POSTER

SE4SAFE: A ONE HEALTH APPROACH TO ASSESS THE SAFETY OF BIOGENIC SELENIUM NANOPARTICLES

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Biosynthesized selenium nanoparticles (bSeNPs) are promising tools for agricultural applications, although concerns remain regarding environmental and food safety. Inorganic selenium forms, such as selenite and selenate, can be biologically reduced to elemental selenium (Se^0) through eco-friendly processes. Bacteria are widely used for the green synthesis of nanomaterials due to their metabolic versatility. In this study, bSeNPs were produced using Bacillus mycoides SelTE01 and Stenotrophomonas maltophilia SelTE02 in a controlled bioreactor, enabling the microbial conversion of selenite (SeO_3^{2-}) into elemental selenium. Successful synthesis was confirmed by a color change from pale yellow to red, typical of colloidal selenium. Toxicity was evaluated through a multi-level approach combining ecotoxicological and in vitro cellular models. Ecotoxicity assays were conducted using Daphnia magna and Raphidocelis subcapitata. Sodium selenate showed significant toxicity, with EC50 values of 0.92 mg/L (48 h) for D. magna and 0.25 mg/L (72 h) for R. subcapitata. Although morphological alterations in D. magna and changes in algal distribution occurred after bSeNPs treatment, the bioparticles did not show any toxicity. Cytotoxicity was assessed on human cell lines (HACAT, BEAS, CaCo2, CCD841) using MTT and Crystal Violet assays. Selenate caused a dose-dependent decrease in viability, strongest at 500 µg/L, and induced apoptotic features. CCD841 cells appeared particularly sensitive, showing a threefold reduction in viability. In contrast, bSeNPs slightly reduced viability in HACAT, BEAS, and CaCo2 cells. Notably, CCD841 cells showed increased viability after bSeNPs exposure, suggesting a cell-specific adaptive response. Overall, microbial bioconversion reduces selenium toxicity, supporting bSeNPs as a safer and more sustainable selenium source for agro-nanotechnological applications.