ABSTRACT

This study aimed to determine the electrochemical characteristics and evaluate the performance of a Microbial Fuel Cell (MFC) using Bacillus clausii J1G-0%B as a biocatalyst with varying concentrations of vitamin B1 (0, 2.5, 5, 7.5, 10, and 15 ppm) in the growth medium. The study consisted of bacterial rejuvenation and culture preparation, bacterial growth curve determination, pH and ammonia analyses, and MFC performance evaluation using half-cell and full-cell configurations. Half-cell analysis included Cyclic Voltammetry (CV), Rate Determining Step (RDS), and electron transfer rate constant (k_s) measurements, whereas full-cell analysis involved voltage measurements over three operating cycles (3 × 72 h), maximum power density determination, and biofilm analysis on the anode. CV analysis revealed redox activity, indicating electron transfer that was presumed to be facilitated by cytochrome C1 as an electron carrier from bacterial cells to the electrode. Based on the oxidation-to-reduction peak current ratio and ΔEp values, all vitamin B1 concentrations exhibited a quasi-reversible redox system. RDS analysis produced a non-linear curve, indicating that electron transfer occurred through a diffusion-controlled mechanism. The highest electron transfer rate constant was obtained at 7.5 ppm vitamin B1, with a value of $3.231 \pm 0.966\ s^{-1}$. Full-cell analysis also demonstrated that the 7.5 ppm vitamin B1 treatment produced the highest voltage (0.105 V) and maximum power density ($42.775\ mW/m^2$). Overall, the addition of 7.5 ppm vitamin B1 resulted in the best MFC performance based on electrochemical characteristics, electron transfer rate constant, voltage output, and maximum power density.

Keywords: *Microbial Fuel Cell, Bacillus clausii J1G-0%B, vitamin B1.*