

Atmos. Chem. Phys. Discuss., referee comment RC1
<https://doi.org/10.5194/acp-2021-30-RC1>, 2021
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Comment on acp-2021-30

Anonymous Referee #1

Referee comment on "Interactions of organosulfates with water vapor under sub- and supersaturated conditions" by Chao Peng et al., Atmos. Chem. Phys. Discuss.,
<https://doi.org/10.5194/acp-2021-30-RC1>, 2021

This work measures the hygroscopic properties and cloud condensation nucleation (CCN) activities of model organosulfate aerosols and allow us to better understand the environmental fates and impacts of these compounds. This work fits the scope of Atmospheric Chemistry and Physics. I have the following comments and suggestions for the authors' consideration.

Comments

Line 72, "As OS are ubiquitous and abundant in the troposphere, it is important to understand their hygroscopic properties and CCN activities in order to assess their environmental and climatic effects." As mentioned by the authors, the atmospheric abundance of organosulfates investigated in this work is in order of ng/m³. Can the authors further elaborate or comment the atmospheric significances of these investigated organosulfates? For instance, how the presence of these organosulfates would affect the physiochemical properties of atmospheric aerosols such as surface tension, hygroscopicity and CCN studied in this work?

Line 127, "As shown in Figure 2, the mass of OS samples at different RH was determined by the VSA using the following method." In figure 2, only the results of sodium methyl sulfate were shown. What would be the VSA results for other species?

Line 197, "the increase in sample mass at 50% and 60% RH may be because ethyl-OS were partially deliquesced at this stage." What causes the ethyl-OS partially deliquesce? Why other OSs do not deliquesce partially?

Line 276, "Figure 4 shows that obvious deliquescence transitions were observed for methyl-, ethyl-, and octyl-OS in the VSA experiments; in contrast, as revealed by Figure 5, continuous hygroscopic growth without obvious phase transitions was observed for methyl-, ethyl- and octyl-OS aerosol particles in H-TDMA measurements, suggesting that these aerosol particles may exist in amorphous state." Can the authors discuss why methyl OS, ethyl-OS and octyl OS exhibited different deliquescence behaviours in H-TDMA and VSA measurements?

Figure 6, at the same RH the GFs of methyl-, ethyl- and octyl-OS derived from VSA measurements were found to be consistently smaller than those measured using H-TDMA. Can the authors elaborate this observation?

Line 351, "Such underestimation at 70% and 75% RH is likely to be due to that inorganic compounds (AS, in our work) may dissolve partially in the organics/water solution (which can be formed at much lower RH due to continuous water uptake of organics) before the mixed particle is completely deliquesced (Svenningsson et al., 2006; Zardini et al., 2008; Wu et al., 2011);" Can the authors comment if the amount of AS partially dissolved could be estimated based on their assumption and the hygroscopic data?

Line 392, "No significant difference was observed between kgf and kccn for five types of aerosol particles, and the relative differences between kccn and kgf values do not exceed 25%. However, octyl-OS appears to be an exception, and the average kccn value (0.206) was ~ 1.4 times larger than the average kgf value (0.086)." Given the differences between kgf and kccn were larger than the error bars (Figure 8), can the authors discuss why they would like to claim there is no significant difference between kgf and kccn.

Line 403, "Petters and Kreidenweis. (2008) demonstrated that cloud droplet activation was highly sensitive to the solubility for sparingly soluble compounds in the range of 5×10^{-4} - 2×10^{-1} , expressed as volume of solute per unit volume of water (Petters and Kreidenweis, 2008). Compared to the highly soluble methyl- and ethyl-OS, the solubility of octyl-OS (8.43×10^{-4} - 4.26×10^{-2}) (Chemistry Dashboard, 2021) is rather limited." What are the estimated water solubility for methyl- OS and ethyl-OS? Are they highly soluble or sparingly soluble?

Line 408, "incomplete dissolution at subsaturated condition in H-TDMA measurements may lead to underestimation of kgf values for octyl-OS; as a result, the solubility limit may explain the observed difference between kgf and kccn for octyl-OS." As mentioned by the authors, shall the authors estimate the kgf values for octyl-OS with solubility limit and surface tension correction?