to revitalize the biofilm by removing the inert biomass for the maintenance of stable power in MFCs. Among them, the moderate shear stress (9.34 mPa) successfully reduced the thickness and thereby revitalized the biofilm within a short time. The field emission scanning electron microscopy (FESEM) and cell viability count analysis of the biofilms confirmed that the shear stress (9.34 mPa) reduced the dead cells accumulation in the biofilm. Moreover, this treatment significantly reduced the polarization resistance (68%) by dislodging nonconductive inert dead cells from the surface. Our results revealed that the application of shear stress could be an effective method to maintain the stable power generation by reducing the thickness and increasing the cell viability of the biofilm in the MFC.

KEYWORDS

Electroactive biofilm; *Pseudomonas aeruginosa;* Resistance; Shear stress; Palm oil mill effluent

ACKNOWLEDGEMENTS

This work was supported by the Universiti Malaysia Pahang, Malaysia (RDU 140322 and GRS 150371) and Newton Research Collaboration Programme (NRCP1617/5/42).