Selectivities of K/Ca and K/Pb Exchange in Two Tropical Soils. (S11-appel122429-Oral)

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Abstract:

Measurement of cation selectivity in soils provides important information about the affinity and binding strength of a particular cation on soil surfaces. Gaines-Thomas (KGT) selectivity coefficients were determined for a variety of K/Ca and K/Pb ratios on an Oxisol and Ultisol soil from Puerto Rico. The calculated KGT values indicated a preference for K+ over Ca2+ or Pb2+. The selectivity for Pb2+ was significantly greater than that for Ca2+ due to the larger hydrated charge density of Pb2+ relative to that of Ca2+. The patterns of selectivity were independent of metal type. The selectivity of the Oxisol for Ca2+ or Pb2+ exhibited no trend/did not change with changes in divalent metal surface coverage indicating exchange sites had similar affinities for Ca2+ and Pb2+. The Ultisol displayed a decrease in selectivity for Ca2+ and Pb2+ with increasing surface coverage of these ions. This was attributed to the presence of smectite in the Ultisol which was able to partially collapse when K+ saturated. Some of the Pb sorption in the soils was due to chemisorption. The Oxisol chemisorbed ~ 3000 ppm Pb while that value for the Ultisol was ~ 1900 ppm. The differences were due to the greater quantities of Fe/Al oxides and organic matter in the Oxisol relative to the Ultisol. SEM-EDX spectroscopy detected discrete Pb-C phases in both soils. The C was from organic matter as PbCO3 was not stable under experimental conditions. It was possible Pb was associated with organic sulfhydral groups. The selectivity exhibited by soil systems for various nutrient and heavy metals is important in elucidating how available these metals will be for plant/animal uptake as well as their mobility and stability in the soil environment.

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