Electrochemical Alteration of Clay Soils*

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Abstract: The composition and physical properties of three clay soils were altered by introducing aluminum under an electrochemical gradient in order to evaluate the role of pH in controlling changes in soil composition and the feasibility of pH buffering during electrochemical treatment.

Both X-ray diffraction and selective chemical extraction methods were used to determine the distribution and mode of occurrence of aluminum in the treated samples. Aluminum was detected in the treated samples in both exchangeable form and as a hydroxy-aluminum interlayer. Aluminum oxide minerals such as gibbsite were not detected in any of the treated samples. Mineralization by aluminum ions was speeded and intensified in bentonite soils by buffering the catholyte with carbon dioxide.

Plasticity of bentonite soil samples from South Dakota was reduced markedly by electrochemical treatment, whereas the plasticity of an illite soil from Illinois and an illite-montmorillonite soil from Mississippi were relatively unaffected. Nearly all treated samples exhibited some degree of electrochemical induration or mineralization. Induration was most pronounced in bentonite soil samples with high water contents and alkaline pH largely because of hydroxy-atuminum interlayering in the clay. On the other hand interlayering was negligible in illite soil samples with low pH; the main effect of electrochemical treatment in this case was the addition of aluminum in exchange sites.

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