

Experimental determination of the partitioning coefficient of important BVOC oxidation products at the atmospheric simulation chamber SAPHIR

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Atmospheric aerosols from biogenic and anthropogenic sources play a key role in climate change and air quality. Organic aerosol (OA), a major contributor to the submicrometer particulate matter (PM₁) is either directly emitted through e.g., combustion processes (primary OA, POA) or formed through the oxidation of volatile organic compounds (secondary OA, SOA). Since SOA constitute a major fraction of the total OA (Jimenez, 2009) a detailed understanding of SOA formation is of importance. Recent measurements show that semi-volatile organic compounds are stronger enriched in the particulate phase relative to the gas phase as calculations based on equilibrium vapor pressure would suggest (Hohaus, 2015; Zhao, 2013). It is currently unclear whether this is due to uncertainties in the estimates of vapor pressures or to the existence of uptake pathways to particles other than absorption.

A set of chamber experiments were conducted at the atmosphere simulation chamber SAPHIR to investigate the SOA formation from the ozonolysis of β -pinene, limonene and real plant emissions. Real plant emissions were obtained by transferring *Pinus sylvestris* (Scots pine) emissions from the newly constructed plant chamber SAPHIR-PLUS into SAPHIR. The composition of fresh and photochemically aged SOA was investigated in detail using ToF-AMS and compound specific measurements.

A new experimental methodology was used for compound-specific analysis of organic aerosol. The Aerosol Collection Module (ACM) (Hohaus, 2010) utilizes an aerodynamic lens to remove the gas from the particulate phase of an aerosol. The particulate phase is then directed onto a sampling surface that is cooled to sub-zero temperatures. After collection the particles are thermally desorbed and transferred to a detector for further analysis. In this work, a PTR-ToF-MS was coupled to the ACM to detect and quantify important organic compounds in the gas and particulate phase. Partitioning coefficients were derived from eq.1 where C_i^p and C_i^g are mass concentrations of species i per unit volume air in the particulate and gas phase, respectively [$\mu\text{g m}^{-3}$], C_{OA} gives the mass concentration of total absorbing particulate phase per unit volume air [$\mu\text{g m}^{-3}$], and $K_{p,i}$ represents the equilibrium partitioning coefficient [$\text{m}^3 \mu\text{g}^{-1}$].

$$\frac{C_i^p}{C_i^g} = K_{p,i} \cdot C_{OA} \quad (1)$$

Here, we present a comparison of partitioning coefficients determined experimentally by ACM-PTRMS and co-located PTR-based instruments (CHARON, TD-PTR-MS) (Eichler, 2015; Holzinger, 2010) and discuss experimental results in the context of calculated values derived from vapor pressure estimates.

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