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

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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.

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