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Citric acid production using a biological electro dialysis with bipolar membrane

ACCEPTED MANUSCRIPT

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Abstract

The aim of this study was to investigate the feasibility of citric acid (CA) production using a biological electro dialysis with bipolar membrane, i.e., the microbial electrolysis desalination and chemical-production cell (MEDCC). To optimize the performance, batch, recirculation, and packed ion-exchange resin (IER) modes were carried out in the MEDCC. With 0.1 M Na₃Cit, the maximum current density was 7.7±0.3, 9.2 ± 0.6, and 11.1± 0.5 A/m² in the batch, recirculation, and packed IER modes, respectively. The maximum CA production of 0.443 ± 0.096 M was achieved within 96 h operation using 0.5 M Na₃Cit with the recirculation mode. The lowest internal resistance of 48.5 Ω was observed with the packed IER mode. The lowest electric consumption of 0.81±0.03 kWh/kg in the MEDCC was achieved with 0.5 M Na₃Cit and the recirculation mode, which was only 10% - 40% of the electrical energy consumed in other electro dialysis processes. The MEDCC with the recirculation mode had higher abundance of *Geobacter* and higher biomass in the anode biofilm than that with the batch mode, resulting in better performance in terms of higher current density and CA production. The MEDCC should be a potential valuable method for CA production with low energy consumption.

Keywords: Microbial electro dialysis and chemical-production cell; bipolar membrane; citric acid

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