World Academy of Science, Engineering and Technology
International Journal of Environmental and Ecological Engineering
Vol:12, No:02, 2018

Uranium Migration Process: A Multi-Technique Investigation Strategy for a Better Understanding of the Role of Colloids

Authors : Emmanuelle Maria, Pierre Crançon, Gaëtane Lespes

Abstract : The knowledge of uranium migration processes within underground environments is a major issue in the environmental risk assessment associated with nuclear activities. This process is identified as strongly controlled by adsorption mechanisms, thus leading to strongly delayed migration paths. Colloidal ligands are likely to significantly increase the mobility of uranium in natural environments. The ability of colloids to mobilize and transport uranium depends on their origin, their nature, their structure, their stability and their reactivity with uranium. Thus, the colloidal mobilization and transport properties are often described as site-specific. In this work, the colloidal phases of two leachates obtained from two different horizons of the same podzolic soil were characterized with a speciation approach. For this purpose, a multi-technique strategy was used, based on Field-Flow Fractionation coupled to Ultraviolet, Multi-Angle Light Scattering and Inductively Coupled Plasma Mass Spectrometry (AF4-UV-MALS-ICPMS), Transmission Electron Microscopy (TEM), Electrospray Ionization Orbitrap Mass Spectrometry (ESI-Orbitrap), and Time-Resolved Laser Fluorescence Spectroscopy (TRLFS-EEM). Thus, elemental composition, size distribution, microscopic structure, colloidal stability and possible organic and/or inorganic content of colloids were determined, as well as their association with uranium. The leachates exhibit differences in their physical and chemical characteristics, mainly in the nature of organic matter constituents. The multi-technique investigation strategy used provides original data about colloidal phase structure and composition, offering a new vision of the way the uranium can be mobilized and transported in the considered soil. This information is a real significant contribution opening the way to our understanding and predicting of the colloidal transport.

Keywords : colloids, migration, multi-technique, speciation, transport, uranium
Conference Title : ICHMCWS 2018 : International Conference on Heavy Metal Contamination of Water and Soil
Conference Location : Amsterdam, Netherlands
Conference Dates : February 12-13, 2018