Development of DGT technique for the estimation of the U bioavailable fraction in mining environments

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Uranium (U) is known of its dual mode toxicity - radiological and chemical one, with the latter being a subset of particular concern. The chemical impact of U, its toxicity and bioavailability (*i.e.* ability to traverse the cell surface of an organism) is associated with its chemical speciation. In this context, the technique of Diffusive Gradients in Thin Films (DGT) is a potential monitoring tool for the bioavailable fraction, as it provides *in situ* measurement of the time-averaged concentrations of labile metal species in solution. This study provides for the first time an insight on the feasibility of the DGT technique for the estimation of U bioavailable fraction in mining impacted environments.

The comprehensive laboratory evaluation of DGT technique with different resins (Chelex, Metsorb, Diphonix and two experimental resins) was carried out prior to the application in the field. Several mining sites in France with different natural geochemical characteristics and different water treatment technologies were investigated. Three metal speciation and fractionation techniques- DGT, filtration (0.45μm, 0.2μm), ultrafiltration (500 kDa, 100 kDa, 10 kDa) techniques- were investigated and compared at two former mining sites in France. The sampling was conducted in stream water, upstream and downstream of the mining sites and within the various stages of the water treatment. A systematic and significant difference was found between DGT-labile concentration and the 10 kDa fraction, suggesting that U is present as natural complexing ligands which are kinetically inert or/and bigger than <2 kDa.

This study confirms strong potential of DGT technique as a monitoring and speciation tool in mining environments and a good alternative to the time-consuming ultrafiltration technique.