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P30

BACTERIAL BIOSYNTHESIS OF SELENIUM NANOPARTICLES BY ENVIRONMENTAL ISOLATES OF *Stenotrophomonas maltophilia*

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Abstract

Five bacterial strains identified in soil samples collected at three dismissed industrial sites contaminated by heavy metals and metalloids such as lead, arsenic, and selenium were analysed for their capability to reduce the toxic oxyanion selenite (SeO_3^{2-}) to the non-toxic zero-valent selenium. All isolates resulted taxonomically related to the *Stenotrophomonas maltophilia* species and capable of forming Se-nanopaticles (SeNPs). The strains labelled as A16, AW, B, T, and SeITE02 were obtained by means of enrichment cultures added with organic lead (A16), arsenite (AW, B, T), and selenite (SeITE02) respectively. Each isolate was investigated for the degree of resistance to selenite, the rate of selenite reduction to elemental selenium, as well as the formation of SeNPs and their localization within the bacterial cell.

Strains SeITE02 and AW, able to reduce 0.5 mM SeO_3^{2-} within 48 hours of incubation in rich medium, evidenced the highest efficiency in selenite reduction. Strain A16 was also efficacious in selenite reduction, showing the greatest reduction rate in early exponential growth. Nevertheless, it did not effect the whole reduction of the SeO_3^{2-} amount initially added to the culture medium. Moreover, a pre-treatment with SeO_3^{2-} at sub lethal concentrations (0.2 mM) positively affected both the rate and the efficiency of selenite reduction. This was particularly true for the strains SeITE02 and A16. All bacterial isolates were then found capable of producing selenium nanospheres. Localization of these SeNPs varied either with the strain or with the age of the bacterial cultures. In general, once reached the stationary phase, bacterial culture specimens showed extracellular SeNPs embedded in complex aggregates probably due to the concurrent production of EPS substances.

In a biotechnological perspective, the strains *S. maltophila* A16, AW, and SeITE02 may thus be considered either for detoxification purposes in the treatment of seleniferous environmental matrices (e.g. soils, surface waters, and wastewaters) or for the controlled biosynthesis of nanostructured particles of interesting physic-chemical characteristics.