
Influence of Silica Content on the Surface Charge Characteristics of Allophanic Clays

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Abstract: The surface and charge characteristics of 6 allophanic clays originating from a climatosequence of Andisols have been studied by titration, ion retention, surface area, and reactivity measurements. Several properties of these clays, such as the pH of zero charge, the magnitude of the surface area, and the reactivity of structural hydroxyl groups, appear to be governed by their chemical composition, especially by their silica content. A similar relationship between the above properties and silica content also exists for synthetic aluminosilicate gels (often quoted in the literature as possible models of allophanes), despite their different structure to the natural clays. An explanation is that as desilication proceeds, octahedral polymeric units of aluminum progressively individualize in both the synthetic and natural samples. The surface areas of the allophanic clays, based on the slope of the titration curve at pH 7, are closely related to the amounts of structural hydroxyl that can react with fluoride at about the same pH. The permanent negative charges are always very low, even for silica-rich, allophane-bearing samples. It is therefore suggested that all of these clays should be virtually free of tetrahedral aluminum.

Key Words: Allophane • Andisols • Desilication • Soils • Specific surface • Zero point of charge

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