

This is a very straightforward and easy-to-follow paper measuring the GF of some organic salts using HTDMA, in my opinion, it merits publication in ACP, yet I have a few comments:

Thanks Zilong for your reading and comments.

(1) Can the authors explain more that in what extent, that those organic salts probably present in the particle, instead of organic acids?

Response:

The existence of organic salts instead of their acids in the atmospheric aerosol strongly depends on the atmospheric environments. Several previous observations showed the evidences of the presence of organic salts in the atmospheric aerosols (e.g., Trebs et al., 2005; Smith et al., 2010). In the manuscript, we cited all publications we can find. The further discussions on this point are beyond the scope of this study.

(2) P7696, L5: "The effect of organic compounds on the hygroscopicity of atmospherically relevant inorganic. . . ." Here, some thermodynamic works perhaps are worthy to mention. For example: Clegg et al., J. Phys. Chem. A., 5692-5717 and 5718-5734; Marcolli and Krieger, J. Phys. Chem. A 2006, 110, 1881-1893; Topping et al., Atmos. Chem. Phys., 5, 1223-1242, 2005.

Response:

Thanks. These articles are cited in the MS.

(3) P7695, L15: "Recently, the formation of organic salts such as aminium salts was proposed to be a. . . ." There are two recent papers on aminium salts, Ge et al., Atmos. Environ., 2011, 45, 524-546 and 561-577.

Response:

Thanks! These articles are cited in the MS.

(4) Page 7698, Section 2.3. Can the authors discuss in more details about the measurement uncertainty based on the review by Swietlicki et al., Tellus B-Chem. Phys. Meteorol., 60, 432-469, 2008?

Response:

The measurement uncertainty is strongly instrument-dependent. The HTDMA used in this study is designed and quantified by Andreas Massling. He wrote one paper and published in ACP (Massling et al., 2007). The authors think that it is better to use the measurement error reported by Massling for our system.

(5) Table 1: I think it will be better to add the number of datapoints for each salt (al- though there is a range for RH). Besides, the footnote of table 1 for GF seems to be wrong, should be: GF=A+B1×RH(1)+B2×RH(2) + B3×RH(3) + B4×RH(4)

Response:

It is not necessary to list how many data points in the table because it can be easily found in the figure 1. This equation is deleted from the MS. We used a new equation to fit the curves, see below.

(6)Figure 1: is it possible for the authors provide plots of RH vs molality for these salts? Besides, it will be better if the authors can provide their measured data in the form of tables for each salt for possible use by other researchers in the future (perhaps in the supplement)

Response:

The molality can be estimated by the following equation (Svenningsson et al., 2006):

$$m_s = \frac{n_s}{\text{mass}_{\text{water}}} = \frac{\rho_s \frac{\pi}{6} D_{\text{dry}}^3 / M_s}{\rho_{\text{water}} \frac{\pi}{6} (D_{\text{wet}}^3 - D_{\text{dry}}^3)} = \frac{\rho_s}{M_s \rho_{\text{water}} (GF^3 - 1)} \quad [4]$$

where ρ_s and M_s respectively are the density and molecular weight of the solute. Here, we assume water and solute volumes are additive. This equation is valid only when/after the dry particle fully dissolved in the water. The water activity at which the dry particle completely dissolved is identified when the molality calculated using equation [4] is larger than the solubility of organic salt. From equation [4], we can see that molality is calculated from growth factors. Therefore, to show the relationship between GF and water activity is enough to present the particle hygroscopicity. We did not provide plots of RH vs molality in the MS, but molality was calculated to use to predict the van't Hoff factors in the MS.

The measured data were parameterized using polynomial fitting. The growth factors of organic salts can be easily retrieved using these parameters. The detailed description, see below.

