

Interactive comment on “Hygroscopic behavior of atmospheric aerosols containing nitrates and water-soluble organic acids” by Bo Jing et al.

Anonymous Referee #1

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The present manuscript focussed on the hygroscopic behaviors of some of the nitrate aerosols and their mixtures with water-soluble organic acids at different fractions using a hygroscopic tandem DMA. The authors explained the hygroscopic behaviors of all investigated salts and mixtures by comparing with ZSR model and some previous studies. They explained the difference between the measured and predicted growth factors in terms of initial phase state and mass transfer limitation. The authors have published several papers on hygroscopic behaviors of various compounds and their mixing with water-soluble organic acids, hence; methodology and data analysis are trustworthy and sound. However, there are many speculations and biased statements in the manuscript. The authors have drawn conclusions without providing evidence. It is hard to believe for the same reasons (dissolution and mass transfer limitation) to the

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variation in growth factors of all investigated substances of this study. Except for these two reasons, could not find any novelty in this study. Unfortunately, the manuscript in its present form does not meet the standards of the journal, thus, unable to recommend for the publication in the community of ACP.

Major comments The authors explained hygroscopic behaviors of all substances based on suspected phase state and mass transfer limitations without providing any evidence. They just assumed dissolution of organic acids if the growth factor of nitrate salts-organic mixtures higher than the predicted ZSR value. In contrast, lower growth factors of nitrate –organic mixtures are interpreted with mass transfer limitations. These are the only possible explanations for all investigated mixtures in this study. I suggest the authors should provide more reliable information in order to assert their conclusions that how the coating of organics changes the phase state of nitrate aerosols? Are there any additional measurements to show the phase state of each system? TEM analysis?

Insufficient residence time and mass transfer limitation– why only for $\text{NH}_4\text{NO}_3/\text{PA}$ and other calcium nitrate mixed aerosols and why not for others? Authors should discuss more about this issue. The authors should show more evidence for their conclusion drawn as insufficient residence time for above mentioned mixed particles.

Although the authors had stated in the abstract that they investigated mixtures with varying organic fractions, but showed only one fraction (1:1) for all the mixed systems in the manuscript. How dissolution happened for $\text{NH}_4\text{NO}_3/\text{OA}$ and $\text{NH}_4\text{NO}_3/\text{SA}$ mixed particles. The authors should discuss more about this function because this is the only reason for observed higher growth factors of those particles compared to predicted. What is the exact cause of dissolution? Why OA did not show dissolution in this study. How much it is correct to use the growth factor of OA from the study of Mikhailov et al. (2009) in ZSR model of present study.

The authors should report all the measured and predicted growth factors in a Table

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in addition to literature values so that the readers can easily follow the text in the manuscript.

Specific comments P6L9: The authors should replace nitrates with nitrate salts here as well as in the whole manuscript. P6L21: The authors should report the measured and predicted hygroscopic growth factor of $\text{Ca}(\text{NO}_3)_2$ particles here. P6L22: Here, the assumption of phase state (for example, amorphous) just because of existing water-uptake at lower RH is sometimes revolting although it is the main conclusion of their study. I think the author should show some more evidence for phase state rather based on previous studies and water uptake at lower RH. Contamination also plays a role on water uptake at lower RH. P7L10-24: Should move these lines (about discussion of ZSR and AIOMFAC models) to section 2. P7L5-6: Malonic acid and phthalic acid exhibited continuous-water uptake in whole RH range as the authors stated. This means the initial phase state of these acids is amorphous? P9L18-19: Report the growth factor value of sodium malonate here and also cite a reference about the formation of sodium acetate in ambient aerosols. P10L15-19: This statement is biased and no reasonable evidence for observed particle shrinkage. Do you have any electronic images like TEM etc.; it is hard to believe that the existence of gel-like structures in this study without showing any electronic images.

The authors must and should provide more shreds of evidence for their conclusions.

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