
Comparison of Intercalation Methods for Differentiating Halloysite from Kaolinite

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Abstract: The intercalation of formamide, potassium acetate, and hydrazine by halloysite and/or kaolinite-rich samples, with and without subsequent displacement of the interlayer species by water or glycerol/water, has been investigated. Halloysite, as such, or in mixtures with kaolinite is completely expanded by all the treatments used, thereby enabling halloysite concentrations to be determined from the basal X-ray powder diffraction (XRD) peak ratios of the appropriate complexes. The values so obtained are usually proportional to the abundance of tubes, laths, and spherules in the transmission electron micrographs of the samples. The analysis of kaolin samples (halloysite plus kaolinite) by intercalation methods is less straight forward because a proportion of the kaolinite component in the system may not expand, even after lengthy (≥ 18 days) contact of the sample with the intercalating agent. Only prolonged immersion in hydrazine produces complete or nearly complete expansion of this component. When allowance is made for the presence of non-clay mineral components, kaolin-mineral percentages estimated from XRD peak intensity ratios of the hydrazine complexes generally agree with values derived from differential thermal analysis to within $\pm 10\%$. Kaolinite in mixtures with halloysite cannot be directly determined by intercalation procedures inasmuch as treatments which result in complex formation with kaolinite also expand halloysite. In such systems, kaolinite can be estimated by difference between the concentration of kaolin minerals and halloysite.

Key Words: Formamide • Halloysite • Hydrazine • Intercalation • Kaolinite • Potassium acetate • Test

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