Geophysical Research Abstracts
Vol. 12, EGU2010-822-1, 2010
EGU General Assembly 2010

Ozonolysis of a series of biogenic organic volatile compounds and secondary organic aerosol formation

François BERNARD (1), Alain QUILGARS (1), Mathieu CAZAUNAU (1), Benoît GROSSELIN (1), Véronique DAELE (1), Abdelwahid MELLOUKI (1), Richard WINTERHALTER (2), and Geert K. Moortgat (2)

(1) ICARE-CNRS, Loiret, Orléans, France (francois.bernard@cnrs-orleans.fr), (2) Max-Planck-Institute for Chemistry, Atmospheric Chemistry Department, Mainz, Germany

Secondary organic aerosols are formed via nucleation of atmospheric organic vapours on pre-existing particles observed in various rural environments where the organic fraction represents the major part of the observed nano-particle (Kavouras and Stephanou, 2002; Kulmala et al., 2004a). However, nucleation of organic vapors appears to be unlikely thermodynamically in relevant atmospheric conditions (Kulmala et al., 2004b).
In this work, a systematic study has been conducted to investigate the aerosol formation through the ozonolysis of a series of monotepenes using a newly developed aerosol flow reactor and the ICARE indoor simulation chamber.

The nucleation thresholds have been determined for SOA formed through the reaction of ozone with a-Pinene, sabinene, myrcene and limonene in absence of any observable existing particles. The measurements were performed using the flow reactor combined to a particle counter (CPC 3022). Number concentrations of SOA have been measured for different concentration of consumed monoterpenes. The data obtained allow us to estimate the nucleation threshold for a range of 0.2 - 45 ppb of consumed monoterpenes. The nucleation threshold values obtained here ($\leq$ 1 ppb of the consumed monoterpenes) have been found to be lower than the previously reported ones (Berndt et al., 2003; Bonn and Moortgat, 2003; Koch et al., 2000; Lee and Kamens, 2005).
The ICARE simulation chamber has been used to study the mechanism of the reaction of ozone with various acyclic terpenes (myrcene, ocimene, linalool and a-farnesene) and to derive the SOA mass formation yield. The time-concentration profiles of reactants and products in gas-phase were obtained using in-situ Fourier Transform Infrared Spectroscopy. In addition, the number and mass concentrations of SOA have been monitored with a Scanning Mobility Particle Sizer. The chemical composition of the SOA formed has been tentatively characterised using Liquid Chromatography - Mass Spectrometry.

The results obtained will be compared with those from the literature when available and discussed in terms of their atmospheric impact.

Berndt, T., O. Böge and F. Stratmann (2003). Gas-phase ozonolysis of a-pinene: gaseous products and particle formation. Atmospheric Environment, 37: 3933-3945.
Bonn, B. and G.K. Moortgat (2003). Sesquiterpene ozonolysis: Origin of atmospheric new particle formation from biogenic hydrocarbons. Journal of Geophysical Research, 30(11).
Kavouras, I. and E.G. Stephanou (2002). Direct evidence of atmospheric secondary organic aerosol formation in forest atmosphere through heteromolecular nucleation. Environmental Science and Technology, 36: 5083-5091.
Koch, S., R. Winterhalter, E. Uherek, A. Kolloff, P. Neeb and G.K. Moortagt (2000). Formation of new particles in the gas-phase ozonolysis of monoterpenes. Atmospheric Environment, 34: 4031-4042.
Kulmala, M., V.-M. Kerminen, T. Anttila, A. Laaksonen and C.D. O'Dowd (2004b). Organic aerosol formation via sulphate cluster activation. Journal of Geophysical Research, 109(D04205): 1-7.
Kulmala, M., H. Vehkamäki, T. Petäjä, M. Dal Maso, A. Lauri, V.-M. Kerminen, W. Birmili and P.H. McMurry (2004a). Formation and growth rates of ultra-fine atmospheric particles: a review of observations. Journal of Aerosol Science, 35: 143-176.
Lee, S. and R.M. Kamens (2005). Particle nucleation from the reaction of a-pinene and O3. Atmospheric Environment, 39: 6822-6832.