Department of Environmental Sciences & Engineering Seminar
ESE Faculty Candidate (Environmental Chemistry)

Dissolved organic matter as a key player in metal bioavailability

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133 Rosenau
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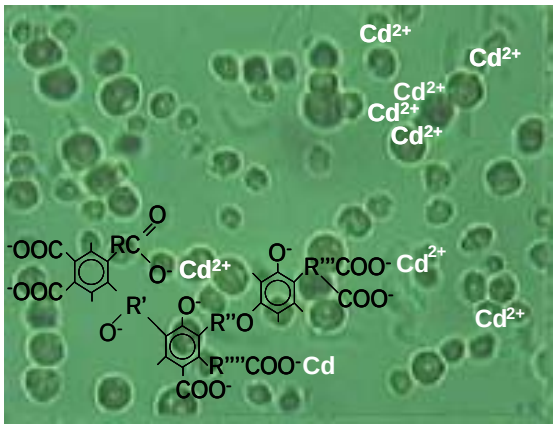

Abstract:
Bioavailability is a key concept in bridging aquatic geochemistry of contaminants to their ecotoxicity. It is currently accepted that the contaminants' bioavailability is controlled by their chemical speciation and in particular, the concentration of the free contaminant able to bind the sensitive sites of microorganism. Dissolved organic matter (DOM) can alter the contaminants' speciation; therefore their bioavailability can be expected to be affected by DOM. Nonetheless, the current practice is to "divide" the total contaminant load in a particulate and a dissolved fraction. The latter is used to set regulatory maximum contaminant loads for surface water quality in Europe and Switzerland, and also to assess the ecotoxicological hazard, without further consideration of the speciation and bioavailability within the dissolved fraction. In my view this "paradox" is related to the existing controversy and gaps in our knowledge about the role of the DOM in metal bioavailability.

This talk focuses on the role of DOM in metal bioavailability. It will describe the current research efforts toward an improved understanding of the interactions of DOM with toxic trace metals and microorganisms under freshwater conditions. We apply advanced tools for chemical speciation and fractionation, (e.g. permeation liquid membrane and flow field flow fractionation), combined with different bioassays, to elucidate the multiple and contrasting effect of DOM on metal bioavailability. It is a generally accepted view that DOM reduces metal bioavailability by complexing trace metals in waters and by decreasing of the steady state free metal ion concentrations. In addition to this primary and well known effect of DOM, our results show that DOM can also enhance metal bioavailability. In particular, the interaction of DOM with microorganisms can result in additional metal binding sites on the biota surface and in changes in algal membrane permeability, charge and potential. The influence of DOM composition and concentration, the pH of the medium and the nature of the microorganisms on the DOM - biota interactions will be discussed in detail. The consequences of these DOM - biota interactions for the bioavailability of priority contaminants, such as Cd(II), Cu(II) and Pb(II) will be presented. The environmental implications of the dual role of the DOM on metal bioavailability will be discussed with respect to the development of site-specific water quality criteria and under conditions of changing environment.

Biosketch:
Vera Slaveykova is a Swiss National Science Foundation Professor at the Ecole Polytechnique Federal de Lausanne, Switzerland. She is currently leading the group of the Environmental Biophysical Chemistry at the Institute of Environmental Sciences and Engineering at the EPFL. Her research is in the field of molecular environmental chemistry of aquatic systems. It is focused on improving our understanding of the important phenomena controlling the transfer and impact of trace elements, and their interactions with different natural components such as natural organic matter and microorganisms.