

### Abstract

The use of microbial fuel cells (MFCs) in integrated science, technology, engineering, and mathematics (STEM) education has seen increasing popularity in education circles. The MFC uses interdisciplinary scientific concepts to harness electricity from respiring microbes. However, to enable widespread educational use of the MFCs, using Nafion™ membranes is impractical. In this study, we aim to investigate the feasibility of using cheaper materials as the membrane in an MFC as a cost-effective alternative to the expensive standard membrane, using a modified version of the conventional Bennetto MFC; Parchment Paper, Cellophane, Dialysis Tubing; as well as Aluminium, Plastic, and Filter Paper as negative controls. We also tested rudimentary treatment with PVA glue to decrease chemical and physical permeability to electrons and substances other than protons, as well as to increase the productivity of MFC by increasing the effectiveness of charge balancing between chambers. The result we got shows that the best candidate is double layered parchment paper, having shown a comparable peak in average open circuit voltage (OCV) and only a 49.1% reduction in average longevity duration from those when Nafion™ is used, compared to the 72.7% decrease for the other membrane material candidates, in addition to outperforming Nafion™ for more than 3 hours on average. Thus, we have accomplished our goal of finding a low-cost alternative to the expensive Nafion™ membranes. Nonetheless, further study is required on the inexplicable, inconsistent performance of Aluminium Foil as a membrane in MFCs.