Monovalent-Divalent Exchange on Smectitic Soil Under Varying pH and Redox State. (S02-sonon160741-Poster)

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Abstract:

Binary K-Ca exchange reactions in an Iowa smectitic soil were investigated with respect to pH and redox. It is known that pH affects surface electrical potential and thereby, influencing adsorption affinity for cations on the exchange phase. Redox is also known to affect smectite's overall surface electrical potential, hence surface charge, by changing the redox state of structural (octahedral) iron, e.g., Fe(II) to Fe(III), thereby affecting monovalent cation preference. Our data showed that the operationally defined surface charge, sum of exchangeable cations, was directly dependent on pH and redox. When pH was increased from approximately 3.8 to 7.3 under oxidized conditions, the soil's surface charge increased from approximately 10 cmolc kg-1 to 40 cmolc kg-1. On the other hand, under reduced conditions, when pH was increased from approximately 3.8 to 5.2 the soil's surface charge increased from approximately 10 cmolc kg-1 to 45 cmolc kg-1. The relative affinity of K+ by the soil's surface was highest under low pH and reduced conditions and lowest under high pH, reduced or oxidized conditions. Regardless of redox state, affinity for K+ at low pH was biphasic but at high pH, the systems obeyed nearly ideal solid-solution behavior.

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