Understanding abiotic surface interaction mechanisms of nucleotides on soil minerals

Study of nucleotide adsorption mechanism on environmental surfaces serves many purposes including but not limited to understanding the environmental provenance of unwanted genetic material such as antibiotic resistance genes and the prebiotic origin of life. In our past published results, we found adenosine-5`-monophsophate (AMP) has high affinity for a common iron oxide mineral, hematite. Adsorption mechanism was deciphered using in situ attenuated total reflectance Fourier transform infrared (ATR-FTIR) spectroscopic probes in single and multi-anion (i.e. in the presence of phosphate and citrate) systems. Although preliminary findings verified the inner-sphere nature of the surface complexation, the presence of citrate desorbed AMP from the surface of hematite. Thus, in this study a thorough probe into the surface complexation mechanism using both macroscopic and spectroscopic experiments was made. The effects of ionic strengths using both NaCl and $CaCl_2$ were investigated under various other solution properties. Initial findings suggested that, although overall macroscopic adsorption was unaffected by ionic strength changes, the use of in situ ATR-FTIR revealed some differences in surface complexation modes of various functional groups of adenosine base moiety. Experiments are ongoing to probe much deeper into the mechanism.