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Atmospheric Chemistry and Physics Discussions

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

Anonymous Referee #2

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The paper presents experimental investigations of thermodynamic properties of different oxo-dicarboxylic acids which are of atmospheric relevance. The investigated properties include cloud condensation (CCN) activity, vapor pressure, density and their tendency to decarboxylate in aqueous solution.

Overall remarks:

The data and results presented in the paper of Frosch et al. are of importance for the atmospheric chemistry and physics community as detailed information on thermodynamic properties of atmospheric relevant organic compounds is generally lacking. Aerosol-cloud interactions are some of the least understood processes in the atmosphere inducing a high uncertainty in the context of climate change. This is partly due to the ambiguous role of organics in cloud formation processes whose clarification can

be addressed in one way by performing well structured experiments related to CCN activation as presented herein. The paper provides some fundamental data on thermodynamic properties of polyfunctional organic compounds which are needed to draw a comprehensive picture of the formation ways and fate of organic particulate matter in the atmosphere.

The paper is nicely written and well structured. The detailed sensitivity analysis of the vapor pressure results for 2-oxoglutaric acid (section 4.2) shows a critical and profound examination of the performed worked and obtained results which can be seen throughout the entire publication. I strongly recommend publication after considering some minor comments as listed below.

As my background in organic chemistry is not profound enough to comment on the chemical reaction mechanisms and properties of different isomeric structures of organic compounds, I will mainly comment on the results concerning the thermodynamic properties and the related experiments.

Special remarks:

1)Section 1: For a publication in ACP the atmospheric relevance of the investigated oxo-acids could be elaborated in more detail, or at least that of the parent carboxylic acids. Are there any numbers given in the literature related to their atmospheric abundance in the particulate and the gas phase phase? What are potential sources of the investigated compounds?

2)Section 4.1: Where does the relatively large range of 1-5 seconds for the calculated evaporation time inside the DMA and/or the tubing comes from? Different tubing length for different experiments or a variability in the flow rates? Please explain.

3)Section 4.1: In the paper is mentioned that it has been suggested that glutaric acid particles might be unstable and that fissioning or restructuring to a smaller size can happen between the DMA and the CCNC (Kumar et al., 2003). When taking the calcu-

lated evaporation times inside the DMA and the tubing into consideration it puts your results in agreement with Köhler theory, and, therefore, it is concluded that glutaric acid activated according to Köhler theory. However, do your findings rule out the above mentioned possibility of a restructuring of the particles being responsible for a smaller size instead of assuming evaporation before entering the CCNC? Please clarify.

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