Goldschmidt 2025 Abstract
https://doi.org/10.7185/gold2025.29003

Direct reduction of the radioactive technetium-99 by *Pseudodesulfovibrio aespoeensis*

MARCOS F MARTINEZ-MORENO, IRENE CARDAIO, KATHARINA MÜLLER, ANDREA CHERKOUK AND NATALIA MAYORDOMO

Helmholtz-Zentrum Dresden-Rossendorf e.V., Institute of Resource Ecology

Technetium (Tc) is a radionuclide with 45 identified isotopes being ^{99}Tc the most abundant in the environment, a β^- emitter with a long half-life ($t_{1/2}$= 2.13×10^5 years) [1]. This abundance of ^{99}Tc is mainly due to the fission of ^{235}U and ^{239}Pu in nuclear reactors and nuclear weapon detonations, as well as due to the decay product of the short half-life isotope ^{99m}Tc used for radiodiagnosis [2]. ^{99}Tc will be part of the inventory of the high radioactive waste to be stored in the deep geological repositories (DGRs), consisting of a multi-barrier system. After sealing the DGR, the activity of sulfate- and iron-reducing bacteria (SRB and IRB) could compromise the integrity of the repository, possibly leading to the mobilization of radionuclides. Therefore, for the safety assessment, it is crucial to study the interaction of ^{99}Tc with DGR-relevant bacteria under well-defined conditions. Some SRB could mediate the reductive immobilization of mobile Tc^{VII} to less mobile Tc^{IV} [3].

Therefore, this work focused on studying the influence of the SRB *Pseudodesulfovibrio aespoeensis* ASPO-2, isolated from the groundwater of an underground laboratory [4], on the directly promoted reductive immobilization of Tc^{VII}. The yield of Tc immobilization has been analyzed at circumneutral pH by means of liquid scintillation counting (LSC). The localization of Tc on or in the bacterial cells and its retention mechanisms have been determined by scanning electron microscopy (SEM) and spectroscopic techniques (XPS and XAS), respectively.

Our results suggest that the presence of *P. aespoeensis* in the DGR environment could promote the direct immobilization of Tc limiting the migration of this radionuclide into the bio- and geosphere

The authors acknowledge funding from the German Federal Ministry of Education and Research for NukSiFutur young investigator group TecRad (02NUK072) and MFM-M for the funding obtained from the Ramón Areces Foundation.

[1] Johnstone *et al*., 2017, *J. Chem Educ*, 94, 320−326

[2] Meena and Arai, 2017, *Environ Chem Lett*, 15:241–263

[3] Lloyd et al., 1998, *Geomicrobiol J*, 15:1, 45-58

[4] Motamedi and Pedersen, 1998, *Int J Syst Evol Microbiol*, 48:1, 311–315