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Molecular-level spectroscopic investigations of the complexation and photodegradation of catechol to/by iron(III)

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Surface water plays a crucial role in facilitating or inhibiting surface reactions in atmospheric aerosols. Little is known about the role of surface water in the complexation of organic molecules to transition metals in multicomponent aerosol systems. We will show results from real time diffuse reflectance infrared Fourier transform spectroscopy (DRIFTS) experiments for the in situ complexation of catechol to Fe(III) and its photosensitized degradation under dry and humid conditions. Catechol was chosen as a simple model for humic-like substances (HULIS) in aerosols and aged polyaromatic hydrocarbons (PAH). It has also been detected in secondary organic aerosols (SOA) formed from the reaction of hydroxyl radicals with benzene. Given the importance of the iron content in aerosols and its biogeochemistry, our studies were conducted using FeCl3. For comparison, these surface-sensitive studies were complemented with bulk aqueous ATR-FTIR, UV-vis, and HPLC measurements for structural, quantitative and qualitative information about complexes in the bulk, and potential degradation products. The implications of our studies on understanding interfacial and condensed phase chemistry relevant to multicomponent aerosols, water thin islands on buildings, and ocean surfaces containing transition metals will be discussed.