

SOA aging with different OH sources

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Understanding secondary organic aerosols (SOA) - their formation, composition and aging - is a major task in today's atmospheric research: SOA present a major fraction of the total organic aerosol and plays an important role in the global climate system due to their radiative properties and their influence on the hydrological system, e.g. on cloud or fog formation. In addition to their climatic relevance aerosols exert an adverse impact on the human health.

Within the MUCHACHAS (Multiple Chamber Aerosol Chemistry and Aging Studies) experimental series SOA was generated by ozonolysis of α -pinene and then aged further by OH exposure.

The experiments were performed in the environmental chamber at the Paul Scherrer Institute (PSI). The chamber consists of a 27-m³ fluorinated ethylene propylene (FEP) bag suspended in a temperature-controlled enclosure (Paulsen et al., 1995). Four xenon arc lamps (16 kW total) are used to irradiate the chamber. Several instruments monitor the gas phase (VOC, NO/NO_x, O₃, CO) in the chamber. A PTRMS (proton transfer reaction mass spectrometer) monitors the temporal evolution of the gaseous reactant and a variety of products. The particle phase is characterized by the particle number size distribution (SMPS, scanning mobility particle sizer), the total particle number (CPC, condensation particle counter), and the chemical composition (HR-ToF-AMS, high-resolution time-of-flight aerosol mass spectrometer).

In all experiments SOA was initially formed from the ozonolysis of α -pinene. The aging of the SOA and gaseous products from ozonolysis were then investigated under different conditions: (1) high NO_x concentration, (2) low NO_x concentration and (3) exposure to OH radicals in both dark and lighted environment. The OH production was provided by the addition of tetramethyl ethylene (TME) and ozone - as a dark OH source - or by photolysis of HONO.

Preliminary results of the AMS and PTRMS show that - after turning on the lights - the ratio of m/z 44 (commonly associated with carboxylic acid functional groups) with total organics exhibits a linear correlation to the natural logarithm of the ratio between the measured pinonaldehyde

concentration ([PA]) and the maximum pinonaldehyde concentration ([PA₀]), a proxy for OH exposure (Fig. 1).

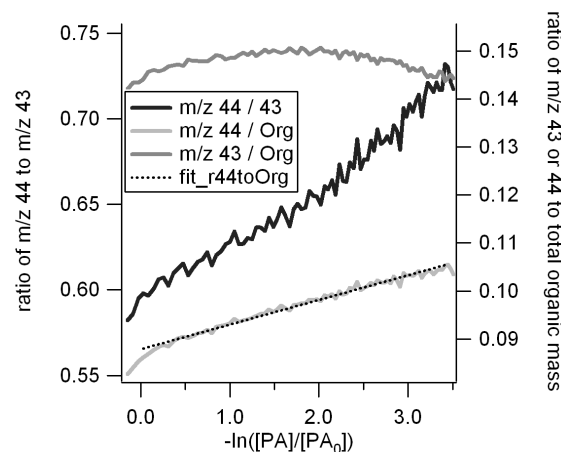


Figure 1. Natural logarithm of the ratio between the measured pinonaldehyde concentration ([PA]) and the maximum pinonaldehyde concentration ([PA₀]) vs different m/z - organic ratios.

Moreover, the total aerosol mass concentration (after correction for wall losses) is increased during aging with the OH radicals. This indicates that the production of less volatile products during the oxidation process is favored over fragmentation in these experiments.

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Paulsen, D., Dommen J., Kalberer M., Prevot, A. S. H., Richter, R., Sax, M., Steinbacher, M., Weingartner, E., & Baltensperger, U. (2005). *Environ. Sci. Technol.*, 39(8), 2668-2678.