

47 - Speciation and release kinetics of cadmium and zinc in paddy soils: Application of X-ray absorption spectroscopy (XAS)

Saengdao Khaokaew, Rufus L Chaney, PhD Matt Ginder-Vogel, PhD Donald L. Sparks, Prof., PhD . Department of Plant and Soil Sciences and the Delaware Environmental Institute University of Delaware Newark Delaware United States, USDA Environmental Management and Byproduct Utilization Laboratory, Beltsville, MD 20750, USA United States

Cadmium (Cd) and zinc (Zn) are normally associated in natural environments. Zinc is an essential micronutrient, but is toxic at higher concentrations while Cd is considered harmful to human health at any concentration. Proper management of Cd and Zn contaminated soils requires a thorough understanding of both Cd and Zn speciation and release kinetics, which is the aim of this research. X-ray absorption spectroscopy (XAS) was used to investigate Cd, Zn, and S speciation in alkaline and acidified Cd-contaminated Thai paddy soils. Bulk extended X-ray absorption fine structure (EXAFS) spectroscopic data indicates that CdCO₃ and Cd-humic complexes are the predominant Cd species in the alkaline soil, while CdS and CdCO₃ are the major species in the acidified soil. Interestingly, the speciation of Zn in both soils is different from Cd. In the alkaline soil, Zn (OH)₂ is the primary species along with complexes of organic matter. X-ray microfluorescence (Åμ-XRF) spectroscopic images reveal that Cd tends to be diffusely distributed throughout the soil while Zn is localized. Stirred-flow kinetic experiments reveal that Cd and Zn release from soils is initially rapid followed by a gradual slow release at longer time periods. The total amount of Cd and Zn released after the alkali soil was acidified was higher than 80%. Elucidation of Cd and Zn speciation and release kinetics in the Thai paddy soils is crucial for developing and implementing best management practices needed for productive agriculture in Cd and Zn contaminated areas.

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