

Abiotic and biotic oxidation of chemically synthesized Se(0) nanoparticles

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The biogeochemical cycle of selenium is receiving increased attention as selenium is both an essential micronutrient and an environmental contaminant. Chemical and biological processes control the mobility, availability and environmental impact of selenium. Although selenium oxidation is an important selenium-mobilizing process, very little is known about its biotic and abiotic pathways. We compared the abiotic and biotic oxidation of chemically synthesized red Se(0) nanoparticles and attempted to elucidate the mechanisms of biological selenium oxidation. We tested the abiotic oxidation of Se(0) by three oxidants i.e. MnO₂, KMnO₄ and FeCl₃ and their efficiency under aerobic and acidic conditions at 25°C. After 21 days, 2.3, 6.4 and 3.2 % of the initial Se(0) was oxidized to selenite, in the presence of MnO₂, KMnO₄ and FeCl₃, respectively. We tested the biological oxidation of red Se(0) by one aerobic heterotrophic bacterium, designated Strain JG-17 isolated from Punjab, India. It exhibited the ability to dissolve elemental selenium and 0.05 % of initial Se(0) (~ 0.01 mM) was oxidized to selenite after 3 days at pH 7 and 25°C. 16S rRNA gene sequence revealed that JG-17 is closely related to *Bacillus megaterium*. The results indicated that strain JG-17 releases sulfur-containing extracellular compounds including sulfite and thiosulfate during Se(0) oxidation. In an *in-vitro* abiotic experiments, we confirmed the oxidation and dissolution of Se(0) in presence of sulfite and thiosulfate.