Two-chamber microbial fuel cell to simultaneously remove ethanolamine and nitrate

Byung-Min An, Young-Hyun Song, Ja-Won Shin, Joo-Yang Park*

Department of Civil and Environmental Engineering, Hanyang University, 222 Wangsimni-ro, Seongdong-gu, Seoul 133-791, Republic of Korea, emails: aabbmm@naver.com (B.-M. An), yhsong86@hanyang.ac.kr (Y.-H. Song), gam0369@hotmail.com (J.-W. Shin), Tel. +82 2 2220 0411; Fax: +82 2 2220 1945; email: jooypark@hanyang.ac.kr (J.-Y. Park)

Received 30 December 2014; Accepted 30 July 2015

ABSTRACT

Microbial fuel cells (MFCs) are a promising technology to treat wastewater while recovering bioenergy and have been studied to remove carbon and nitrogen. Electrons generated at the anode from the oxidation of organic electron donors are used to reduce nitrate at the cathode, and these processes produce power. In this study, a two-chamber MFC that coupled an anode chamber and biocathode chamber was investigated to remove ethanolamine and nitrate. We developed an MFC in which micro-organisms at the cathode performed complete denitrification using electrons supplied by ethanolamine oxidation at the anode. The biocathode MFC produced a maximum power density of 8.41 W/m³ with a corresponding current and cell voltage of 2.9 mA and 170 mV, respectively. This research demonstrates that an MFC with both a biological anode and cathode simultaneously removed ethanolamine, produced power, and denitrified. Results from this study indicate that ethanolamine might be a suitable resource for generating electricity with MFC technology.

Keywords: Microbial fuel cell; Two-chamber; Ethanolamine; Biodegradation; Biocathode

*Corresponding author.

Presented at the 7th International Conference on Challenges in Environmental Science and Engineering (CESE 2014) 12–16 October 2014, Johor Bahru, Malaysia

1944-3994/2014-3986 © 2015 Balaban Desalination Publications. All rights reserved.