Significant improvement of power generation through effective substrate-inoculum interaction mechanism in microbial fuel cell

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ABSTRACT

Low power generation and low voltage output is a common problem in microbial fuel cell (MFC) run with complex wastewater. Biocatalysts are one of the major components to ensure the high performance of the MFCs. In the present study, palm oil mill effluent (POME) is treated with a combination of Saccharomyces cerevisiae, Klebsiella variicola and Pseudomonas aeruginosa to intensify the power generation and treatment efficiency of the MFC. MFCs are catalyzed by pure cultures exhibited low power generation in the range of 50–103 mW/m2 whereas the yeast-bacteria inoculum demonstrates 5–10 fold higher power generation (500 mW/m2 at 0.67 V) with ~90% COD removal efficiency. The mechanism of enhanced power generation by yeast-bacteria inoculum is unravelled which suggests that Klebsiella variicola and Pseudomonas aeruginosa play a crucial role in transferring the electrons from the bulk phase to the electrode surface through self-produced electron-shuttles and at the same time extract electrons from the yeast leading to high power generation. Moreover, substrate-inoculum synergism also offers higher wastewater treatment efficiency. The findings of the work suggest that the use of substrate-inoculum mutualistic interaction between yeast and bacteria as a profound replacement to the existing bacterial inoculum for achieving higher performance in MFCs.

KEYWORDS

Microbial fuel cell; Palm oil mill effluent; Substrate-inoculum synergy; Yeast-bacterial interaction

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