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Atmospheric Chemistry and Physics Discussions

Interactive comment on "A single parameter representation of hygroscopic growth and cloud condensation nucleus activity" *by* M. D. Petters and S. M. Kreidenweis

Anonymous Referee #2

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The paper describe a way to estimate CCN activation using a single parameter (kappa) to express water activity. The paper is in general confusingly written. The key issue in this paper is not a new form of Köhler theory (kappa-köhler theory), but a new way of expressing water activity. Kappa seems to be a non-Raoult formulation of a volume-concentration activity coefficient. This in itself is a very interesting approach, simplifying calculations done on particles consisting of complex mixtures. This focus on activity coefficients should be clearer in the paper in general as well as in the abstract.

Specific comments:

Ţ It would be informative to show how kappa relates to traditional Köhler theory; how

is this method of describing water activity related to other ways to describe it?

Ţ Why is the upper value of kappa equal to 2?

Ţ In Equation 1 the density is written as the density of water, is this not an assumption? Should this not be the density of the solution?

Ţ Equation 6 seems to have a “switch” behavior when kappa is around 1, is this true?

Ţ Why is it claimed that kappa is between 0.01 and 2 when tables 1+2 do not show any values above 1.4 (even for NaCl which has the highest value of 1.33 derived from growth factor measurements)

Ţ The point 1:2:2 leviglucosan:succinic;fulvis in figure 3 does not correspond to the value given for kappa in table 3 (0.123,0.163). Which one is correct?

Ţ In the summary and conclusions section it is stated that “This approach appears adequate for predicting CCN activity of mixed particles having appreciable amounts of strongly surface active materials, but the generality of this assumption requires further verification.” What is meant by adequate? For which purpose and by what means is this determined?

Ţ The first sentence in the final paragraph “Although the focus of this paper is on characterizing the CCN activity of atmospheric particulate matter, it is possible to also derive values of kappa from other types of data, such as hygroscopic growth factor data obtained from an HTDMA” is off balance. The sentence should be rewritten as it is not apparent that this is the focus of the paper.

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