Colloidal Transport of Heavy Metals in Natural Subsurface Sediments

Sema Sevinc Sengor
Middle East Technical University, Environmental Engineering Department, Ankara, Turkey (ssengor@metu.edu.tr)

Colloid particles are widely distributed in the environment. These colloids have recently been gaining significant attention due to their unique characteristics in environmental remediation pertaining to degradation, transformation and immobilization of contaminants in soils and aquifers. On the other hand, once mobilized by subsurface water flow, colloids may pose risks to surface water and groundwater quality as they are effective “carriers” of a variety of common contaminants found in water and soils. Therefore, understanding the transport mechanisms of the colloids and incorporation of colloidal transport processes in reactive transport models are crucial for successful applications of many remediation efforts in the subsurface. Fe (hydr)oxide colloidal compounds have large surface areas and high reactivity, which can lead to spontaneous adsorption of many pollutants. For the successful stabilization of pollutants, it is vital to understand the associated biogeochemical processes, and competitive effects of contaminant sorption onto these colloidal phases. This work focuses on the development of a mechanistic Fe(hydr)oxide based colloid-facilitated reactive transport model which identifies the impact of Fe(hydr)oxide colloids on the stability and mobility of heavy metals (Zn and Pb) in example subsurface sediments of Lake Coeur d'Alene (LCdA), USA. Key reactions include the mobilization of heavy metals initially sorbed onto the colloidal Fe(hydr)oxide minerals through microbial reductive dissolution. Precipitation of metal sulfides at depth as a result of biogenic sulfide production is also captured. The simulations compare the biogeochemical cycling of metals considering colloidal vs. immobile phases of Fe(hydr)oxide minerals in the lake sediments.