Goldschmidt 2025 Abstract
https://doi.org/10.7185/gold2025.29032

The impact of uranium and malic acid on microbial communities in a reference soil

MR. RAÚL EDUARDO LINARES JIMÉNEZ[1], TING-SHYANG WEI[1], ROBIN STEUDTNER[1], KATRIN FLEMMING[1], ANDREA CHERKOUK[2], THORSTEN STUMPF[2] AND SUSANNE SACHS[3]

[1]Helmholtz-Zentrum Dresden-Rossendorf
[2]Helmholtz-Zentrum Dresden-Rossendorf e.V., Institute of Resource Ecology
[3]Helmholtz-Zentrum Dresden-Rossendorf, Institute of Resource Ecology

Radionuclides (RNs) that are released into environments, for example, from contaminated sites or due to accident scenarios, can migrate via the groundwater into the surface soil. Subsequently, they can interact with indigenous microorganisms and plants, entering the food chain and posing a health risk to humans. An accurate modeling of the RN uptake by plants requires an understanding of the processes involved in RN transport and accumulation, including the influence of soil microorganisms. Both, soil microorganisms and root exudates of plants can modify the RN speciation in the soil, thus influencing their mobility and bioavailability [1, 2].

In this study, we investigate the impact of uranium (U) and malic acid (MA), as an example of a common root exudate, on the composition of the microbial community in a reference soil. The soil community comprised three main phyla: Firmicutes, Actinobacteriota and Proteobacteria. However, in the presence of 1.8 mg U/kg soil and 20 mg MA/kg soil after 28 days, no apparent abundant changes in these three phyla in the reference soil were observed based on 16S amplicon sequencing. Additionally, the isolate *Mesorhizobium* sp. DNB0012 from the reference soil is used to study its interaction with U and MA. The bioassociation of U to *Mesorhizobium* sp. DNB0012 is determined with inductively coupled plasma mass spectrometry. Furthermore, the viability of the isolated cells in the presence of U and MA is examined by live/dead staining. Time-resolved laser-induced fluorescence spectroscopy is used to determine the U speciation in the presence of *Mesorhizobium* sp. DNB0012 and MA.

This study will assess the interaction between U, MA and soil microorganisms on a molecular level and its impact on the bioavailability of U. These results could improve radioecological models for the assessment of the RN transport and transfer in the environment to the food chain.

This study is funded by the German Ministry of Education and Research under contract No. 15S9437C.

References:

[1] Gupta (2017), *Rev. Environ. Contam. Toxicol. 241*, 139-160.

[2] Banala (2021), *Environ. Technol. 21*, 101254.