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

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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 monoterpenes 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 α-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 (≤ 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.
