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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Modelling the cloud condensation nucleus activity of organic acids" *by* Z. Varga et al.

Z. Varga et al.

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Answer to Referee #1

We express our thanks for the Referee's comments and questions, which helped us improve the paper. We have made several changes according to the Referee's comments. Please find the detailed answers to the comments/questions below.

1. The Referee's impression is correct: data on critical supersaturation are presented for particles that are large enough for the droplet solution to be sub-saturated at the maximum in the traditional Köhler curve. In Figure 4 data for succinic acid (ddry≥60 nm) and adipic acid (ddry≥110 nm) are not influenced by solubility. According to the model calculation of Bilde and Svenningsson (2004) there can be an even higher barrier at small droplet size caused by the solubility. However, this

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barrier is relevant in very small droplets of slightly soluble acids (eg. adipic, succinic acid) having an insoluble core, while our experiments were performed with unsaturated solutions in the droplet size range where the nucleus is completely dissolved. Consequently, the barrier in very small droplet size range is not considered here. Osmolality measurement could be used to determine the solubility of organic acids if water activity was constant in super-saturated solutions. However, according to Peng and Chan (2001) water activity further decreases after the saturation point if the mass fraction of the solute is increased. So, we did not determine the solubility of the organic acids, but we inserted a table in which the properties of the investigated acids are listed.

2. We accept the Referee's opinion about the depletion of surface active compounds and aknowledge this issue and the work by Li et. al (1998) and Sorjamaa et. al (2004) in our paper as requested.

3. Thank you for the information on additional literature data on critical supersaturation. We have completed the comparison of our results with other experimentally determined critical supersaturation values.

4. We accept the Referee's suggestion about the change of the title. It has been changed to ĎModelling the cloud condensation nucleus activity of organic acids on the basis of surface tension and osmolality measurements."

5. p. 5344, line 8. We agree that eq. 2 contains some simplifications, that is why we used the original Köhler equation (eq. 1.) for the calculations. This is clarified now in the text on page 5345.

6. p. 5345 We have completed the "Experimental" section and the size of the droplets studied in the osmometry and surface tension measurements are also given.

7. Section 3.1 and 3.2 We agree with the Referee that parameterisations for water activity and surface tension are useful, so we give these equations in table 2a-b and 3a-b.

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8. p. 5347, l. 7. The sentence in question has been modified.

9. p. 5347 The first paragraph of section 3.2 has been moved to the experimental part as suggested. Reference for the electrodynamic balance is also given in the paper.

10. p. 5348, l. 4. The density values with references are given in Table 1.

11. p. 5349 l. 8- and figure 3. We have completed the paper with the comparison of osmolality-derived van't Hoff factors and those calculated from dissociation constants (figure 3).

12. p. 5350. l. 15-17. Of course, CCN ability is always a combination of the Kelvin effect and the Raoult effect. In the sentence in line 15-17 we wanted to refer to the scientific discussion between Facchini et al. and Rood and Williams about possible effect of organic aerosol constituents on critical supersaturation. The above sentence has been complemented to make it clear and references are also given.

Figures We have corrected the figures and legends as requested.

Table 2. We have completed Table 2 (Table 3a-b in the new version of the paper) with the origin of the data. However, we do not feel authentic to compare the reliability of electrodynamic balance, HTDMA and direct vapour pressure measurements since we have no experience with this techniques.

Interactive comment on Atmos. Chem. Phys. Discuss., 7, 5341, 2007.

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