

Organosulfate Formation in Proxies for Aged Sea Spray Aerosol: Reactive Uptake of Isoprene Epoxydiols to Acidic Sodium Sulfate

Abstract

Oxidation of isoprene, the biogenic volatile organic compound with the highest emissions globally, is a large source of secondary organic aerosol (SOA) in the atmosphere. Organosulfates, particularly methyltetrol sulfates formed from acid-driven reactions of the oxidation product isoprene epoxydiol (IEPOX) onto particulate sulfate, are important contributors to SOA mass. To date, most studies have focused on organosulfate formation on ammonium sulfate particles at low pH. However, recent work has shown that sea spray aerosol (SSA) in the accumulation mode (~100 nm) is often quite acidic (pH ~ 2). Marine biota are well-established sources of isoprene, with annual global oceanic fluxes of isoprene estimated to range from 1-12 Tg, and IEPOX-derived organosulfates have been identified in marine environments. Herein, we demonstrate that substantial SOA, including organosulfates, are formed on acidic sodium sulfate particles, representative of marine aerosol heterogeneously reacting with H₂SO₄ to form Na₂SO₄. We compare SOA formed from the reactive uptake of IEPOX onto particulate sulfate and find that the cation (sodium vs. ammonium) impacts the physical properties and chemical composition of the SOA formed. Additionally, we investigate the formation of SOA derived from sodium sulfate based on key properties including particle acidity and the extent of exposure to oxidation via OH radicals. Our results suggest that isoprene-derived SOA formed on aged SSA is potentially an important, but underappreciated, source of SOA and organosulfates in marine and coastal regions and could modify SOA budgets and composition in these environments.

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