

Volatility of aged secondary organic aerosol (SOA) from ozonolysis of monoterpenes.

K. Salo¹, M. Hallquist¹, Å. M. Jonsson^{1,2}, H. Saathoff³, C. Spindler⁴, Th. F. Mentel⁴ and N. Donahue⁵

¹ Atmospheric Science, Department of Chemistry, University of Gothenburg, Sweden.

² IVL, Swedish Environmental Research Institute, P.O. Box 5302, Sweden

³ Institute for Meteorology and Climate Research, Forschungszentrum Karlsruhe, Germany

⁴ Institut für Chemie und Dynamik der Geosphäre, ICG-2, Forschungszentrum Jülich, Germany

⁵ Center for Atmospheric Particle Studies, Carnegie Mellon University, Pittsburgh, USA

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In this work a Volatility Tandem DMA (VTDMA) was used to monitor changes in particle volatility due to dark hydroxyl radical ageing of Secondary Organic Aerosols (SOA). The overriding aim of this study was to investigate later-generation oxidation of 'traditional' SOA formed from ozone + terpene reactions. One important aspect was the determination of the evolution of the volatility of especially the higher-volatility products over a range of temperatures.

The fresh SOA was produced from ozonolysis of α -pinene and limonene both with and without the use of ammonium sulphate seed aerosol. As an OH-radical source the ozonolysis of tetramethylethylene (TME) was used (Lambe *et al.*, 2007). The experiments were done at the AIDA chamber facility at the Institute for Meteorology and Climate Research (Saathoff *et al.* 2003). The AIDA chamber is a 84.5 m³ large aluminium vessel with a surface to volume ratio of 1.22 m⁻¹ and the current experiments were done at four temperatures (253 K, 273 K, 293 K and 313 K).

The VTDMA system used consists mainly of three parts; an initial DMA (differential mobility analyser TSI 3071), a conditioning unit and a SMPS-system. The initial DMA is operated in a recirculating mode, where a monodisperse aerosol fraction is selected. The conditioning unit is made of eight individually stainless steel tubes with 40 cm length and an inner diameter of 6 mm set at independent temperatures. The tubes are mounted in heated aluminium blocks in line with charcoal denuders. This system has been described in detail by Jonsson *et al.* (2007). The SMPS-system (TSI 3096) was used to monitor the change in particle diameter. In addition, a thermodenuder/AMS (Aerodyne TOF-AMS) combination was used for chemical characterisation (cf. Figure 1). Using this system it was possible to follow the general change in SOA chemical composition due to ageing for SOA material of different volatility (all SOA and fraction remaining at 383 K).

The results from these measurements showed clearly that the chemical composition and corresponding volatility changed due to the ageing induced by OH chemistry.

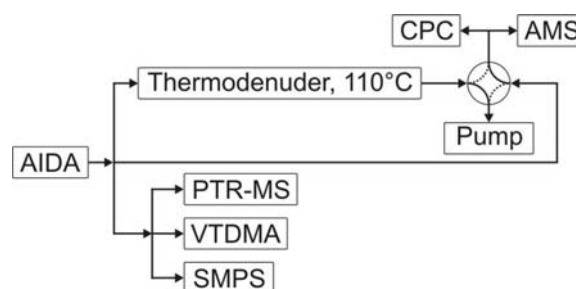


Figure 1. Schematic of the experimental setup showing the most relevant instruments.

As an example Figure 2 shows the volatility changes observed by the VTDMA system, as volume fraction remaining (VFR), before and after generating OH radicals in the aerosol system by oxidising TME.

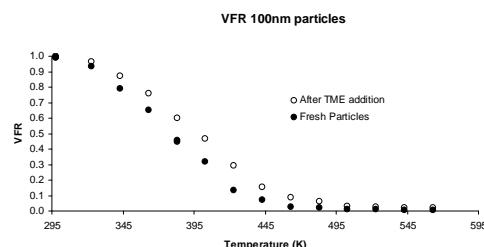


Figure 2. Increase in volume fraction remaining (VFR) after OH-radical ageing.

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