Influence of pH, Concentration, and Chelating Power of Organic Anions on the Synthesis of Aluminum Hydroxides and Oxyhydroxides[1]

A. Violante and P. Violante

Istituto di Chimica Agraria dell' Università di Napoli, 80055 Portici, Italy

[1] This work was supported in part by the CNR research grant CT79.01978.06.

Abstract: Chelating organic acids hampered the hydrolytic reactions of Al and affected the nature of the crystalline aluminum hydroxides. Chemical composition, structure, size, nature of functional groups, and concentration of each organic anion, as well as the pH of the system, controlled the rate of $Al(OH)_3$ crystallization. The order of effectiveness of the various acids was: glutaric < succinic = phthalic < glycine < malonic < glutamic < aspartic < oxalic < salicylic = malic < citric < tartaric. An increase in the stability of complexes formed between the organic ligands and Al decreased the rate of crystallization and changed the final aluminous products from bayerite to nordstrandite and/or gibbsite and then to pseudoboehmite and/or amorphous material. In the presence of anions with a great affinity for Al, particularly at pH equal to or less than 9.0, the reaction products were commonly poorly crystalline or structurally distorted. In the range of pH 8.0 to 10.0 moderately or strongly chelating anions acted to retard or prevent olation and facilitated the formation of stable pseudoboehmite or X-ray-amorphous products. The stronger the chelating power or the higher the concentration of organic anions, the easier was the formation of pseudoboehmite or amorphous material.

Key Words: Aluminum hydroxide • Aluminum oxyhydroxide • Carboxylic acid • Chelation • Crystallization • Pseudoboehmite

Clays and Clay Minerals; December 1980 v. 28; no. 6; p. 425-434; DOI: 10.1346/CCMN.1980.0280604

Clay Minerals Society (www.clays.org)