Effects of trace elements and current densities on denitrification, microbe growth, ATP generation and enzyme activity in a bio-electrochemical reactor

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This study explored the effects of trace elements and current densities on denitrification, microbe growth, ATP generation, and enzyme activity in a bio-electrochemical reactor (BER). The optimum current density of 200 mA/m² and the addition of trace elements significantly improved the nitrate removal efficiency compared with the control (99.9% versus 85.2%) and remarkably reduced the intermediate nitrite accumulation (4.01 ± 0.03 versus 8.25 ± 0.35 mg/L). A microbial study showed that the application of the optimum current density and trace elements promoted the microbial growth, ATP activity, cell membrane permeability and denitrification key enzyme activity. An elemental analysis revealed that iron and molybdenum significantly improved the catalytic activity of nitrate reductase (Nar), while iron and copper enhanced the catalytic activity of nitrite reductase (Nir). This study provides an important insight into the potential effects of using an optimum current density and trace elements on denitrifying microorganisms and the denitrification performance within a bio-electrochemical reactor BER.

Keywords: Bio-electrochemical reactor (BER); Trace elements; Electro-stimulation; Denitrification key enzyme activity; Microbial growth

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