ABSTRACT

Microbial Fuel Cell (MFC) is a technology that utilizes the metabolic activity of microorganisms to generate electrical energy. Saccharomyces cerevisiae has significant potential in MFC applications; however, its electron transfer efficiency requires enhancement, one of which can be achieved through the addition of various nitrogen sources. This study aims to analyze the electrochemical characteristics and performance of Saccharomyces cerevisiae as a biocatalyst in MFCs, focusing on the effects of different nitrogen sources: peptone, tryptone, and BSA (Bovine Serum Albumin). The research involved several stages, including culture media preparation and electrochemical analysis. The concentration of Saccharomyces cerevisiae cells was verified using a hemocytometer. Analyses were conducted in both half-cell and full-cell configurations. In the half-cell system, observations included changes in pH, alcohol content, cyclic voltammetry, and rate-determining step (RDS) curve analysis to calculate the electron transfer rate constant (Ks). Meanwhile, in the full-cell configuration, measurements included voltage output, maximum power density, anode biofilm formation, and anode weight change. The results showed that the pH decrease in each nitrogen variation was caused by ethanol and organic acid production. Electron transfer occurred via the cytochrome pathway (a, a3, b, c, and c1) through a diffusion mechanism, as indicated by the non-linear RDS curves. The highest Ks values were obtained from peptone 5 mg/mL (1.61 ± 0.285 s^{-1}), followed by tryptone 1 mg/mL (1.53 ± 0.332 s^{-1}), and BSA 1 mg/mL (0.95 ± 0.055 s^{-1}). The highest average voltage was recorded in peptone 5 mg/mL (0.132 V), followed by tryptone 1 mg/mL (0.117 V), and BSA 1 mg/mL (0.039 V). The maximum power densities were 46.6 mW/m² (peptone 5 mg/mL), 45 mW/m² (tryptone 1 mg/mL), and 7.1 mW/m² (BSA 1mg/mL), respectively. SEM analysis showed increased biofilm formation with higher nitrogen concentrations, with peptone at 5 mg/mL exhibiting the best overall performance across all parameters.

***Keywords**: Microbial Fuel Cell, Saccharomyces cerevisiae, peptone, electron transfer, cyclic voltammetry, biofilm.*