741-7 Speciation and Release Kinetics of Cadmium and Zinc in Thai Paddy Soil.

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Cadmium (Cd) and zinc (Zn) naturally occur together. While Zn is a required micronutrient, Cd is harmful to human health. Although Cd has no biological role in rice, rice can take up Cd from soil, resulting in Cd entering the human food chain. The International Water Management Institute (IWMI) reported that rice produced in areas irrigated from the Huai Mae Tao River contains levels of Cd which are much higher than world standards due to discharge from Zn-mining. Our research aims to elucidate Cd and Zn speciation and release kinetics in a Thai paddy soil under alternating submerged/and drained conditions. The pH of this soil is 7.3 and the total amount of Cd and Zn are 130 and 7,020 ppm respectively. The alternating submerged/drained approach is a primary practice for cultivating rice in Thailand and other areas in Southeast Asia. This cultivation technique results in alternating redox and pH regimes; therefore, it may affect Cd and Zn speciation and mobility. To characterize Cd and Zn speciation we used synchrotron-based techniques, SEM-EDX, and a stirred-flow kinetics technique. Bulk X-ray absorption fine structure (XAFS) spectroscopic data indicates that the $CdCO_3$ content decreases after submerging, while the CdS content increases. However, $CdCO_3$ is the primary species in dry soil. X-ray microfluorescence (μ-XRF) spectroscopic images reveal variable patterns of elemental distribution. Cd tends to localize with Ca after submersion; however, Cd is diffusely distributed in the dry soil. Stirred-flow kinetic experiments reveal that Cd and Zn release from soil is initially rapid followed by a gradual slow release of the metals at longer time periods. Less than 25 % of total Cd and Zn were released after 2 hours. Elucidating the speciation and release kinetics of Cd and Zn in paddy soils is necessary to develop and implement sustainable, best management practices that allow productive agriculture in mine-waste impacted areas.

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