Water activity was calculated from the relative humidity according to:

$$a_w = \frac{RH}{\exp\left(\frac{2\sigma_{s/a} M_w}{RT\rho_w D_l}\right)}$$

Where, a_w , σ , M_w , R , T , ρ_w , D_i are water acitivity, the surface tension, the molecular weight of water, the universal gas constant, the density of water, and the droplet diameter. The droplet diameter is the product of growth factor and dry diameter. As an approximation, the Kelvin effect is calculated for pure water. A equation presenting the relationship between RH and growth factors proposed by Dick et al. (2000) is used to perform the polynomial fitting:

$$GF = \left[1 + \left(a + ba_w + ca_w^2 \right) \frac{a_w}{1 - a_w} \right]^{1/3}$$

Here, water activity is used instead of RH. The fitting parameters are shown in the table.

Salts	a_w	a	b	c
Ammonium sulfate	0.8-0.9	0.23018	0.92875	-0.7282
Sodium acetate	0.4-0.9	0.51418	0.67867	-0.65864
Sodium oxalate	-	-	-	-
Ammonium oxalate	-	-	-	-
Sodium malonate	0.2-0.9	-0.25346	3.20915	-2.5515
Sodium succinate	0.2-0.9	-0.11095	3.25171	-2.92462
Sodium tartrate	0.2-0.9	-0.52175	2.19924	-1.38076
Ammonium tartrate	0.2-0.9	-0.01105	0.3971	-0.236
Sodium pyruvate	0.8-0.9	0.66856	-0.45491	0.28678
Sodium maleate	0.1-0.9	-0.31807	3.41428	-2.69608
Humic acid sodium salt	0.1-0.9	0.10856	0.28154	-0.33565

(7)P7699, L20: similar to the behavior reported by Peng and Chan (2001). Should be Peng and Chan (2001)

Response: Thanks, we have already corrected.

(8)P7699, L25: "The reason is unclear". Not any possible guess?

Response:

The solubility of sodium succinate is strongly temperature dependent (Rozaini and Brimblecombe, 2009). The temperature at which the measurement was performed may cause this discrepancy in DRH determination. In addition, the impurity of solution being measured may be also one possible reason.

Modifications in the MS:

Similar to sodium malonate, no deliquescence point is observed for sodium succinate, as shown in Fig 1. (d). This is different from the observation using an EDB by Peng and Chan (2001), whose result shows the DRH is 63.5-66%. The solubility of sodium succinate is strongly temperature dependent (Rozaini and Brimblecombe, 2009). The difference in the temperature at which the measurement was performed between two studies may cause this discrepancy in DRH determination. In addition, the impurity of solution being measured may be also one possible reason.

Reference:

Dick, W. D., P. Saxena, and McMurry, P. H.: Estimation of water uptake by organic compounds in submicron aerosols measured during the southeastern aerosol and visibility study, *Journal of Geophysical Research*, 105(D1), 1471–1479, 2000.

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Peng, C. G., and Chan, C. K.: The water cycles of water-soluble organic salts of atmospheric importance, *Atmospheric Environment*, 35, 1183-1192, 2001.

Rozaini, M. Z. H., and Brimblecombe, P.: The solubility measurements of sodium dicarboxylate salts; sodium oxalate, malonate, succinate, glutarate, and adipate in water from $t = (279.15 \text{ to } 358.15) \text{ K}$, *Journal of Chemical Thermodynamics*, 41, 980-983, 2009.

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Svenningsson, B., Rissler, J., Swietlicki, E., Mircea, M., Bilde, M., Facchini, M. C., Decesari, S., Fuzzi, S., Zhou, J., Monster, J., and Rosenorn, T.: Hygroscopic growth and critical supersaturations for mixed aerosol particles of inorganic and organic compounds of atmospheric relevance, *Atmospheric Chemistry and Physics*, 6, 1937-1952, 2006.

Trebs, I., Metzger, S., Meixner, F. X., Helas, G. N., Hoffer, A., Rudich, Y., Falkovich, A. H., Moura, M. A. L., da Silva, R. S., Artaxo, P., Slanina, J., and Andreae, M. O.: The $\text{nh}_4^+ \text{--} \text{no}_3^- \text{--} \text{cl}^- \text{--} \text{so}_4^{2-} \text{--} \text{h}_2\text{o}$ aerosol system and its gas phase precursors at a pasture site in the amazon basin: How relevant are mineral cations and soluble organic acids?, *Journal of Geophysical Research-Atmospheres*, 110, 2005.