

Interactive comment on “Evaluation of the new capture vaporizer for Aerosol Mass Spectrometers (AMS) through laboratory studies of inorganic species” by Weiwei Hu et al.

Anonymous Referee #2

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This paper compares the efficiency of two vaporizer systems for Aerodyne AMS/ACSM. The first one, called standard vaporizer (SV), is the vaporizer which is currently equipping all Aerodyne AMS/ACSM. The second one is a newly design vaporizer named “capture” vaporizer or CV. The capture vaporizer was designed in order to reduce/eliminate uncertainties related to particle bounce during the vaporization step. The authors focused their work on five inorganic species (ammonium nitrate, ammonium sulfate, ammonium chloride, and sodium nitrate) representative for inorganic species that can be found in ambient non-refractory particles. For each salt, influence of the vaporizer temperature on the fragmentation patterns, individual collection efficiency and particle sizing on both vaporizers were investigated. This provides a clear

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explanation of the processes taking place during the vaporization and ionization steps of the AMS/ACSM and the influence of the vaporizer' type. The text is well supported by a large number of figures. This work is appropriate for AMT. However, the authors may consider the following comments before publication.

Specific comments:

-As mentioned in the introduction of the manuscript, Xu et al. (2016) already described the capture vaporizer (even if this early paper was focused on PM_{2.5} lens). This article also included a comparison with the SV based on similar inorganic species as in the present work (NaNO₃, NH₄NO₃ and (NH₄)₂SO₄) as well as investigated influences of vaporizer temperature, changes on fragmentation pattern including recommended modifications of the fragmentation table and particle sizing (PTOF-mode). In some aspects, the manuscript presents similar results as Xu et al. (2016). Therefore, the authors have to strongly emphasize their motivations, and to clearly justify what is new compared to this earlier work. A more systematic discussion should be made. For example, recommended modifications of the fragmentation table (as presented on Table 2) appears to be different from the ones presented in Xu et al. (2016), which is not discussed at all. Finally, it is unfortunate that the authors did not investigate organics or inorganic-organic mixtures for example.

-Section 3.1: I would suggest to reorganize this section since the authors first state that measurements were made at 500-550°C (and not at standard 600°C) but provide an explanation for this choice only later on (section 3.1.3). Therefore, it would be better to discuss the influence of the vaporizer temperature before the fragmentation patterns at a specific vaporizer temperature.

-Moreover, is there any reason why the authors decided to work at similar temperature? I think it would be more representative to compare the CV at 500-550°C with the SV at 600°C since both temperatures represent the optimal ones of the corresponding vaporizer. In this way, a clear parallel can be drawn between classical AMS/ACSM

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results and upcoming CV measurements.

Minor comments:

-Line 176: Please provide a link or server location where William et al. (2010) can be found.

-Line 188: Are the CU 2014 results really needed? Although the authors provide a clear statement to explain the nature of the bias, the correction factor of 0.6 is not justified.

-Line 294 & Fig. 4b: Do the authors have an explanation for the trend of NO₂/NO ratio when $T_v(\text{SV}) > 550^\circ\text{C}$?

-Line 380: The authors speculate about change on IENO₃ on the edge of the CV compare to center position. Would it be possible to directly determine the IENO₃ at this position?

-Line 407: Should be Fig. 7c

-Line 424: Can the authors precise the vaporizer temperature during these 4 days? Was the temperature of the vaporizer only adjusted before the nitrate calibration?

-Line 456: I am not fully agreeing with the sentence “this is the first time that AMS CE has been reported as a function of T_v ”. It might be true for the SV but not for CV since Fig. 10 from Xu et al. (2016) shows the AMS/CPC mass loading vs. temperature for NH₄NO₃, (NH₄)₂SO₄ and α -pinene SOA (Fig. 10).

-Section 3.2: In Fig. 10, the authors describe the decrease of the AMS signal when closing the particle beam by estimating the lifetime of the signal decay (τ). However, they refer to two different units in the text: decay time and τ . It would be easier to use only one nomenclature.

-Fig. 10 and 11: Units of the x-axis are missing.

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-Line 548: The authors attribute CE <1 of ammonium sulfate in the CV to possible particles bounce on the edge of the CV. Does this mean that the particle beam can be slightly larger than the center of the CV, or a possible artefact?

-Line 608: section 3.3: Could you please also mention on the text the particle diameters used for each salt?

-Line 632: Should be Fig. 12e and g

-Line 641: Should be Fig. 13a3-c3

-Line 682: This is quite speculative. A comparison with SMPS ambient size distribution is needed to support this statement.

-Line 696: Should be Fig. 13b1-b3

Reference

-W. Xu, P. Croteau, L. Williams, M. Canagaratna, T. Onasch, E. Cross, X. Zhang, W. Robinson, D. Worsnop, J. Jayne (2016): Laboratory characterization of an aerosol chemical speciation monitor with PM_{2.5} measurement capability, *Aerosol Science and Technology*, doi:10.1080/02786826.2016.1241859

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