Inhibition of Nitrate Reduction by NaCl Adsorption on a Nano-Zero-Valent Iron Surface during a Concentrate Treatment for Water Reuse - DTU Orbit (06/10/2019)

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Nanoscale zero-valent iron (NZVI) has been considered as a possible material to treat water and wastewater. However, it is necessary to verify the effect of the matrix components in different types of target water. In this study, different effects depending on the sodium chloride (NaCl) concentration on reductions of nitrates and on the characteristics of NZVI were investigated. Although NaCl is known as a promoter of iron corrosion, a high concentration of NaCl (>3 g/L) has a significant inhibition effect on the degree of NZVI reactivity toward nitrate. The experimental results were interpreted by a Langmuir-Hinshelwood Hougen-Watson (LHHW) reaction in terms of inhibition, and the decreased NZVI reactivity could be explained by the increase in the inhibition constant. As a result of a chloride concentration analysis, it was verified that 7.7-26.5% of chloride was adsorbed onto the surface of NZVI. Moreover, the change of the iron corrosion product under different NaCl concentrations was investigated by a surface analysis of spent NZVI. Magnetite was the main product, with a low NaCl concentration (0.5 g/L), whereas amorphous iron hydroxide was observed at a high concentration (12 g/L). Though the surface was changed to permeable iron hydroxide, the Fe(0) in the core was not completely oxidized. Therefore, the inhibition effect of NaCl could be explained as the competitive adsorption of chloride and nitrate.

Supplementary material.

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