Geophysical Research Abstracts, Vol. 7, 04217, 2005
SRef-ID: 1607-7962/gra/EGU05-A-04217

SOA Formation from alpha-Pinene Ozonolysis: Influence of OH Scavengers to the SOA Yields and Products

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The formation of secondary organic aerosol (SOA) from the ozonolysis of terpenes has been studied intensively for nearly twenty years. Recently, the enhancement of SOA yields from the acid catalysed reactions of organics has been receiving great attention. Recent studies indicate that the presence of acidic seed particles increases the SOA yield significantly. More detailed studies report the formation of higher molecular weight products in SOA which could result in an irreversible uptake of organic compounds (mainly aldehydes) into the particle phase.

In order to improve our understanding of the effects of particle acidity to SOA formation gas phase alpha-pinene ozonolysis was carried out in the presence of neutral or acidic seed particles in a 9 m^3 Teflon chamber at mixing ratios of 100 ppbv for alpha-pinene and about 70 ppbv for ozone. 2-Butanol and cyclohexane were used as OH scavengers. The resulting particles were sampled by a denuder/PTFE filter for the analysis of individual chemical species using capillary electrophoresis with electrospray ionisation ion trap mass spectrometer (CE-ESI-ITMS) and with HPLC with atmospheric pressure chemical ionisation ion trap mass spectrometer (HPLC-APCI-ITMS).

In the present study, particles were sampled in chamber experiments by conventional denuder-filter combinations as well as by a newly developed particle sampling device based on condensation and impaction (C-GIS). Extensive particle phase analytics were performed by capillary electrophoresis–mass spectrometry.

Our new results from the terpene ozonolysis in the presence of OH scavengers show that the presence of OH scavengers reduces the formation of oligomeric compounds in SOA. This result indicates that hydroxyl radicals play an important role in the formation of precursor compounds for the particle phase heterogeneous acid catalysed reactions leading to the higher molecular weight compounds and the enhancement of SOA yields. Better understanding of the role of hydroxyl radicals in the formation of SOA is necessary to distinguish between the contribution of ozonolysis and hydroxyl radicals to the SOA yields.

Here we present the results from a series of experiments for alpha-pinene ozonolysis with both acidic and neutral seed particles and the influence of OH scavengers (2-butanol and cyclohexane) to products and SOA yields from alpha-pinene ozonolysis.