

Water activity measurement of pure and mixed organic/inorganic solutions

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Keywords: Water Activity, Hygroscopicity, CCN Activity.

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Atmospheric aerosols play an important role on Earth's climate, atmospheric chemistry, visibility and human health. Aerosols are complex mixtures of organic and inorganic matters and several studies show that organic and inorganic constituents of the atmospheric aerosol are internally mixed.

The water activity of solutions comprising atmospheric particles is a key parameter to calculate the super-saturation required for particles to activate as cloud condensation nuclei (CCN). It is also needed to determine water uptake properties below 100% relative humidity which impacts visibility, direct radiative forcing, and hydrological cycle in the atmosphere.

Early experimental studies on the water activity of different constituents of the atmospheric aerosol acting as cloud condensation nuclei (CCN) mainly focused on common atmospheric inorganic salts such as ammonium sulfate and sodium chloride. However, organics have been shown to be a significant fraction of the aerosol mass (Kanakidou et al. 2005) in different environments, and the presence of organic species in atmospheric aerosol can affect both the aerosol hygroscopicity and the ability of mixed particles to serve as CCN (Raymond and Pandis, 2002, Kanakidou et al. 2005, Kristensen et al. 2012).

The focus of this study is to measure the water activity of several atmospherically relevant pure and mixed Organic/Inorganic systems in wide concentration range and provide data required to determine hygroscopic growth factor (Gf) and cloud-nucleating behavior of aerosol particles.

Methods

Water activities, a_w , are measured using an AquaLab water activity meter (Model 4TE, Decagon Devices, U.S.A.) covering the temperature range from 289-313K.

Results

Figure 1 shows measured water activity as a function of total concentration of solute for aqueous solutions of pure NaCl, solutions

containing NaCl and the amino acid Glycine and pure Glycine.

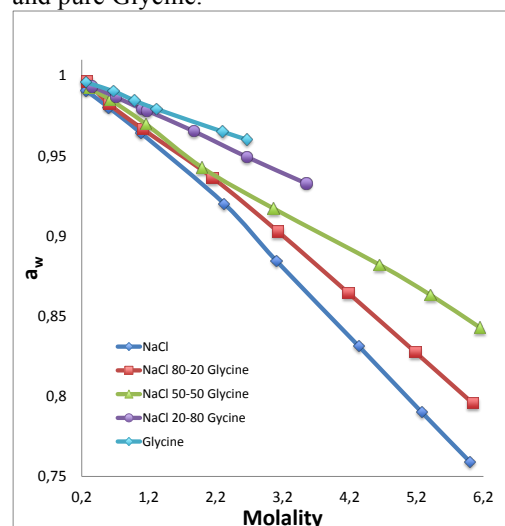


Figure 1: Water activity of pure and mixed NaCl/Glycine solutions (mass ratios are provided in the legends) measured at different concentrations at 298 K.

Measured water activities will be compared with thermodynamic modeling results. Hygroscopic growth factors calculated from the measured water activities will be presented and discussed.

We acknowledge the Carlsberg Foundation and the Nordic Center of Excellence on Cryosphere-atmosphere interactions in a changing Arctic climate (CRAICC).

Reference

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