

Co-sorption of nickel and zinc onto green rust sulfate

KHONDAKER MD. NUR ALAM AND EVERT J. ELZINGA

Rutgers, The State University of New Jersey

Presenting Author: kn339@scarletmail.rutgers.edu

Green rust (GR) is a brucite-like Fe(II)-Fe(III) layered double hydroxides (Fe(II)-Fe(III)-LDH) mineral that occurs prevalently in reducing natural and engineered systems. Our recent studies with combined batch sorption experiments, X-ray diffraction (XRD) analyses, and X-ray absorption spectroscopy (XAS) analyses showed that the sorption of structurally similar trace metals to the octahedral Fe(II) in the GR structure, such as Ni(II) and Zn(II) is extensive in the binary systems with pre-equilibrated GR sulfate and leads to the incorporation of these metals into the $\text{Fe(II)}_{0.67-x}\text{Me(II)}_x\text{Fe(III)}_{0.33}(\text{OH})_2\text{-LDH}$ phases, predominantly by coupled Me(II)-Fe(II) cation exchange and coprecipitation reactions. However, the co-existence of Ni(II) and Zn(II) in the reducing systems can potentially affect their sorption mechanisms in the GR-water interface, which necessitates the investigation of the co-sorption processes of these trace metals with GR in a ternary system. In this study, batch kinetic experiments were conducted for the Ni(II) and Zn(II) sorption in the binary and ternary systems with pre-equilibrated GR suspensions prepared in one bulk volume, which were combined with the XAS analyses of the sorption solids to directly compare the different sorption systems and assess the co-sorption mechanisms of Ni(II) and Zn(II) with GR. The batch kinetic results showed that the extent and behavior of Ni(II) and Zn(II) sorption with GR in ternary systems are similar to that observed in binary systems, and the mutual interactions between Ni(II) and Zn(II) are minimal. In addition, the XAS results suggested that Ni(II) and Zn(II) precipitate in the mixed Ni(II)/Zn(II)/Fe(II)-LDH phases during sorption with GR when they co-exist.