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Biological effect of Acidithiobacillus thiooxidans on some potentially toxic elements during alteration of SON 68 nuclear glass

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Although underground nuclear waste repositories are not expected to be favourable places for microbial activity, one should not exclude localized action of extremophilic bacteria on some materials involved in the storage concept. Among endogenous or accidentally introduced acidophiles, some are susceptible to lead to a locally drastic decreased in pH, with potential consequences on materials corrosion. Experiments were performed with *Acidithiobacillus thiooxidans* on 100-125 μm french reference nuclear glass SON68 grains in a mineral medium under static conditions during 60 days at 25 degC. Growth medium was periodically renewed and analyzed by ICP-AES and ICP-MS spectrometry for both major, trace and ultra-trace elements. Biofilm formation was evidenced by confocal laser microscopy, staining DNA with ethidium bromide and exopolysaccharides with calcofluor white. Biofilm thickness around material grains exceeded 20 μm under the chosen experimental conditions. It can be noticed that while numerous studies on biofilm formation upon interaction between *Acidithiobacillus ferrooxidans* and materials are found in the literature, evidence for biofilm formation is still scarce for the case of the acidophilic bacterium *A. thiooxidans*. Presence of biofilm is a key parameter for material alteration at the solid/solution interface in biotic systems. Indeed, various constitutive elements of materials trapped in the polyanionic polymer of biofilm may also influence the alteration process. In particular, biofilm may reduce the alteration rate of materials by forming a protective barrier at their surface (Aouad et al., 2008). In this study, glass alteration rates, determined using strontium as tracer, showed that the progressive formation of a biofilm on the surface of glass has a protective effect against its alteration. Uranium and rare earth elements (REE) are efficiently trapped in the biogenic compartment of the system (exopolysaccharides + bacterial cells). Besides, the ratio biotic/abiotic concentrations of REE and U in the leachant decreases with increasing time which seems to indicate a good capacity of EPS for long term trapping of potentially toxic elements. Aouad G., Crovisier J.-L., Damidot D., Stille P., Hutchens E., Mutterer J., Meyer J.-M., and Geoffroy V. A. (2008) Interactions between municipal solid waste incinerator bottom ash and bacteria (*Pseudomonas aeruginosa*). Science of The Total Environment 393((2-3)), 385-393.