VIDEO ARTICLE

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Using Bacteria to Manufacture Metalloid Nanomaterials for Different Applications

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Abstract

Understanding mechanisms of metal or metalloid ion interactions with bacteria and the toxicity/resistance in bacteria is important for biomedical applications to metal/loid pollutant bioremediation. Recently we see a conversation to move beyond bioremediation of metal/loids by biosorption to bioconversion to value added production of novel compounds. The oxyanions of the chalcogens Selenium and Tellurium are bioavailable and toxic to most bacterial species. However, now several species have been isolated that are able to tolerate these oxyanions and convert them to the less toxic and less bioavailable elemental forms of Se^0 and Te^0 as precipitates that are on the nanoscale. Thus, the field has moved to see if such strains as able to bioconvert these toxic metalloids into nanomaterials of specific structures. This would then simultaneously having potential for bioremediation of chalcogen contaminated sites as well as being an eco-friendly alternative for the synthesis of Se and Te nanomaterials. My group, and in collaboration with others, have explored a number of different bacterial strains for their capacity to produce Se and Te nanomaterials including: *Escherichia coli*, *Bacillus mycoides* SeITE01, *Stenotrophomonas maltophilia* SeITE02, *Rhodococcus aetherivorans* BCP1, and *Rhodobacter capsulatus*. The nanomaterials that these strains produce are nanoparticles and nanorods of various sizes, dimensions, and crystalline structures. The physicochemical characteristics of the nanomaterial forms are dependent on a combination of the strain and different culturing conditions. In some cases, the nanomaterials are either secreted or produced extracellularly, for others the nanomaterials are found intracellularly. The Se and Te nanomaterials that are produced are remarkably stable, a feature of natural biochemicals as 'capping' agents from the microbes. The nanomaterials obtained to date have displayed promising electronic, fluorescent and antimicrobial properties.

Keywords: Nanomaterial; selenium, tellurium, bacteria.

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Biography of Presenting Author

Raymond J. Turner is a multi-ethnic multi-generational Canadian. Academic career began with a B.Sc. (1985) in Biochemistry / Chemistry followed by a Ph.D. (1990) in Biophysical chemistry. Post-Doctoral training (1990-1994) was obtained in Molecular and Microbial Biochemistry. In January 1998, was recruited to the University of Calgary and is presently appointed as Faculty Professor of Science. Has held the post as Associate Department Head and Graduate program director and chair of various research cluster units between. He has also served on Dean's and vice-presidents' advisory committees. Research funding from the Canadian funding councils of NSERC, CIHR, Genome Canada, and MITACS as well as a number of industrial partners. Has received awards of excellence in research and excellence in graduate student supervision from the University of Calgary. Received visiting professorship appointments from the University of East Anglia, England, University of Bologna and University of Verona, Italy, as well as receiving a number of Fellowships from the Instituto di Studi Avanzati, Italy. Awarded the Western Universities Speaker Lectureship from the Canadian society of Chemistry in 2015. Research interests are multi-disciplinary from metal toxicity/sensitivity and resistance/tolerance mechanisms in bacteria, to Biofilm physiology and biochemistry, to protein transporters and translocases.

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