Title: The Formation and Aging of Organic Aerosols Under Atmospherically Relevant Conditions: An Evolving Complex Chemical Picture

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Fine atmospheric particles are a major contributor to air pollution and affect human health and global climate, yet the processes that lead to their formation are poorly understood. Atmospheric concentrations of organic aerosols (C_{OA}) are less than 10 μg m^{-3}. Secondary organic aerosol (SOA), formed by oxidation of volatile organic compounds (VOCs), is a primary component of atmospheric aerosols. Laboratory SOA studies using environmental chambers to emulate atmospheric chemistry are typically carried out with organic mass loadings of the order of 100 μg m^{-3}. Various studies have however, have shown that the chemical composition and properties of aerosols formed in chambers under high C_{OA} levels (C_{OA} > 15 μg m^{-3}) differ from those of real atmospheric particles; therefore, extrapolation of results derived from chamber-based studies may be inappropriate for modeling the atmospheric production of aerosols.

We are using an innovative, soft ionization aerosol mass spectrometer, developed in the Petrucci group, to measure the chemical composition of SOA at atmospherically relevant levels. This new analytical method, near-infrared laser desorption/ionization aerosol mass spectrometry (NIR-LDI-AMS), is used in conjunction with the University of Vermont Environmental Chamber (UVMEC) to study the formation of SOA by ozonolysis of the prevalent atmospheric VOC limonene. Results are presented showing that at low C_{OA} levels, the initial conditions of the aerosol-forming reactions result in strikingly diverse outcomes. With continued work, we hope to gain a better understanding of the mechanism by which aerosols are formed at atmospheric concentrations, as well as develop a nascent knowledge of the importance of chemistry at the inception of particle formation on the ultimate fate of the organic particles. This improved understanding is fundamental to accurately model aerosol formation in the atmosphere, and subsequently its effect on human and environmental health.