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Proteomic analysis of 2,4,6-trinitrotoluene degrading yeast Yarrowia lipolytica

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Abstract

© 2017 Khilyas, Lochnit and Ilinskaya. 2,4,6-trinitrotoluene (TNT) is a common component of many explosives. The overproduction and extensive usage of TNT significantly contaminates the environment. TNT accumulates in soils and aquatic ecosystems and can primarily be destroyed by microorganisms. Current work is devoted to investigation of Yarrowia lipolytica proteins responsible for TNT transformation through the pathway leading to protonated Meisenheimer complexes and nitrite release. Here, we identified a unique set of upregulated membrane and cytosolic proteins of Y. lipolytica, which biosynthesis increased during TNT transformation through TNT-monohydride-Meisenheimer complexes in the first step of TNT degradation, through TNT-dihydride-Meisenheimer complexes in the second step, and the aromatic ring denitration and degradation in the last step. We established that the production of oxidoreductases, namely, NADH flavin oxidoreductases and NAD(P)+-dependent aldehyde dehydrogenases, as well as transferases was enhanced at all stages of the TNT transformation by Y. lipolytica. The up-regulation of several stress response proteins (superoxide dismutase, catalase, glutathione peroxidase, and glutathione S-transferase) was also detected. The involvement of intracellular nitric oxide dioxygenase in NO formation during nitrite oxidation was shown. Our results present at the first time the full proteome analysis of Y. lipolytica yeast, destructor of TNT.

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Keywords

2,4,6-trinitrotoluene, Biodegradation, Old yellow enzymes, Proteomic assay, TNT, Yarrowia lipolytica

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