Effect of Tartaric Acid and pH on the Nature and Physicochemical Properties of Short-range Ordered Aluminum Precipitation Products

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Abstract: The influence of tartaric acid and pH on chemical composition, morphology, surface area, and porosity of short-range ordered Al precipitation products was studied. Samples were prepared (1) at pH 8.0 and at the tartaric acid/Al molar ratios (R) ranging from 0 to 0.25 and (2) at R = 0.1 and in the pH range of 4.7 to 10.0. In Al precipitation products formed at pH 8.0, the organic C content increased from 8 g/kg (R = 0.01) to 93 g/kg (R = 0.25), whereas the Al content decreased from 363 g/kg (R = 0.01) to 271 g/kg (R = 0.25). The specific surface of the materials was particularly high (>400 m^2/g) when samples were prepared at R < 0.1, but drastically decreased when samples were prepared at R > 0.1 (e.g., 78.6 m^2/g at R = 0.25). When the C content was relatively high (>45 g/kg), aggregation between the particles was promoted, and the specific surface, thus, decreased. Electron optical observations showed that such samples were strongly aggregated. In the materials prepared at R = 0.1, but at different initial pH values, the C content decreased from 90 g/kg (pH = 4.7) to 25 g/kg (pH = 10.0). As a consequence, the lower the initial pH, the lower was the specific surface of the Al precipitation products. Tartaric acid plays an important role in both pertubation of crystallization of Al hydroxides and promotion of aggregation of the reaction products. The two processes counteract in influencing the specific surface and pore volume of Al hydroxides.

Heating treatments greatly affected the specific surface and porosity of Al precipitation products. The specific surface and porosity of the samples generally increased by increasing the temperature up to 400°C and then decreased. Small amounts of C still remained after heating some samples for 12 hr at 600°C.

Key Words: Aggregation • Aluminum hydroxides • Crystallization • Porosity • Precipitation • Surface area • Tartaric acid

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