Atmospheric Chemistry and Physics Discussions

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Comment on acp-2022-339

Anonymous Referee #1

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-RC1, 2022

General comments:
Authors proposed a new single parameter hygroscopicity representation for insoluble aerosol surfaces, and have done comparisons with traditional TK or FHK models. The proposed model might be extended to atmospherically relevant insoluble particles and findings of this search reveal that water-insoluble aerosol can adsorb water if their surfaces have been oxidized or functionalized with polar groups, thus of importance to atmospheric aerosol research. I only have some minor and specific comments.
1. The logic of the introduction is not clear, and hard to follow. For example, a lot of discussions about the FHK model in the results part, but very few descriptions in the introduction. In my opinion, both the FHK and TK should be introduced before the discussions of FHH-AT.
2. The TK model directly gives the relationship between aerosol growth factor and relative humidity (saturation ratio), suggest authors also present an direct formula that links RH, Dd(dry diameter) , Dw (wet diameter) and the single hygroscopicity parameter.

Specific Comments:
L37-38, "for water-soluble particles……, TK can accurately predict their water uptake behavior", I am not sure whether use "accurately predict" is correct. Even the aerosol particle is water soluble, the performance of TK still depends highly on the solubility 1.
L40 "partially water soluble corresponding to very small solubility" or has other physical understanding?
L44, BET does not appear again in the following, is the abbreviation necessary?
L95-96, should use TK and FHK?
L119 flowrate of L/min is better
L159 the van't Hoff factor is missing
L227 change "and" to ";" before AFHH?
L258 "derived is", delete "derived"

1. Chen, J.; Lee, W.-C.; Itoh, M.; Kuwata, M., A Significant Portion of Water-Soluble Organic Matter in Fresh Biomass Burning Particles Does Not Contribute to Hygroscopic Growth: An Application of Polarity Segregation by 1-Octanol–Water Partitioning Method. Environmental science & technology 2019, 53, (17), 10034-10042.