Dehydration, Diffusion and Entrapment of Zinc in Bentonite

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Abstract: Interactions with bentonite are important in the chemical speciation and fate of heavy metals in soils and other ecosystems. The interactions of Zn with bentonite were studied using X-ray diffraction (XRD), dehydration, kinetic and sequential extraction procedures. The species and activity of Zn retained by bentonite were affected markedly by pH. The $Zn(OH)^+$ was retained by bentonite prepared at pH $\geqslant$ 6.9. The extent of dehydration of $Zn(OH)^+$-bentonite was higher than that for Zn-bentonite. At a relative humidity of 55.5%, the basal spacing of the $Zn(OH)^+$-bentonite was from 1.21 to 1.26 nm with 1 water sheet and that of the Zn-bentonite was 1.51 nm with 2 water sheets. The greater affinity of $Zn(OH)^+$ for bentonite than Zn was associated with a lower degree of hydration. When an aqueous suspension of Ca-bentonite was incubated with soluble Zn, the concentration of Zn retained by the Ca-bentonite was linearly related to the square root of time. The rate of the interaction was controlled probably by the interlayer diffusion and subsequently by the diffusion into the ditrigonal cavities in bentonite. The Zn retained by bentonite was dehydrated *in situ* so as to increase the bonding of Zn with surfaces of bentonite. With hydrothermal treatment the retained Zn could diffuse easily into the cavities and transform increasingly to the residual forms that are associated with the entrapped form.

Key Words: Bentonite • Entrapment • Interaction • Micropore Diffusion • Speciation • Zinc

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