
The Nature of Polynuclear OH-Al Complexes in Laboratory-Hydrolyzed and Commercial Hydroxyaluminum Solutions¹

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Abstract: Laboratory-hydrolyzed and commercial OH-Al solutions were characterized using kinetics of Al-ferron color development, kinetics of structural OH neutralization with H⁺, ²⁷Al NMR spectroscopy, and sulfate precipitation. The results showed that the Al₁₃ complexes having the Keggin structure were dominant only in fresh, laboratory-hydrolyzed OH-Al solutions of OH/Al molar ratio = 1.8 and above. These species gradually converted to other polynuclear forms that reacted with ferron slowly, were not detectable by ²⁷Al NMR spectroscopy, and yielded different basic Al sulfates following Na₂SO₄ addition. These more stable complexes can best be interpreted to have a Al(OH)₃-fragment structure. In the three commercial aluminum chlorohydrate (ACH) solutions studied, Al₁₃ complexes accounted for a small portion of the total Al present. More than 80% of the Al was present as species that were not detectable with NMR spectroscopy and resembled the slow-reacting complexes in aged, laboratory-hydrolyzed OH-Al solutions. Small portions of the slow-reacting complexes appeared to be submicron particulates that acted as nuclei for gibbsite formation or aggregates of Al₁₃ complexes that dispersed to Al₁₃ upon dilution. Polyaluminum chloride (PA) solution resembled the moderately aged laboratory-hydrolyzed OH-Al solutions.

Key Words: Al₁₃ complexes • Aluminum chlorohydrate • Polyaluminum chloride • Polynuclear OH-Al complexes

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