Geophysical Research Abstracts
Vol. 20, EGU2018-2324-1, 2018
EGU General Assembly 2018

Biodegradation of Dinitroxylene by nitrate-reducing and sulfate-reducing cultures collected from contaminated sites

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The production and processing of military nitroaromatic explosives has led to the contamination of soil and water by energetic compounds. These groups of nitroaromatic explosives represent an environmental hazard because of their relatively recalcitrant nature to natural attenuation and their toxicological and potentially mutagenic effects on a number of microorganisms. Recently, isomers of DNX were detected at TNT and DNTs contaminated sites. As group members of the nitroaromatic explosives, DNX isomers have similar chemical structure to TNT and DNTs, and thus are postulated to pose similar risks to human health and the environment. Biological treatment processes are often considered first, since they are the least expensive means of destroying contaminant compounds, and cost-least damage to the environments. Therefore, the present study was focused on developing a considerable biological treatment strategy for remediating DNX contaminated sites, the ability of two previously obtained enrichment cultures (nitrate-reducing and sulfate-reducing cultures) to metabolize DNX was examined. Meanwhile a series of batch experiments were conducted to determine the DNX biodegradation in the presence of co-substracte and/or electron acceptors. The results showed that DNX is readily biotransformed by nitrate-reducing and sulfate-reducing cultures. However, the rate of DNX degradation was observed to be slightly influenced by the addition of electron donor and acceptors. The rates of DNX degradation were slightly faster under sulfate-reducing conditions, compared to nitrate-reducing conditions. A 180-h lag period was noticed prior to sulfate reduction. The onset of sulfate reduction coincided with the complete biotransformation of DNX to ANX and the onset of ANX reduction to DAX, indicating the presence of DNX inhibited sulfate reduction. It is also suggest that DNX was used an electron acceptor, more preferable than sulfate in sulfate-reducing culture.No evidence shows DAX biodegradation in both nitrate-reducing and sulfate-reducing cultures, indicating DAX was the end product of DNX biotransformation process under anaerobic conditions.