

Interactive comment on “Investigation of molar volume and surfactant characteristics of water-soluble organic compounds in biomass burning aerosol” by A. Asa-Awuku et al.

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Received and published: 7 November 2007

Specific Comments:

“How far from the burning was the sampling made? How long was the collection and what was the volumetric flow rate collected? What was the total mass collected on the filters and would the authors suggest longer collection for future research studies? Is there any additional data on the collected aerosol such as size distribution or particle concentration?”.

The sampling equipment was placed a few meters from the burning site. A picture is provided in the supplemental section of Lee et al, 2005. Hi-Volume Air Samplers sampled for ~ 3 hours at a flow rate of $1.13 \text{ m}^3 \text{ min}^{-1}$. The total mass collected on

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one filter is unknown however on average the PM_{2.5} mass was 1.81 mg m⁻³ (Lee et al, 2005). We suggest obtaining at least ~ 50 mg of sample for full characterization. No size distribution information is available. For each of the burns OC, EC, inorganic ions, and organic marker concentrations using GC-MS were determined thus ambient particle concentration information can be found in Lee et al, 2005.

The following has been added to the text Page 3593, Line 13: “Sampling and Filter collection methods can be found in Lee et al, 2005”.

“At a minimum, the authors should have performed the full study on a clean filter with no sample, running thru each step and reporting on the contaminant background which can not be removed from the analysis.”

This study did not focus on the analytical techniques employed for filter collection and fractionation but rather the properties relevant for activation for the organics obtained from the fractionation. Further information on potential artifacts from these processes can be found in Lee et al, 2005 (Environ. Sci. and Tech.) and Sullivan and Weber, 2006a (JGR, doi:10.1029/2005JD006485).

Nevertheless, running blank filters through the system did not yield any substantial amounts of surfactant material. This is further supported by the experiments using extracted BB material; upon addition of (NH₄)₂SO₄, the activation behavior of the resulting CCN converged to the calibration experiments using pure (NH₄)₂SO₄.

“It would also be of great use to generate an aerosol with a known mix of 2 hydrophilic/hydrophobic compounds of known composition and pure CCN activity to compare final results and again assess inherent contamination errors in the system.”

Padro et al (2007) did exactly that, using mixtures of known organics with varying degree of hydrophilicity and (NH₄)₂SO₄; the performance of KTA was very good. We are currently testing this with more complex multicomponent mixtures as well.

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“P3597, line 1: What was the RH exiting the two dryers and do the authors know if the particles were dry versus metastable solutions? What errors would this create in the analysis if there were residual water on the aerosols?”

Given the complexity of the aerosol mixture (due to mutual deliquescence), it is unlikely that the aerosol completely dries out. The RH exiting the two driers is $\sim 10\%$ (as direct measurements indicate) hence their water content is rather small. Presence of some liquid water however would have the effect of keeping all the material “in solution”, facilitating the application of KTA. The sentence has changed to read: “The polydisperse droplets are subsequently dried (to $\sim 10\%$ relative humidity) by passing them through two silica gel dryers (Fig. 2).”

Response to Technical Corrections:

P3590, line 14: Changed.

P3590, line 24: Changed to Reflect IPCC 2007, (Forster et al., 2007)

P3593, line 18. Changed to: “WSOC is extracted with 125 ml of pure water from the filter by sonication in a heated water bath ($\sim 60^\circ\text{C}$) for 1.25 hours”

P3594, line 6: Sullivan and Weber, (2006a) term the fraction of WSOC retained by XAD-8 as the hydrophobic fraction. They show that these species include aromatic acids, phenols, organic nitrates, cyclic acids, and carbonyls and monocarboxylic/dicarboxylic acids with greater than 3 or 4 carbons. Because the same methods are used to obtain our fractions, we employ the same terminology.

P3595, line 9: Changed to: “In the original and fractionated samples (since suggested would not make sense for the desalted samples)”

P3596, line 7 and line 14: Removed

P3600, line 2: Removed

P3608, Line 4-5: Changed to: “Using an average organic mass density of 1.4 g cm^{-3} ”

we infer the hydrophobic and hydrophilic fractions to be $780 \pm 231 \text{ g mol}^{-1}$ and $87 \pm 26 \text{ g mol}^{-1}$, respectively. From these average values, we estimate the relative molar ratio of hydrophilics to hydrophobics to be 3:1”.

P3616: Tables have been renumbered

P3621: Table 9 is now referred in text, on P3606, line 11 as the following: “The sensitivity analysis for methods b_1 and b_2 suggests that one of the largest sources of uncertainty for molar volume estimates arises from ω (Tables 6, 7, 8 and 9)”

P3623: The picture has been reformatted and will be resubmitted.

Interactive comment on Atmos. Chem. Phys. Discuss., 7, 3589, 2007.

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