ABSTRACT

Microbial fuel cells have become one of the technologies of choice that researchers continue to develop to address high salinity wastewater pollution while producing renewable energy amid the energy crisis and environmental pollution that have persisted for decades. This study employs acetate, lactate, and citrate at varying concentrations of 10, 30, and 50 mM as additional carbon sources for microbial fuel cells using the halophilic bacterium Bacillus clausii J1G-0%B, aiming to optimize microbial fuel cell performance, thereby offering a solution for treating high-salinity wastewater while generating renewable energy. This study consisted of half-cell testing, which included Cyclic Voltammetry (CV) analysis, Rate Determining Step (RDS), Electron Transfer Rate Constant (k_s), pH changes, and ammonia levels; and full-cell testing, which included voltage analysis, maximum power density, and bacterial biofilm. The results of the study indicate that the addition of acetate, lactate, or citrate carbon sources can improve the electrochemical characteristics of microbial fuel cells k_s by 184.56% to 378.23% compared to the control, where the redox reaction between bacteria and electrodes is limited by diffusion reactions and involves cytochrome a_3, cytochrome b, cytochrome c, and/or cytochrome c_1 of Bacillus clausii J1G-0%B. The performance of the microbial fuel cell showed an average voltage of 33.64 to 77.87 mV and a maximum power density of 9.86 to 20.38 mW/m², with the most optimal results obtained at the 50 mM acetate variant with a k_s value of 1.888 ± 0.002 s^{-1}, an average voltage of 77.87 mV, and a maximum power density of 20.38 mW/m².

Keywords: *microbial fuel cell, saline wastewater, renewable energy, acetate, lactate, citrate*