Reduction of vanadium(V) in a microbial fuel cell: V(IV) Migration and Electron Transfer Mechanism

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The effects of vanadium on the microbial fuel cell performance, migration and distribution of V(IV) as well as electron transfer mechanism of single-chamber MFC were investigated by SEM, Fourier Transform Infrared Spectroscopy (FTIR), Cyclic Voltammetry (CV) and Electrochemical Impedance Spectroscopy (EIS). With anolyte vanadium concentration of 100 mg/L, the shortest degradation cycle was 130.67 h, while the degradation rate was 99.44%. V(V) combined with hydroxyl and carboxyl groups to form V(IV) organic participates, part of which deposited on the anode surface, and the other part distributed in anolyte. V(V) around cathode was reduced to V(IV) receiving electrons from the anode, meanwhile V(V) in anolyte was reduced to V(IV) owing to the electrons transfer on membrane binding enzyme complex. V(V) participated in cathode reactions instead of oxygen, accelerating the synchronization and integrity of electrode reactions.

Keywords: microbial fuel cell; vanadium-containing wastewater; anode adsorption; membrane binding enzyme; V(IV) complex

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