
Sodium-Lithium Exchange Equilibria on Vermiculite at 25° and 50° C*

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Abstract: Sodium-lithium exchange equilibria between dilute aqueous chloride solutions and 0.2– 62 μ Transvaal, South African vermiculite were studied at 25° and 50° C using a dialysis technique. The K content of the vermiculite was reduced to < 1% of the exchange capacity of 2· 14 me/g by exhaustive extraction using Na-tetraphenylboron. The thermodynamic equilibrium constants and in turn the standard free energies and heats of exchange were evaluated from the equilibrium selectivity coefficients at the two temperatures. The standard entropy of exchange, ΔS° , was calculated according to the relationship $\Delta G^\circ = \Delta H^\circ - T\Delta S^\circ$. Similar results were obtained for Na \rightarrow Li and Li \rightarrow Na exchange at 25° C, thus confirming the reversibility of the reaction.

Sodium preference increased with Na saturation of the vermiculite and equilibrium selectivity coefficients ranged from 6· 0 to 22· 0 at 25° C. In comparison, selectivity coefficients for Na-Li exchange on montmorillonite ranged from 1· 0 to 2· 0 and became smaller with increasing Na saturation. The standard free energy and heat of exchange on vermiculite at 25° C were -1444 and -5525 cal mole⁻¹, respectively, resulting in a ΔS° value of -13· 7 e.u. This relatively large entropy change is probably due to differences in ion hydration in the solution and surface phases.

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