

Interactive comment on “A novel tandem differential mobility analyzer with organic vapor treatment of aerosol particles” by “J. Joutsensaari et al.”

Anonymous Referee #1

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General comments

The paper describes an innovation in the TDMA technology, and the reported experimental results for the growth of different types of laboratory generated model aerosol particles in ethanol vapor appear to be of good quality. The scientific impact, however, might be limited, since the modification from an HTDMA to an organic TDMA is only a rather small step in measurement technology, and the atmospheric applicability and relevance of the new technique remain to be proven. Before being considered for publication in ACP, the paper should be discussed and revised in view of the following specific comments and suggestions.

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Specific comments

1. Ethanol is a widespread organic solvent but its properties are still relatively similar to water. Less polar solvents like hexane or methylene chloride would be preferable to achieve a clear distinction.

2. According to the experimental section of the paper, the generated model aerosol particles were not dried completely before entering the TDMA setup. Therefore the discussion about the growth factors and the solvation state (p.12) may be misleading. For better controlled conditions a diffusion dryer should be used directly after the atomizer.

3. In the theory section the authors generally use the term "droplet" for the grown particle. It has to be taken into account that grown particles are not necessarily solution droplets. Atmospheric particles frequently consist of insoluble materials like mineral dust or elemental carbon with no or minor amounts of soluble substances.

4. Information about the solubility of citric acid can easily be found in the literature: it is known to be freely soluble in ethanol.

5. The characterisation of atmospheric aerosols by the combination of an HTDMA and an OTDMA is not straight forward, and it remains to be seen if measurement results for externally and internally mixed aerosols are clearly interpretable. To address this question, experiments with mixed aerosols consisting of inorganic salts and organic compounds should have been included in this study. In any case atmospheric aerosol composition and particle growth are highly complex and interrelated, and chemical analysis will still remain the only way to achieve thorough characterisation of air particulate matter.

6. The general categorisation of aerosol particle components with respect to "organic solvent vapors" (Table 1) cannot be sustained in its present wording. In view of the wide variety and range of polarities of organic solvents, the statement should be explicitly restricted to organic solvents with low-medium polarity, since it will not hold for high polarity solvents like methanol, DMSO, etc.

7. Error bars indicating the measurement uncertainties have to be added to the

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data points in Figures 2 and 3.

Technical corrections

p.4, l.4: ...operation of a TDMA ...

p.4, l.11: ...ethanol and water vapor...

p.5, l.15: 2.1 Setup of the organic TDMA

p.7, l.2: ...flow rate to the ethanol...

p.7, l.18: ...surface inside (a or the) sampling tubing.

p.10, l.6: ...due to the droplet curvature.; ...denotes the surface...

p.10, l.7: ...volume of the solvent...; ...T is the temperature...

p.10, l.8: ...r is the droplet radius.; ... if the diameter of the dry particle

p.10, l.15: ...of the particle (not necessarily a droplet)

p.15, l.11: ...method can help to determine...

p.15, l.13: ...HTDMA...

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