Fabrication and molecular scale characterization of selenium nanoparticles produced by *Stenotrophomonas* sp. BII-R7.

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Abstract

The main objective of the present work is to characterize the structure and size of selenium nanoparticles (Se NPs) produced by the bacterial strain *Stenotrophomonas* sp. BII-R7, using a combination of microbiological, spectroscopic and microscopic techniques. There are several microorganisms described for their ability to interact with selenium (Se), reducing toxic forms [selenite or Se(IV)] to less toxic forms [elemental selenium or Se(0)] [1]. This is the case of the strain *Stenotrophomonas* sp. BII-R7, in which the reduced Se(0) produced, was accumulated in form of nanoparticles. Preliminary BII-R7 draft genome analysis revealed the presence of glutathione-related enzymes, NADH-dependent enzymes or thioredoxin reductase described for their ability to reduce Se(IV) to Se(0).

The Se NPs obtained were analyzed using X-ray diffraction (XRD), Fourier Transform Infrared Spectroscopy (FTIR), high resolution STEM (Scanning-Transmission Electron Microscopy) equipped with HAADF (High-Angle Annular Dark Field) detector and EDX (Energy Dispersive X-ray Spectrometry). XRD analysis indicated the small average size (15 nm) and crystalline hexagonal structure of the Se NPs produced by this bacterial strain. In addition, using this technique, the Se NPs production procedure was optimized by studying the effects of different physicochemical parameters (Se initial concentration, incubation time, type of washing agents used, etc.) on diffraction patterns. On the other hand, STEM-HAADF and EDX microanalysis showed the presence, in addition to small sized Se NPs, of very few extracellular and intracellular amorphous Se NPs around 200 nm of diameter. Finally, the effects of selenium toxicity on cellular viability and consequently, on Se NPs production by *Stenotrophomonas* sp. BII-R7 were also determined using Flow Cytometry.

Definitely, this work describes a microbiological method to produce Se biogenic NPs of different size and morphology, with potential industrial and medical applications.

References

[1] Antonioli P, Lampis S, Chesini I, Vallini G, Rinalducci S, Zolla L, Righetti PG, Appl Environ Microbiol, ***Stenotrophomonas maltophilia* SelTE02, a New Bacterial Strain Suitable for Bioremediation of Selenite-Contaminated Environmental Matrices** (2007) 73(21): 6854–6863.