Aerobic granular sludge formation and COD removal in a continuous-flow microbial fuel cell

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Received 13 December 2017; Accepted 8 September 2018

ABSTRACT

A continuous-flow microbial fuel cell (cMFC) system with bio-cathode chamber (BCC) was designed to improve organic pollutant removal performance, along with electricity production. Aerobic granular sludge (AGS) formation was observed by accident in the BCC of the cMFC system. Process and mechanism of the AGS formation were stated, and the effect of influent chemical oxygen demand (COD) concentration, hydraulic retention time, cathode aeration rate on organic pollutant removal in the cMFC was studied. According to the sludge morphology, AGS formation process could be divided into six stages with a total duration of around 80 d. Mechanism of the AGS formation was explained from macroscopic and microscopic point of views. Moreover, COD removal efficiency was always higher than 90% in the cMFC system after the AGS formation when influent COD concentration was increased from 3,000 to 7,540 mg/L. Maximum output voltage of 91 mV was obtained in the AGS-based cMFC system.

Keywords: Continuous-flow microbial fuel cell; Bio-cathode; Aerobic granular sludge; Organic pollutant removal; Electricity production