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Bio-cathode materials evaluation and configuration optimization for power output of vertical subsurface flow constructed wetland — Microbial fuel cell systems

Shentan Liu^a, Hailiang Song^a, Size Wei^a, Yang Fei^b, Xianning Li^{a,*}

^a School of Energy and Environment, Southeast University, Nanjing 210096, China

^b School of Public Health, Central South University, Changsha 410078, China

ABSTRACT: To optimize the performance of a vertical subsurface flow constructed wetland–microbial fuel cell (CW-MFC), studies of bio-cathode materials and reactor configurations were carried out. Three commonly used bio-cathode materials including stainless steel mesh (SSM), carbon cloth (CC) and granular activated carbon (GAC) were compared and evaluated. GAC-SSM bio-cathode achieved the highest maximum power density of 55.05 mW m^{-2} , and it was most suitable for CW-MFCs application because of its large surface area and helpful capillary water absorption. Two types of CW-MFCs with roots were constructed, one was placed in the anode and the other was placed in the cathode. Both planted CW-MFCs obtained higher power output than non-planted CW-MFC. Periodic voltage fluctuations of planted CW-MFCs were caused by light/dark cycles, and the influent substrate concentration significantly affected the amplitude of oscillation. The coulombic efficiencies of CW-MFCs decreased greatly with the increase of the influent substrate concentration.

Keywords: Microbial fuel cell; Constructed wetland; Wastewater treatment; Rhizosphere effect; Power density.

* Corresponding author. Tel.: +86 13776650963; fax: +86 025 83795618.
E-mail address: lxn@seu.edu.cn (X. Li).

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