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Development and first application of an Aerosol Collection Module (ACM) for quasi online compound specific aerosol measurements

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Atmospheric aerosols influence climate and human health on regional and global scales (IPCC, 2007). In many environments organics are a major fraction of the aerosol influencing its properties. Due to the huge variety of organic compounds present in atmospheric aerosol current measurement techniques are far from providing a full speciation of organic aerosol (Hallquist et al., 2009). The development of new techniques for compound specific measurements with high time resolution is a timely issue in organic aerosol research.

Here we present first laboratory characterisations of an aerosol collection module (ACM) which was developed to allow for the sampling and transfer of atmospheric PM1 aerosol. The system consists of an aerodynamic lens system focussing particles on a beam. This beam is directed to a 3.4 mm in diameter surface which is cooled to -30 °C with liquid nitrogen. After collection the aerosol sample can be evaporated from the surface by heating it to up to 270 °C. The sample is transferred through a 60cm long line with a carrier gas.

In order to test the ACM for linearity and sensitivity we combined it with a GC-MS system. The tests were performed with octadecane aerosol. The octadecane mass as measured with the ACM-GC-MS was compared versus the mass as calculated from SMPS derived total volume. The data correlate well (R2 0.99, slope of linear fit 1.1) indicating 100 % collection efficiency. From 150 °C to 270 °C no effect of desorption temperature on transfer efficiency could be observed. The ACM-GC-MS system was proven to be linear over the mass range 2-100 ng and has a detection limit of $\sim$ 2 ng.

First experiments applying the ACM-GC-MS system were conducted at the Jülich Aerosol Chamber. Secondary organic aerosol (SOA) was formed from ozonolysis of 600 ppbv of b-pinene. The major oxidation product nopinone was detected in the aerosol and could be shown to decrease from 2 % of the total aerosol to 0.5 % of the aerosol over the 48 hours of experiment course.

The SOA was simultaneously characterized by an aerosol mass spectrometer (AMS). The ACM-GC-MS results will be compared with PMF analysis of the AMS organic aerosol. The correlation of specific compounds with PMF factors will be discussed together with future applications of the ACM-GC-MS system for ambient aerosol measurements.

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