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Effects of different nickel species on autotrophic denitrification driven by thiosulfate in batch tests and a fluidized-bed reactor

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Abstract

Nickel is a common heavy metal and often occurs with nitrate (NO_3^-) in effluents from mining and metal-finishing industry. The present study investigates the effects of increasing concentrations (5-200 mg Ni/L) of $NiEDTA^{2-}$ and $NiCl_2$ on autotrophic denitrification with thiosulfate ($S_2O_3^{2-}$) in batch tests and a fluidized-bed reactor (FBR). In batch bioassays, 50 and 100 mg Ni/L of $NiEDTA^{2-}$ only increased the transient accumulation of NO_2^-, whereas 25-100 mg Ni/L of $NiCl_2$ inhibited denitrification by 9-19%. NO_3^- and NO_2^- were completely removed in the FBR at feed $NiEDTA^{2-}$ and $NiCl_2$ concentrations as high as 100 and 200 mg Ni/L, respectively. PCR-DGGE revealed the dominance of *Thiobacillus denitrificans* and the presence of the sulfate-reducing bacterium *Desulfovibrio putealis* in the FBR microbial community at all feed nickel concentrations investigated. Nickel mass balance, thermodynamic modeling and solid