Effect of Time and Temperature on the Chemical Composition and Crystallization of Mixed Iron and Aluminum Species

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Abstract: We studied the influence of time ageing (up to 120 d at 50 ° C or 30d at 95 ° C) on the mineralogical and chemical composition of hydrolytic species of mixed aluminum and iron samples formed at pH 5.0 and initial Fe/Al molar ratio (Ri) ranging from 0.1 to 10. The partitioning distribution of Fe and Al in soluble or solid phases of different sizes (<0.01, 0.2-0.01, >0.2 μm) depended on Ri and time. The ratio of Fe to Al of the <0.2 μm Fe-Al species of the samples at Ri ⩽ 4 slowly increased with time. Usually the higher Ri the higher the amount of Fe + Al present in soluble or very fine solids (<0.2 μm). With time, high percentages of Fe were found mainly in the <0.01 μm while the Al increase in the >0.2 μm sizes. Gibbsite, without the presence of well-crystallized Fe-oxides was formed in the samples at Ri ⩽ 0.5 after 7 – 120 d at 50 ° C. In the samples at Ri ⩾ 1 low-crystalline ferrihydrite was observed after ⩾60 d. Only after 120 d did gibbsite or hematite start to form in the samples at Ri = 1 – 10. However, even after prolonged ageing at 95 ° C, low-crystalline ferrihydrite was still present at Ri ⩽ 4.

The Fe-Al samples at Ri ⩾ 1 aged 32 d at 50 ° C dissolved almost completely by acid ammonium-oxalate (82 – 93%), but the samples at Ri ⩽ 0.5 were only partially solubilized (13 – 60%). After further 30 d at 95 ° C, the percentages of Fe + Al solubilized by oxalate from the samples at R ⩾ 0.5 was still relatively high (22 – 39%).

Key Words: Aluminum • Crystallization • Gibbsite • Iron

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