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Haiping Luo, Xing Cheng, Guangli Liu*, Yajing Zhou, Yaobin Lu, Renduo Zhang, Xiao Li, Wenkai Teng

Guangdong Provincial Key Laboratory of Environmental Pollution Control and Remediation Technology, School of Environmental Science and Engineering, Sun Yat-sen University, Guangzhou, 510275, China

*Corresponding author. Tel.: +86-20-84110052; fax: +86-20-84110267; liugl@mail.sysu.edu.cn

Abstract

The aim of this study was to investigate the feasibility of citric acid (CA) production using a biological electrodialysis 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 Na_3Cit, the maximum current density was 7.7±0.3, 9.2 ± 0.6, and 11.1± 0.5 A/m^2 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 Na_3Cit 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 Na_3Cit and the recirculation mode, which was only 10% - 40% of the electrical energy consumed in other electrodialysis processes. The MEDCC with the recirculation mode had higher abundance of Geobacter and higher biomass in the anode biofim 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 electrodialysis and chemical-production cell; bipolar membrane; citric acid