Evaluation of Oligomeric Content in Secondary Organic Aerosol Using Matrix-Assisted Laser Desorption Mass Spectrometry (MALDI-MS)

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Abstract
Secondary organic aerosol (SOA) is key to our climate, affecting Earth's radiative balance both indirectly and directly. Understanding the chemical composition and properties of SOA are crucial to accurately predict their concentrations and ultimately their impact on climate in models. Multiphase chemical reactions in the atmosphere have been found to form a variety of low-volatility, high-molecular-weight species, or oligomers. Although oligomers may constitute a large portion of SOA, they are not well understood. Most analytical techniques are unable to detect such high-mass organic species, so their formation and degradation mechanisms are still in need of investigation. Herein, we present a method using matrix-assisted laser desorption ionization mass spectrometry (MALDI-MS) to determine the oligomeric content of aerosol particles. We apply the method to analyze SOA particles formed from reactive uptake of IEPOX onto acidic ammonium sulfate seed particles during atmospheric chamber experiments. We compare the oligomeric content of the particles based on key properties, including particle acidity and exposure to oxidants. We compared multiple sample collection methods, including impaction into deionized water using a Liquid Spot Sampler (Aerosol Devices) and direct impaction onto a sampling plate. Our work will provide insight about the formation of oligomers in the atmosphere, which will allow better modeling of their climatic impact.

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