A53X-04 Constraining Gas Phase Yields and Reactive Uptake Coefficients of Isoprene-OH Oxidation Products onto Acidic Particles by Vocus Ammonia-Adduct Chemical Ionization Mass Spectrometry (Vocus NH_4^+ CIMS)

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Abstract

Isoprene, the most abundant non-methane volatile organic compound in the atmosphere, undergoes photochemical reactions with $^{\bullet}OH$ radicals, a major sink for isoprene, leading to the formation of secondary organic aerosols (SOA). Using the Vocus Chemical Ionization Mass Spectrometer (Vocus NH_4^+ CIMS) with ammonium-adduct ions, this study provides new insights into the yield and reactive uptake of oxidized volatile organic compounds (OVOCs) produced from isoprene-OH oxidation under dry conditions.

Multiple epoxides, not just the typical isoprene epoxy-diols (IEPOX), were identified during isoprene photooxidation chamber experiments. The molar yields of key oxidation products were quantified using sensitivities estimated from an innovative voltage scan of the Vocus's front and back ends of the ion-molecule reactor region. The reactive uptake coefficients (γ) for key isoprene-OH oxidation products onto acidic particles, including non-IEPOX epoxy molecules, were quantified by combining chamber experiments with detailed box modeling. The γ values for $C_5H_{10}O_3$, a combination of isoprene hydroxy hydroperoxides (ISOPOOH) and IEPOX, and $C_5H_8O_4$, a non-IEPOX epoxy molecule, show a rapid decrease as the SOA coating thickness increases, indicating a self-limiting effect.

Although ISOPOOH/IEPOX contributes approximately 80% to the total reaction uptake, other oxidation products from isoprene photooxidation, including non-IEPOX epoxy molecules, still contribute 20% to the total SOA formation. These findings emphasize the importance of future models considering the self-limiting effects of both ISOPOOH/IEPOX and SOA formation through non-IEPOX pathways.

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