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Chemical evolution of multicomponent aerosol particles during evaporation

Alessandro Zardini (1), Ilona Riipinen (2), Joakim Pagels (3), Axel Eriksson (3), Douglas Worsnop (4), Erik Switieckli (5), Markku Kulmala (4), and Merete Bilde (1)

(1) Department of Chemistry, University of Copenhagen, Denmark, (2) Departments of Chemistry and Chemical Engineering, Carnegie Mellon University, Pittsburgh, USA, (3) Division of Ergonomics and Aerosol Technology, Faculty of Engineering, Lund University, Sweden, (4) Department of Physics, University of Helsinki, Finland, (5) Department of Physics, Lund University, Sweden

Atmospheric aerosol particles have an important but not well quantified effect on climate and human health. Despite the efforts made in the last decades, the formation and evolution of aerosol particles in the atmosphere is still not fully understood. The uncertainty is partly due to the complex chemical composition of the particles which comprise inorganic and organic compounds. Many organics (like dicarboxylic acids) can be present both in the gas and in the condensed phase due to their low vapor pressure. Clearly, an understanding of this partition is crucial to address any other issue in atmospheric physics and chemistry. Moreover, many organics are water soluble, and their influence on the properties of aqueous solution droplets is still poorly characterized.
The solid and sub-cooled liquid state vapor pressures of some organic compounds have been previously determined by measuring the evaporation rate of single-compound crystals [1-3] or binary aqueous droplets [4-6].
In this work, we deploy the HTDMA technique (Hygroscopicity Tandem Differential Mobility Analyzer) coupled with a 3.5m laminar flow-tube and an Aerosol Mass Spectrometer (AMS) for determining the chemical evolution during evaporation of ternary droplets made of one dicarboxylic acid (succinic acid, commonly found in atmospheric samples) and one inorganic compound (sodium chloride or ammonium sulfate) in different mixing ratios, in equilibrium with water vapor at a fixed relative humidity. In addition, we investigate the evaporation of multicomponent droplets and crystals made of three organic species (dicarboxylic acids and sugars), of which one or two are semi-volatile.

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