
Influence of Citric Acid on the Formation of Short-Range Ordered Aluminosilicates

K. Inoue¹ and P. M. Huang

Department of Soil Science, Saskatchewan Institute of Pedology, University of Saskatchewan Saskatoon, Saskatchewan S7N 0W0, Canada

¹ Permanent address: Laboratory of Soil Science, Department of Agricultural Chemistry, Faculty of Agriculture, Iwate University, Morioka, Japan 020.

Abstract: Reactions between hydroxy-Al ions and orthosilicic acid as influenced by citric acid were studied at an initial Si concentration of 1.6×10^{-3} M, Si/Al molar ratios of 0.5 and 1.0, OH/Al molar ratios of 1.0– 3.0, and citric acid/Al molar ratios of 0– 0.3. In the absence of citric acid and at OH/Al ratios of 1.0– 2.8, imogolite ($>0.01 \mu\text{m}$) was dominant in the precipitates. At citric acid/Al ratios of 0.01– 0.1, imogolite and/or pseudoboehmite were dominant in the precipitates at OH/Al ratios of 1.0 and 2.0, and imogolite and/or ill-defined aluminosilicate complexes at OH/Al ratio of 2.8. Instead of allophane or “ proto-imogolite ” allophane being the predominant species in the precipitates, the formation of ill-defined aluminosilicate complexes at OH/Al ratio of 3.0 was steadily promoted by increasing the solution citric acid/Al ratios from 0 to 0.3. The freeze-dried soluble products ($<0.01 \mu\text{m}$) ranged from silica gel to “ proto-imogolite,” depending upon the basicity of Al and the level of citric acid of the parent solution. The amount of “ proto-imogolite,” increased with increasing citric acid/Al ratios from 0 to 0.1 in solution. Complexing low molecular weight organic acids, such as citric acid, impeded the formation of the short-range ordered aluminosilicates, allophanes and imogolite.

Key Words: Allophane • Aluminosilicate • Citric acid • Hydroxy-Al • Imogolite • Noncrystalline • Pseudoboehmite

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