

Interactive comment on “Qualitative and quantitative determination of water in airborne particulate matter” by S. Canepari et al.

Anonymous Referee #2

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The manuscript "Qualitative and quantitative determination of water in airborne particulate matter" by S. Canepari et al. describes the optimization of an analytical technique for direct and quantitative determination of water bound in various materials and demonstrates the applicability to samples of airborne particulate matter. Water plays a crucial role for a great many properties and impacts of atmospheric aerosols. Current methods for determination of aerosol water content are indirect or not sufficiently quantitative for purposes of predictions of aerosol properties. There is consequently a great need for such techniques, and in particular, as argued by the authors, for routine field applications.

The manuscript is generally clearly presented, well written, suitably referenced to position the study well within the interest sphere of ACP readers, and the authors argue

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their case for the viability and practical usefulness and applicability of this technique well.

One major issue should be addressed before publication, however:

The experimental section, in particular section 2.2, appears to be written for the initiated, which I believe is not sufficient when introducing a new technique, or a new application of a well-established technique to a new community. I, for one, am unfamiliar with this technique and was not able to follow the experimental procedure from the account given in the present manuscript. Even if the method is described and documented elsewhere, it should be crystal clear from the present work to where the reader is referred to find this information. I think, as a minimum, a brief summary of the course of the measurements should be given, chronologically. What happens, when? A schematic of the setup would also be most useful. Or at least a clear reference to where this could be found. And the main features and variables of the measurements should be introduced and clearly defined and placed within the context of the experimental procedure, such as the "drift", "extraction", "transfer lines", "needle", "titration cell", "KF reagent", "titration end point", "software". As the section is written now, I am not able to evaluate exactly what it would entail for me to do the described measurements myself, what equipment is needed, what analysis, how to simply perform the measurements. If you wish to address an audience from a wide range of disciplines, the basics should be in place. If there is a supplement to the manuscript, I have not been able to access it.

In addition to the above, I have the following comments and suggestions:

- 1) It would improve clarity if it was made clear as soon as possible in the presentation what is meant by different "contributions" or "qualities" of water. Coming from a different background where "water" is H₂O, period, I was wondering for a while.
- 2) How was the thermal ramp optimized? By means of trial and error? Could the authors elaborate on why the optimized thermal gradient works so well for such very

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different types of materials and samples? What is the underlying common feature of the different types and stages of water desorption?

3) Would it be possible to get size segregated information of water content with the proposed KF analysis? And if so, what would it take? Could the authors relate the detection limits of the optimized KF method to such aerosol size distribution measurements routinely performed in measurement campaigns? What is the applicability of the optimized KF analysis to PM_{2.5}, or to PM_{1.0}? I realize there is a significant reduction in sample mass when focusing on the smaller particle size fractions, but water interactions are extremely important for this size range and I am naturally wondering if the technique can possibly be applied here?

4) The KF method is not at all well known to me, and therefore neither are the interferences described in p. 27377 line 16, so I suggest not using such phrases for multidisciplinary audiences. How would the authors estimate artifacts from evaporating semi-volatile organics when sampling aerosol from different environments, such as boreal forests, which are dominated by a completely different chemical composition than traffic emissions and dust? Would KF be applicable at all in such environments? The authors mention samples comprising an impressive and most interesting list of organics, but I do not see the results. Again, I wonder if there is a supplement I do not see?

5) I think by "ordinates" p. 27373 line 18, you mean axes?

6) It is not clear to me how the last part of the sentence in p. 27374 line 17 relates to the first part.

7) I don't see where the abbreviation "TG" is defined?

8) What exactly is meant by "secondary ammonium salts" p. 27378 line 3, and "ammonia is almost quantitative from NH₄Cl and NH₄NO₃", p. 27378 line 9? I think these phrases may be ambiguous for researchers with different backgrounds.

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9) I wasn't able to follow the calculations described on p. 27378 lines 14-19 for the ammonia release. I think a few inline formulae and/or concrete numbers would help.

10) There is a typo in p. 27381 line 22, "bond" should be bound.

Interactive comment on Atmos. Chem. Phys. Discuss., 12, 27367, 2012.

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