☒ **Talk** ☐ **Poster**

Elucidating Novel Mechanisms Contributing to Excessive Potassium Fixation in Soils via (Synchrotron) X-ray Techniques

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Potassium bioavailability in soil is directly linked to the behavior of potassium at the mineral–water interface. Potassium adsorption is known to occur in soil via outer-sphere as well as inner-sphere surface complexation. However, the main focus of this study is to identify novel mechanisms of potassium sorption to newly formed surface precipitates. Soil clay minerals and metal oxides can undergo dissolution and precipitation on a short time scale at circumneutral pH values resulting into new surface precipitates. We hypothesize that the formation of surface precipitates can create new potential adsorption sites for potassium, thus affecting potassium bioavailability. The objective of this study is to determine how potassium sorption to aluminum and silicon oxides is affected by co-ions, dissolved silicate, and surface precipitation. Potassium sorption experiments were conducted at a pH of 8.5 using γ-Al_2O_3, AlO(OH) and SiO_2 sorbents in the presence of co-ions (magnesium, iron, nickel, and zinc). Adsorption results indicate that SiO_2 played an important role in increasing potassium sorption compared to aluminum oxides due to its role in the formation of silicated metal hydroxides. The presence of dissolved silicate increased potassium adsorption by up to 31% on average and was found to enhance potassium and metal retention to the solids. X-ray diffraction analysis of the reacted solids indicated that the presence of zinc and nickel enhanced the formation of new surface precipitates, which were indexed to layered double hydroxides (LDHs). X-ray absorption near edge structure (XANES) analysis indicated that potassium may be bound to these surface precipitates (e.g., LDHs) via inner-sphere surface complexation. Overall, these results provide novel insights into potassium adsorption and fixation in soil and clay mineral systems, and they have important implications for effective potassium fertilizer application and bioavailability in soil because of the influence that surface precipitates have on cation sorption.