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酸化過程の違いがイソプレン起源 SOA の光学特性に及ぼす影響
Impact of oxidation processes on optical properties of isoprene SOAs

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Isoprene is the most abundant volatile organic compounds (VOCs) emitted from biosphere and is known as one of the precursors of secondary organic aerosols (SOAs) in the atmosphere. The formation yield of the isoprene-SOAs is considered to be enhanced in the presence of acidic seed particles such as sulfuric acid. Recently, it has been suggested that some organic aerosols, which is called “brown carbon” , can absorb solar radiation, especially at the ultraviolet (UV) and shorter visible wavelengths and contribute to the radiation balance and photochemical reactions in the atmosphere. However, no experimental study on complex refractive index (RI) of the SOAs generated from the isoprene has been reported. In this work, wavelength dependence of the complex RI values of the SOAs generated in the oxidation of isoprene with OH, NO_3, and O_3 in the presence or absence of SO_2 have been examined.

The SOAs were generated in a 6 m^3 Teflon coated stainless steel photochemical smog chamber. In the OH oxidation experiments, the reaction mixture of isoprene and NO in the presence or absence of SO_2 (sulfuric acid precursor) was continuously irradiated by UV light after the addition of a small amount of methyl nitrite as a source of OH radicals. In the ozonolysis experiments, isoprene was reacted with O_3 in the presence or absence of CO (OH scavenger) and SO_2. In the NO_3 oxidation experiments, ozone was added to the mixture of isoprene and NO_2 in the presence of SO_2. The optical properties of the SOAs were measured by two photoacoustic spectrometers (PASS-3 and PAX, absorption and scattering at 375, 405, 532, 781 nm) and a custom-built cavity ring-down spectrometer (CRDS, extinction at 532 nm). Chemical properties of aerosols were also measured by an Aerodyne aerosol mass spectrometer (ToF-AMS). The size distributions of SOAs were measured by a scanning mobility particle sizer (SMPS).

Absorption, scattering, and extinction efficiencies of SOAs are calculated by dividing the absorption, scattering, and extinction coefficients by total mobility cross sections measured with the SMPS. The RI of the SOAs is determined by comparing the size parameter dependence of extinction, scattering, and absorption efficiencies with Mie theory. The significant imaginary part values of RI at 405 and 532 nm are obtained for the SOAs generated in the OH oxidation of isoprene in the presence of SO_2, while the imaginary part values are negligible for the SOAs generated in the ozonolysis (in the presence of OH scavenger) and NO_3 oxidation of isoprene. In the presentation, relationship with chemical properties and the atmospheric implications of the results will also be discussed.

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