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Single cell ICP-MS to study the uptake mechanism of Ce, Cd and U in *Streptomyces coelicolor.*

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Streptomyces can be used for bioremediation of heavy metal (HM) contaminated soil environments, however, the uptake mechanism is rather unexplored. Until recently, methods such as Transmission Electron Microscopy with Energy Dispersive X-ray spectroscopy (TEM-EDX) or total elemental analysis by Inductively Coupled Plasma - Mass Spectrometry (ICP-MS) following acid digestion, were commonly applied to characterise HM accumulation into/onto biological cells. However, TEM-EDX usually provides qualitative information for chosen cells and ICP–MS elemental content provides averaged bulk information about all biological cells without considering cell to cell variations. Recently, the possibility of conducting single cell (sc)ICP-MS in *S. coelicolor* spores was addressed in the case of Cu incorporation [1]. In this study, the work was extended to evaluate the incorporation pathway of Ce, Cd and U. The aim was to identify the interaction mechanisms (incorporation vs. sorption) of the selected elements via scICP–MS. Two washing agents were tested: EDTA-Tris-HCl (only incorporation) vs. Tris-HCl (incorporation and sorption). Results suggest comparably strong sorption of Ce and U before, and full incorporation into the spores after, one 7-day-sporulation cycle. The incorporated Ce always reached a concentration plateau, independent of the exposure concentration (0.1, 1, 10 and 100 µM), while the incorporated U increased with the exposure concentrations. Contrastingly, Cd was neither sorbed nor incorporated significantly after sporulation. Our results suggest that (1) the uptake mechanism of Ce and U by *S. coelicolor* starts with a relevant sorption step, followed by biogenic incorporation (from the hyphae into newly formed spores), and that (2) *Streptomyces* are not good candidates for the effective bioremediation of Cd in soils. This study provides first insights into a simple and efficient procedure to identify HM–cell interactions, useful for bioremediation works.

References

[1] García Cancela, González Quiñónez, Corte-Rodríguez, Bettmer, Manteca & Montes-Bayón (2022), *Metallomics* 14(3), https://doi.org/10.1093/mtomcs/mfac015.