Geophysical Research Abstracts,
Vol. 10, EGU2008-A-11756, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-11756
EGU General Assembly 2008

Detection of Gas Phase Oxidation Products of Isoprene and α-Pinene and their Role in Secondary Organic Aerosol Formation

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Many modern atmospheric issues are caused or exacerbated by the presence of airborne particulate matter, including the impairment of local visibility, perturbations to atmospheric chemistry, climate change on the global scale and damaging effects on general population health.

The Secondary Organic Aerosol (SOA) formed in the atmosphere following the oxidation of certain volatile organic compounds (VOCs) constitutes a large proportion of the total mass and number density of contemporary organic aerosol (Kalberer *et al.*, *Science*, **303**, 1694–1662, 2004). Currently the formation pathways and chemical composition of SOA are not well characterised: in essence the link between the gas and the aerosol phases is not comprehensively understood. In particular there exists a distinct lack of detailed knowledge regarding the composition and evolution of the organic gas phase matrix during SOA formation and how the species involved may contribute towards aerosol formation and growth.

In order to explore the “missing link” between the gas and aerosol phases, the University of Leicester Chemical Ionisation Reaction Time-of-Flight Mass Spectrometer (CIR-TOF-MS) was employed to monitor gas phase organics during a series of

SOA formation experiments at the Paul Scherrer Institute Aerosol Chamber. Utilizing H_3O^+ ions to initiate proton transfer to the analyte species, the CIR-TOF-MS was able to successfully monitor in "*real-time*" (*ca*. 1 minute) the majority of the contributing VOCs down to sub-ppbV levels. Standard NO_x, ozone and aerosol measuring instrumentation and a Peroxy Radical Chemical Amplifier (PERCA) were deployed to support VOC measurements. The study comprised ten comprehensive experiments involving the photooxidation and ozonolysis of isoprene and α-pinene, two species that have recently been identified to possess a significant role in the formation of biogenic SOA. As part of the study the effect of altering the starting VOC/NO_x ratio was investigated under both high and low NO_x scenarios.

The work presented focuses on the comprehensive VOC and peroxy radical data, recorded by the CIR-TOF-MS and PERCA, along with insightful modelling results obtained using the Master Chemical Mechanism (V3.1). The findings demonstrate the potential role for certain key atmospheric oxidation products of biogenic origin in the formation of SOA.