CAPACITIVE DEIONIZATION POWERED BY MICROBIAL FUEL CELLS: FEASIBILITY STUDY OF SELF-SUSTAINED DESALINATION OF PRODUCED WATER

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Capacitive deionization (CDI) is a process designed to remove unwanted ions from aqueous streams using electrical power and is considered a minimally polluting and potentially cost effective method for desalination. This study developed a bench-scale system consisting of a membrane CDI unit powered by microbial fuel cells (MFCs). The MFCs used graphite felt electrodes and were fed with a glucose solution to generate electrical power via microbial activities. The electrical output was used to run the CDI unit for desalination of waters with a range of NaCl concentrations. The MFCs generated voltage as high as 1.3 V with an external resistance 10k;. The CDI unit was powered by the MFC electrical output and removed up to 500 mg/L NaCl within 30 hours. Electrical conductivity of 1,000 mg/L NaCl was lowered from 2,052 µs/cm to 35.2 µs/cm within 70 hours. The preliminary results show successful desalination of the tested salt waters, but at slow rates. The next phase of the study will focus on increasing the MFC electrical power output and reducing the external/internal resistance of the MFCs and CDI unit. Potential applications of the developed system may include the combined treatment of produced water and fracturing flowback water.

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