Interaction of Dissolved Organic Matter with Free metal ions in Heavy Metal Contaminated Soil Solution

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Free or non-complexed metal ion (FMI) is considered as the key factor in determining heavy metal bioavailability and toxicity. It is well known that dissolved organic matter (DOM) is a polyfunctional complex and heterogeneous mixture of components originating from the degradation of plants, animals and microorganisms. It can interact with metal ions to form organometal complexes, thus strongly affecting the metal speciation. Therefore, knowledge on DOM properties is necessary to better understand the fate of heavy metals in aquatic systems.

In this research, the concentrations of free Cu^{2+}, Cd^{2+}, Pb^{2+}, Zn^{2+}, Ni^{2+} in the soil solution of 16 different kinds of heavy metal contaminated soils (12 from France and 4 from China) will be determined by Donnan membrane technique (DMT). NICA-Donnan model can be used to stimulate free metal ion activity in the Donor solution, thus comparing with the speciation measured by DMT to evaluate its accuracy.

Furthermore, combined with chemical batch experiment of isolating the humic substances, UV-visual absorption spectra, 3D fluorescence excitation- emission (EEM) spectroscopy and size exclusion chromatography (SEC) will be applied to the Donor solution as well to investigate the composition, molecular weight and size fractions of DOM. The relationship between DOM properties and free metal ions in soil solution will be analyzed to interpret the mechanism that DOM strongly facilitates the transport of heavy metals.