

Interactive comment on “Thermodynamic properties and cloud droplet activation of a series of oxo-acids” by M. Frosch et al.

Anonymous Referee #3

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This manuscript presents data on density, evaporation rates, and cloud condensation nucleation activity for oxo-dicarboxylic acids and contrasts their properties to those of dicarboxylic acids. As part of the study, the authors provide an in-depth analysis of the various forms and transformations that oxo acids may undergo in aqueous solutions, and how those transformations may affect the results. The main finding of the paper is that the oxo dicarboxylic acids are in general less volatile and more CCN active than the dicarboxylic acids.

The paper is well written and within the scope of Atmospheric Chemistry and Physics. The measurements provide new insights to help modeling the evolution of organic aerosol as it undergoes chemical transformations via oxidation in the atmosphere. I recommend the paper for publication in ACP.

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Comments:

The quoted k value for ammonium sulfate is incorrect ($k = .53$ applies to hygroscopic growth measurements). A value of ~ 0.6 is more appropriate for CCN measurements.

Since the reported data, and the derived k -values, are referenced against the value of ammonium sulfate through the supersaturation calibration in the instrument, I would like the authors to quote their calculated supersaturation from their model. This could be done in form of a table with pairs of dry diameter and calculated supersaturations, or in form of a k -value range. This is important since different groups choose different reference models (with AIM being the recommended model to achieve longitudinal consistency between studies (Rose et al. ACP, 2008)). Reporting the reference values will allow others to properly adjust the data against any reference point chosen.

In several places the authors argue that "all molecules have a high solubility" and thus conclude that limited solubility does not need to be taken into account. Although this is likely correct, I believe that the authors should attempt to make a more quantitative argument. Using the equations in Bilde and Svenningsson, or one of its cousins, the authors should establish or quote a lower limit of solubility where it becomes important. Finally the authors should provide some argument why the oxoacids do not fall inside the sparingly soluble regime, e.g. through dissolving this minimal amount in water in their lab, or using the E-AIM model/Unifac (<http://www.aim.env.uea.ac.uk/aim/model3/model3a.php>) approach to estimate the water activity of the saturated solution for the oxoacids, and from that whether solubility should play a role.

Interactive comment on Atmos. Chem. Phys. Discuss., 10, 3755, 2010.

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