Treatment of Aged Landfill Leachate by a Self-Sustained Microbial Fuel Cell-Microbial Electrolysis Cell System

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Microbial fuel cells (MFCs) can supply power and drive reactions for microbial electrolysis cells (MECs) when they are connected in series. This study designed three different air-cathode single-chamber MFC-MEC systems constructed with aged landfill leachate as the substrate to enhance energy recovery and pollutant removal efficiency. These systems were designated as MFC (S₁), MFC-MEC (S₂) and MFC-MEC-MFC (S₃). Maximum voltage outputs of 146, 421, and 253 mV were obtained from the S₁, S₂ and S₃ systems, respectively. The removal efficiency of COD in the S₂ and S₃ systems was significantly enhanced compared to that of the S₁ system, and the removal rate of ammonia could reach more than 90%. In addition, the degradation of ammonia nitrogen in the S₁ and S₂ systems was consistent with fractal reaction kinetics, providing a theoretical basis for pollutant removal in the future. Therefore, it was demonstrated that the associated system could enhance the performance of electricity generation and thus could be applied to enrich wastewater treatment efficiency as a new and promising approach.

Keywords: microbial fuel cell; microbial electrolysis cell; landfill leachate; chemical oxygen demand; ammonia

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