
Selectivity and Adsorption Capacity of Smectite and Vermiculite for Aluminum of Varying Basicity*

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Abstract: Smectite (from South Dakota, Wyoming, and Mississippi) and vermiculite (Transvaal) were treated with solutions of $\text{Al}(\text{OH})_B^{(3-B)+}$, with B varying from 0 to 2.5. The average basicity ($\text{OH}/\text{Al} = B$) of the Al adsorbed differed very much from the basicity of the Al added. The average basicity of the Al adsorbed by smectite was always above the average basicity of the Al added. In contrast to smectite, vermiculite adsorbed smaller hydroxy-Al complexes. One reason for the different selective behavior was the difference in expansion between smectite (about 18 Å) and vermiculite (about 14 Å). Because of the adsorption of the relatively more basic OH-Al by smectite, smectite adsorbed considerably more Al than vermiculite. The total amount of aluminum in the interlayer generally could not be calculated by the difference between Al added and that remaining in solution after the reaction because of possible protonation of the clay mineral and adsorption of structural Al and other cations, which is more pronounced for vermiculite. The results in the present study demonstrated that neither the quantitative nor the qualitative composition of an $\text{Al}(\text{OH})_B$ -treated exchanger can be deduced from B of the Al salts added. These points are frequently overlooked when cation exchangers are pretreated with Al of variable basicity and are used for further investigations, such as studies of CEC, surface area, interlayer spacing, anion reactions, the formation of gibbsite, etc. Before these kinds of investigations are conducted employing the pretreated OH-Al-exchangers, their composition should be known precisely.

Key Words: Adsorption • Aluminum • Expansion • Smectite • Vermiculite

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