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Phosphorus Recovery Optimization in Microbial Fuel Cell

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Abstract : Understanding the impact of key operational variables on concurrent energy generation and phosphorus recovery in microbial fuel cell is required to improve the process and reduce the operational cost. In this study, full factorial design (FFD) and central composite designs (CCD) were employed to identify the effect of influent COD concentration and cathode aeration flow rate on energy generation and phosphorus (P) recovery and to optimise MFC power density and P recovery. Results showed that influent chemical oxygen demand (COD) concentration and cathode aeration flow rate had a significant effect on power density, coulombic efficiency, phosphorus precipitation efficiency and phosphorus precipitation rate at the cathode. P precipitation was negatively affected by the generated current during the batch duration. The generated energy was reduced due to struvite being precipitated on the cathode surface, which might obstruct the mass transfer of ions and oxygen. Response surface mathematical model was used to predict the optimum operating conditions that resulted in a maximum power density and phosphorus precipitation efficiency of 184 mW/m² and 84%, and this corresponds to COD= 1700 mg/L and aeration flow rate=210 mL/min. The findings highlight the importance of the operational conditions of energy generation and phosphorus recovery.

Keywords : energy, microbial fuel cell, phosphorus, struvite
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