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Effect of ferrihydrite on 2,4,6-trinitrotoluene biotransformation by an aerobic yeast

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Abstract

This study investigated the impact of ferrihydrite on the pathway and rate of 2,4,6-trinitrotoluene (TNT) transformation by *Yarrowia lipolytica* AN-L15. The presence of ferrihydrite in the culture medium decreased the rate of TNT biotransformation but resulted in the accumulation of the same TNT metabolites as in the absence of ferrihydrite, albeit at slightly different concentrations. Transformation products observed included aromatic ring reduction products, such as hydride-Meisenheimer complexes, and nitro group reduction products, such as hydroxylamino- and amino-dinitrotoluenes. Independently of the presence of ferrihydrite the subsequent degradation of the hydride complex(es) resulted in the release of nitrite followed by its conversion to nitrate and nitric oxide at the low pH values observed during yeast cultivation. Nitric oxide generation was ascertained by electron spin resonance spectroscopy. In addition, increased Fe³⁺-reduction was observed in the presence of TNT and *Y. lipolytica*. This study demonstrates that in the presence of yeast cells, TNT-hydride complexes were formed at approximately the same level as in the presence of ferrihydrite, opening up the possibility of aromatic ring cleavage, instead of promoting the production of potentially toxic nitro group reduction products in the presence of iron minerals. © 2012 Springer Science+Business Media Dordrecht.

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Keywords

2,4,6-Trinitrotoluene, Biodegradation, Ferrihydrite, Nitroaromatics, Yeast