

Metagenomic analysis of denitrifying wastewater enrichment cultures able to transform the explosive, 3-nitro-1,2,4-triazol-5-one (NTO)

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Abstract

Removal of 3-nitro-1,2,4-triazol-5-one (NTO) was investigated in conjunction with heterotrophic and autotrophic denitrifying growth conditions by a microbial consortium from a wastewater treatment plant. Microcosms were supplemented with molasses, methanol, or thiosulfate. Cultures were passaged twice by transferring 10 % of the culture volume to fresh media on days 11 and 21. Rates of NTO removal were 18.71 ± 0.65 , 9.04 ± 2.61 , and 4.34 ± 2.72 mg/L/day while rates of nitrate removal were 20.08 ± 1.13 , 21.58 ± 1.20 , and 24.84 ± 1.26 mg/L/day, respectively, for molasses, methanol, or thiosulfate. Metagenomic analysis showed that Proteobacteria and Firmicutes were the major phyla in the microbial communities. In molasses supplemented cultures, the community profile at the family level changed over time with Pseudomonadaceae the most abundant (67.4 %) at day 11, Clostridiaceae (65.7 %) at day 21, and Sporolactobacillaceae (35.4 %) and Clostridiaceae (41.0 %) at day 29. Pseudomonadaceae was the dominant family in methanol and thiosulfate supplemented cultures from day 21 to 29 with 76.6 and 81.6 % relative abundance, respectively.

Keywords NTO · Insensitive munitions · Metagenomics · Denitrification

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