Abstract No. mylo561
Silver Binding in Humic Substances
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Beamline(s): X23A2

Introduction: Our goal has been to determine the role of reduced sulfur in the binding of some soft metals to a humic acid standard in solution. The work done over this past year focused specifically on silver binding. Naturally occurring concentrations of silver in most aquatic systems are relatively small, and this presented some experimental difficulty by limiting the magnitude of the EXAFS signal. Attempts to signal average in order to increase signal to noise ratio have shown a limited potential. Increasing the concentration of silver could have the effect of saturating all binding sites dominated by reduced sulfur, and thereby producing a mixture of binding environments for silver in these solutions.

Methods and Materials: EXAFS experiments were run in fluorescence mode with a Lytle detector. A cell as constructed which allowed silver/humic acid (Suwannee River humic acid) samples to remain in solution. EXAFS of model compounds, silver sulfide and aqueous silver nitrate, were run. Solutions with a variety Ag:DOC ratios were prepared and run over the course of this experiment. Signal processing has been optimized by the using WinXAS program.

Results: We were able begin studying silver binding to dissolved Suwannee River humic acid. In processing the data, we see there is no edge shift with time which indicates the silver binding environment is stable over the time of the experiment. Because of low signal to noise ratio of even the averaged signals, we expect to increase the concentration of dissolved humic acid in future experiments. This should allow us to increase the corresponding silver concentration without changing the carbon to silver ratio.
The most accurate method of data reduction requires corresponding EXAFS spectra of silver in a variety of binding environments. For this reason, spectra of silver sulfide and aqueous silver nitrate were taken. The signal to noise ratio in each was adequate to do proper analysis.

Conclusions: Currently, no specific conclusions can be drawn in this research as to the nature of silver binding to Suwannee River humic acid. Future beam time will allow us to optimize the experimental conditions so that EXAFS spectra can be analyzed unambiguously. The binding environments of other soft metals such as cadmium and lead will also be studied.

Acknowledgments: This research has been supported by a grant from the U.S. Environmental Protection Agency's science to achieve results (STAR) program. Although the research described in the article has been funded in part by the U.S. Environmental Protection Agency's STAR program through grant R82-5395, it has not been subjected to any EPA review and therefore does not necessarily reflect the views of the agency, and no official endorsement should be inferred. The authors gratefully acknowledge financial support from the NSF (grant EAR9909278), NOAA's Connecticut Sea Grant College Program (PSA 2891), and the Henry and Camille Dreyfus Postdoctoral Program in Environmental Chemistry (support of SEM). The researchers also wish to thank Joe Woichik for his help at the beam line and Anatoly Frenkel for helpful discussions.

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