Go with the Flow: Examining the Potential of Continuous Flow Microbial Fuel Cells

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The purpose of this experiment was to examine the potential of continuous flow microbial fuel cells (CFMFCs) with the aim of determining the relationship between electricity generation and flow rate and creating more practical microbial fuel cells (MFCs). The hypothesis was that a flow rate of 0 mL/h would result in greater electricity generation than 600 mL/h or 1200 mL/h, due to the fact that increased flow rate would retard growth of the biofilm (intrinsic to electricity generation) and would wear it away at a greater rate. To test this, three single-cell MFCs were constructed out of a Tupperware container. An anaerobic anode was separated from an open-air aluminum mesh cathode via a Gore-Tex proton exchange membrane (PEM). A carbon rod anode was connected to the respective aluminum cathode via alligator wires. The flow rate of each CFMFC was regulated via a peristaltic pump powered by a variable power supply while an anodic slurry of Rid-X, sucrose, and table salt was used to better facilitate pumping. A reservoir was connected to each CFMFC via the pumps and served to provide a cycling of nutrients (replicating real-world conditions). Three trials of five days each were conducted, with measurements taken twice daily. Data analysis revealed that the 0 mL/h control significantly outperformed the 600 mL/h and 1200 mL/h CFMFCs (averaging 50% and 100% greater comparative electricity generation respectively). The findings indicate that flow rate and power are inversely related. Furthermore, they reveal that proper biofilm management and sheltering are vital to successful CFMFCs.

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