Atmospheric Chemistry and Physics Discussions

Atmos. Chem. Phys. Discuss., referee comment RC2
https://doi.org/10.5194/acp-2022-339-RC2, 2022

Comment on acp-2022-339

Anonymous Referee #3

Referee comment on "A single-parameter hygroscopicity model for functionalized insoluble aerosol surfaces" by Chun-Ning Mao et al., Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2022-339-RC2, 2022

The manuscript by Mao et al. quantified CCN activity of plain and surface-treated polystyrene latex (PSL) particles. The data were interpreted using the Köhler theory by considering a few different types of water-particle interactions. The authors claim that the result of the present study can be useful for interpreting CCN activation of atmospheric insoluble particles. The manuscript is well organized. It is easy to follow the story. However, I have some concerns about the data quality.

Major comments

Commercially available solutions for PSL particles typically contain surfactants for avoiding coagulation (Kidd et al., 2014). The manuscript provides no descriptions about potential influences of surfactants on the data. The reviewer checked the website of the manufacturer of PSL particles for the present study to search for the corresponding information. It seems that the manufacturer adds some additional chemical species to stabilize the PSL solutions (if I understand it correctly). As the manuscript only provides CCN spectra in the supplement as results, it is difficult to judge the potential artifacts on the data. The reviewer is not sure how it influences the conclusion of the study. As the manuscript focuses on CCN activity of PSL particles, quantitative information on this point would be needed for evaluating the data quality. At the current moment, the reviewer is unable to judge the technical validity of the study due to the lack of this information.

Size selection of PSL particles by the DMA should be conducted more carefully. Most of (e.g., NaCl, (NH4)2SO4) atomizer-generated particles have number size-distributions that are significantly broader than the DMA transfer function. In these cases, the setting diameter for the DMA and the mode diameter of the selected particles agree. However, standard PSL particles typically have narrow size distributions. The widths of the distributions are comparable to that of DMA transfer functions in many cases. So, it would be ideal to measure the size distributions of PSL particles using the DMA for matching the mode diameters for PSL and DMA transfer function. The manuscript describes that the authors measured the PSL particles using the DMA and CPC. However, it is not clear how the DMA diameter was finally set.

As shown in the abstract, the authors concluded that the plain PSL particles are less hygroscopic than functionalized PSL particles. Figure S1 shows the experimental data for the study. I agree with the statement for 100 nm particles. However, the data for 200 nm particles exhibit an opposite trend. A clear explanation would be needed.

Minor comments

L114 Silicone dryers

Silicagel dryers?

L207

I agree that the data suggest the PSL particles for the present study look like hygroscopic based on the data. Does it agree with identified bulk property of PSL?

References

Kidd, C.; Perraud, V.; Finlayson-Pitts, B. J., Surfactant-free latex spheres for size calibration of mobility particle sizers in atmospheric aerosol applications, *Atmos. Environ.* **2014,** *82*, 56-59.