
Effects of Structural Iron Reduction on the Hydraulic Conductivity of Na-Smectite

Siyuan Shen, Joseph W. Stucki and Charles W. Boast¹

Department of Agronomy, University of Illinois, Urbana, Illinois 61801

¹Graduate Research Assistant, Professor of Soil Physical Chemistry, and Professor of Soil Physics, respectively, Department of Agronomy, University of Illinois, 1102 South Goodwin Avenue, Urbana, Illinois 61801, USA.

Abstract: The long-term impermeability of clay barriers in waste disposal facilities and hydraulic structures is of critical importance to environmental, agricultural, and industrial concerns. Changes in the oxidation state of Fe in the constituent clays of compacted clay barriers may degrade the hydraulic conductivity of these structures because other properties related to hydraulic conductivity, such as swelling, gel microstructure, and particle size, are greatly altered by the oxidation state. Two Na-saturated smectites (SWa-1 and API 25) were reduced by sodium dithionite ($\text{Na}_2\text{S}_2\text{O}_4$), both in suspension and *in situ* after consolidation, to examine the effects of structural Fe reduction on hydraulic conductivity. Results indicated that the hydraulic conductivity depended on both the oxidation state and the consolidation history of the clay. The hydraulic conductivity of clay reduced in suspension before consolidation was lower than that of oxidized clay. Initially reduced smectite, thus, may be compactable to a less-permeable material with higher bulk density. But reduction of smectite *in situ* after consolidation increased the hydraulic conductivity and its variability. The oxidized state of clay liners should, therefore, be preserved.

Key Words: Barriers • Bulk density • Clay • Hydraulic conductivity • Iron • Liners • Permeability • Reduction • Smectite • Water

Clays and Clay Minerals; August 1992 v. 40; no. 4; p. 381-386; DOI: [10.1346/CCMN.1992.0400402](https://doi.org/10.1346/CCMN.1992.0400402)

© 1992, The Clay Minerals Society

Clay Minerals Society (www.clays.org)
