Arsenic speciation in soils and CCA-treated wood leachate

Myron Georgiadis[1]*, Yong Cai[1] and Helena M. Solo-Gabriele[2]

[1]Department of Chemistry & SERC, Florida International University, University Park, Miami, FL 33199; [2] University of Miami, Dept. of Civil, Arch., & Environ. Engineering Coral Gables, FL 33124

The evaluation of the extraction efficiency and arsenic speciation in soil was performed by using phosphate as extractant. PACS-2, a standard reference material (marine sediment) was used as the model sediment/soil for the study. The primary results indicated that only a small percent (<20%) of arsenic, including both arsenite (As^{III}) and arsenate (As^{V}), could be extracted from PACS-2 using 10 to 100 mM phosphate solutions. We observed the conversion from As^{III} to As^{V} or readsorption of arsenic back to the solid phase during extraction and storage before analysis for both spiked and non-spiked samples. In order to gain real arsenic speciation information in soils, we have been conducting several experiments to preserve the arsenic species during the extraction.

Phosphate with EDTA: EDTA has been used to preserve As^{III} in water samples for arsenic speciation analysis. It was used in our study in an effort to stabilize arsenic species during extraction from soils. It was found that the use of EDTA at this concentration level (50 mM) did not improve much the decline of As^{III} concentration with extraction time. In other words, EDTA did not prevent As^{III} from conversion or readsorption. This is probably due to the large amounts of metal ions extracted from the sample. Greater concentration of EDTA interfered with the HPLC analysis; therefore it could not be used in the extraction.

Phosphate with hydroxylamine hydrochloride: Hydroxylamine was chosen as an extractant because of its mild reducing characteristics, which may be helpful in preserving As^{III} from oxidation. The results shows that As^{III} concentrations still decrease with prolonged extraction times. However, the decreasing rate and magnitude were much smaller compared to those observed using phosphate alone. The decline in As^{III} concentration occurred with extraction periods above 12 hours. The total amount of arsenic extracted was about 28%, indicting that hydroxylamine helped arsenic release from soil/sediment.

Phosphate with sodium diethyldithiocarbamate(NaDDC): NaDDC is a chelating agent that complexes As^{III}, therefore may prevent its conversion to As^{V} and/or reduce its readsorption to the solid phase. PACS-2 was extracted with 0.5% NaDDC + 10mM phosphate. It was observed that much more As^{III} and less As^{V} were extracted with the NaDDC/phosphate mixture than with phosphate alone. As^{III} concentration was found to be higher than As^{V} in PACS-2 under these experimental conditions, suggesting that PACS2 may contain more As^{III} than As^{V}. It seems likely that NaDDC can complex As^{III} as soon as its extraction occurs.