

Formation and transport of complexes of arsenic, iron and organic matter in a flow through system

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The mobility of arsenic and other metal ions in the environment is dominated by adsorption onto metal oxide surfaces, (particularly iron, aluminium, and manganese oxides), clay minerals, and by interactions with natural organic matter (NOM). Competition between NOM and As for sorption sites on mineral surfaces can potentially increase arsenic mobility. Batch experiments have suggested that arsenic binds to NOM either directly or by forming a ternary adsorption complex using Fe (leached from an Fe-mineral) as the cation bridge. However, formation and transport of these complexes in a flow-through system has not yet been studied.

To answer the following questions we used column systems filled with ferrihydrite with As rich solutions.

- 1) Does the presence of humic material affect the transport speed of As?
- 2) Are ternary As-Fe-NOM complexes formed in flow-through systems when As(V) interacts with humics-loaded ferrihydrite-coated sand?
- 3) Are the As-NOM and As-Fe-NOM complexes present in dissolved or colloidal state?

Arsenic, humic acids (OM) and As-Fe-OM complexes were injected into the columns and breakthrough curves of As, Fe and OM were followed. Samples from the eluate were collected and dialysed to quantify the amount of free As vs OM- and OM-Fe-complexed As. In addition, As-Fe-OM colloidal complexes were prepared separately and injected into the columns and compared with systems containing just free As.

Preliminary results show that As transport is faster in systems where humics are present, suggesting that humics compete with sorption sites in the ferrihydrite coated sand. Because many As-contaminated environments contain Fe minerals and OM, lab experiments need to include both As and OM to properly mimic natural systems.

Is melting of the Arctic Ocean changing methanesulfonic acid in the Arctic?

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Ice cover in the Arctic has been on the decline in recent years, particularly over the western Arctic Ocean. Does this reduction of ice cover significantly impact the production of the climatically important dimethyl sulfide and its oxidation products, one of which is methanesulfonic acid (MSA)? Trends in Arctic biogenic sulfate show a significant increase over the period analyzed: 1993 to 2003. MSA concentrations over 27 years (1980-2007) of sampling at the Canadian High Arctic Global Atmospheric Watch station at Alert, Nunavut (82°N, 62.5°W) vary from 0.1 to 50 ng m⁻³. Decadal tendencies are evident in the MSA concentrations, but there is no significant overall trend. Three distinct periods are identified based on MSA concentrations. From 1980-1990, MSA concentrations were relatively high with decreasing trend. During the period from 1991-1998 the MSA concentrations were lower with no significant trend, and from 1999 to 2008 the MSA concentrations were higher again with increasing trend. Potential source contribution function (PSCF) plots (Seibert plots) suggest that regions related to higher MSA concentrations are associated with increased *chlorophyll A* from SeaWiFS imagery. The PSCF plot for the middle period with low MSA concentrations is very different from those of the other two more similar periods. Although significant negative correlations of MSA concentrations with sea-ice concentrations are found for the region north of 70°N latitude, it is unclear that there is a causal relationship.