

A45P-2085 - Raman Microspectroscopy of Individual IEPOX-derived Secondary Organic Aerosol Particles After OH Oxidation

Thursday, 15 December 2022
15:45 - 19:15

• McCormick Place - Poster Hall, Hall A (South, Level 3)

Abstract

Isoprene is one of the most common biogenic volatile organic compounds (BVOC) in the atmosphere, produced by many plants. Isoprene undergoes oxidation to form gaseous isoprene epoxydiols (IEPOX) under low-NO_x conditions, which can lead to the formation of secondary organic aerosol (SOA) particles. SOA-containing particles affect climate by scattering and absorbing solar radiation or acting as cloud condensation nuclei (CCN). High concentrations of SOA are also associated with adverse health impacts in people. While in the atmosphere, IEPOX SOA particles continue to undergo reactions with atmospheric oxidants, including hydroxyl radical (OH).

To isolate and probe this process, we studied atmospheric chemical processes in an aerosol chamber to better understand the evolution of heterogeneous OH oxidation of IEPOX-derived SOA particles. Since very little is understood about the structural and spectroscopic properties because of the complexity of their many sources and atmospheric processing, individual particle measurements are necessary to provide better understanding of the composition of IEPOX SOA.

We injected particles composed of mixtures of ammonium sulfate and sulfuric acid across a range of acidities (PH = 0.5 – 2.5) and gas-phase IEPOX into the chamber to generate SOA. The SOA particles were then sent to an oxidation flow reactor, and exposed to different OH concentrations representative of aging of a number of days. We kept relative humidity (RH) constant at ~65%, the temperature was ~23 °C, and levels of oxidation were controlled by adjusting lamp intensity. After oxidized SOA was impacted on quartz substrates, we used single-particle Raman microspectroscopy to identify their functional group compositions. From the Raman vibrational spectra of submicron particles (~500-1000 nm aerodynamic diameter), we observed a distinct difference in core-shell morphology and composition: an organic outer layer and an aqueous-inorganic core. The core also has significantly more CH-stretch than the shell. Small changes were also observed with increasing oxidation, which are important to consider when predicting SOA particle evolution in the atmosphere.

A45P-2085 Raman Microspectroscopy of Individual IEPOX-derived Secondary Organic Aerosol Particles After OH Oxidation

Weiyu Chen¹, Alison Fankhauser², Jin Yan³, Madeline Cooke⁴, Cara Waters², Rebecca Parham², N. Cazimir Armstrong³, Yao Xiao², Katherine Kolozsvari², Zhenfa Zhang³, Avram Gold³, Jason D Surratt³ and Andrew P Ault⁴, (1)Oberlin College, Department of Geology, Oberlin, OH, United States, (2)University of Michigan Ann Arbor, Department of Chemistry, Ann Arbor, United States, (3)University of North Carolina at Chapel Hill, Department of Environmental Sciences and Engineering, Chapel Hill, United States, (4)University of Michigan Ann Arbor, Department of Chemistry, Ann Arbor, MI, United States