Autotrophic Denitrification for Nitrate Removal from Groundwater with an Integrated Microbial Fuel Cells (MFCs)-microbial Electrolysis Cell (MEC) System

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Bioelectrochemical system (BES) that is self-sufficient was developed to treat nitrate in groundwater, which consists of air cathode microbial fuel cell (MFC) and microbial electrolysis cell (MEC). Without external power, the highest nitrate removal rate and the highest removal efficiency of autotrophic denitrification MFC were 10.6 mg/(L·d) and 56.5%, respectively. However, the highest denitrification rate increased to 13.5 mg/(L·d) when three air cathode MFCs (0.8 V) were adopted in series as the power source for autotrophic denitrification MEC, which was 27.4% higher than that of autotrophic denitrification MFC. In addition, the nitrate removal efficiency was as high as 80.6%, which was the same to that of the conventional biological nitrogen removal (BNR). Thereby, autotrophic denitrification was significantly improved in MFCs-MEC and the hybrid system made BES more feasible in treating low ionic strength water (<1000 μ S/cm) like groundwater. Furthermore, excessive organic input to groundwater was avoided by the autotrophic denitrification which might cause secondary pollution to it.

Keywords: nitrate removal; autotrophic denitrification; groundwater pollution; microbial electrolysis cell; microbial fuel cell

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