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Participation of oxygen in the bacterial transformation of 2,4,6-trinitrotoluene

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Abstract

The exposure of *Bacillus cereus* ZS18 cell suspensions to 2,4,6-trinitrotoluene (TNT) in the absence of other oxidizable substrates increases oxygen uptake, exceeding the basal level of respiration of the bacterium 1.5- and 2-fold with 50 and 100 mg/liter of TNT, respectively. The interaction of both living and to less extent dead bacterial cells with TNT results in the accumulation of superoxide anion ($O_2^{\cdot-}$) in the extracellular medium, which was revealed by the EPR spectroscopy. The accumulation of O_2 decreased by 50-70% in the presence of Cu,Zn-superoxide dismutase of animal origin. In the presence of living bacterial cells, the level of TNT decreased progressively, yielding hydroxylaminodinitrotoluenes together with O_2 . In the presence of heat-killed cells, a moderate decrease in TNT was observed, and the appearance of O_2 was not accompanied by the production of any detectable TNT metabolites. Chelating agents inhibited the transformation of TNT and decreased the formation of O_2 . The demonstrated generation of O_2 during the interaction of TNT with $K_4[Fe(CN)_6]$ together with the observed effects of chelating agents suggest the participation of iron in the one-electron reduction of TNT and the functioning of an extracellular redox cycle with the involvement of molecular oxygen. © 2008 MAIK Nauka.

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Keywords

2,4,6-trinitrotoluene, Aerobic transformation, Superoxide anion