Interactions between Fe(II) and arsenic species during co-sorption onto aluminum oxide and clay mineral substrates under anoxic conditions

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Reductive dissolution of Fe(III)-oxides and hydroxides in suboxic and anoxic soils and sediments leads to substantial changes in aqueous geochemical conditions, including a strong increase in the aqueous concentrations of Fe(II) and trace metal(loid) species released during dissolution of Fe(III)-oxide sorbents. The fate of released Fe(II) and trace metal(loid)s is likely to be at least partially controlled by sorption reactions with mineral constituents remaining in the soil matrix, and may further be influenced by redox reactions between Fe(II) and redox-sensitive elements including As. While there have been quite a few studies addressing sorption of Fe(II), As(III) and As(V) onto common soil minerals in binary systems, very little is known about the interactions between these species in ternary systems involving co-sorption.

Here, we use a combination of batch experiments and X-ray absorption spectroscopy to study the co-sorption of Fe(II) with As(V) and As(III) onto aluminum-oxide and clay surfaces under anoxic conditions and at near-neutral pH values typical of reduced geochemical environments. We observe notable differences between the ternary and binary systems as to the extent and mechanisms of Fe(II) and As sorption. The XAS results indicate the operation of several processes, including formation of monomeric surface complexes and precipitation of Fe(II)-Al(III)-layered double hydroxides. Interactions among these processes and the significance of redox reactions in the ternary systems will be discussed.

Co-benefits of tackling poor air quality and regional climate: A focus on ecosystems

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A substantial body of experimental evidence exists describing the impacts of ozone (O_3) and aerosols on important ecosystems (agro-, forest and grassland ecosystems). Much of this empirical data has been collected from co-ordinated studies conducted in North America and Europe; and more recently in Asia. Pooling these data allows the development of risk assessment methodologies which can be used to assess the benefits of emission reductions over regional to global scales. This talk describes these risk assessment methodologies focussing both on their strengths (in relation to providing estimates of a variety of ecosystem damage) as well as weaknesss and limitations (primarily associated with limited data availability for key global regions such as Asia, Africa and Latin America).

Within this context results are presented that describe benefits of emission reductions of O_3 and aerosol forming species for crop yields, forest productivity and grassland biodiversity along with benefits for near term climate. Examples of indirect benefits are also given by showing the importance of ecosystems acting as sinks for atmospheric pollution; alterations to this sink under extreme climates (e.g. heatwave type conditions) are exemplified through their influence on net atmospheric pollution concentrations and subsequent human health impacts.

Finally, the importance of considering ecosystem damage and feedbacks to the climate system within a new generation of Earth System Models, currently being developed to understand the implications of climate change, is advocated based on the evidence presented.

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