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Ideal mixtures of non-ideal subsystems: an approach to mixed inorganic/organic aerosols

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We studied the partitioning of organic aerosol components between the gas and the particulate phase as a function of the relative humidity. As model systems we used NH4HSO4 + glutaric acid aerosol and NH4HSO4 + succinic acid aerosol, important components of the continental, tropospheric aerosol. The experiments were performed in the large Aerosol Chamber at the FZ-Juelich at room temperature.

The particulate phase was characterized on line by SJAC/IC (Steam Jet Aerosol Collector/ Ion Chromatography). Simultaneously we measured the gas phase concentration of the organic component by a rotating wet denuder/TOC (Total Organic Carbon, ECN) and the NH3/NH4+ concentration with an on-line monitor (AMANDA, ECN). Particle size distribution, temperature, and relative humidity were routinely recorded. Aerosol mass spectroscopic measurements possibly allow for direct observation of liquid water.

A mixed component model similar to Clegg et al. (2001) was applied to the data. Therein the organic and the inorganic subsystem are treated by UNIFAC and Pitzer model, respectively. To a large extent the system can be understood as an ideal mixture of these non-ideal subsystems. The Henry coefficient for glutaric acid was determined to 1.9E9 M/atm which is an order of magnitude larger than the value of 2.0E8 M/atm derived by Saxena and Hildemann (1996). As a consequence glutaric acid has a stronger tendency to stick to the particulate phase than previously estimated.

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