

This is an interesting paper by developing a small volume nebulizer for elemental analysis with aerosol mass spectrometer. The major advantage of this technique is the volume of samples needed for analysis. This manuscript is generally well written, and I recommend it for publication after addressing the following comments.

We thank the reviewer for their helpful comments and suggestions. We have added text to the manuscript to address the questions and comments raised.

1. The future applications of this technique can be expanded, particularly compared with previous AMS offline analysis. In general, the volume of DI-water extracted solutions from filter samples collected with high-volume samplers are not an issue for elemental analysis with AMS. Then why we need such a technique for offline AMS analysis?

The smaller droplet sizes generated in the nebulizer, compared to commercial atomizers minimizes the influence of background material from the solvent. For a single injection of an aqueous solution, the SVN-AMS requires only 400 ng of material and preliminary work on organic solvents shows an even better nebulization efficiency. This small size enables the analysis of trace samples as, for example, samples collected with impactors over short periods of time. Additionally, the SVN-AMS is a platform that enables direct comparison of samples prepared for other offline analyses, including both liquid chromatography and direct electrospray ionization of samples into mass spectrometers, as the concentrations needed for both analyses are similar. Finally, this platform decouples the gas flow rate from the atomization process enabling a concentration of the aerosol packet, if needed.

All of these advantages are mentioned in the manuscript except for the comparison with soft ionization techniques and the decoupling of the gas flow rate with the nebulization process. Text has been added to the end of the introduction and the conclusions:

“The concentration ranges needed (described below) are comparable to the concentrations used for other offline characterizations including soft ionization with electrospray ionization into mass spectrometers. Thus, this technique provides a platform for direct comparison between offline-AMS samples and other analytical techniques.”

“Finally, in contrast to atomizers (where the carrier gas generates the aerosol), ultrasonic nebulizers decouple the aerosol formation from the carrier gas flow rate, enabling potential concentration of the aerosol prior to sampling.”

2. The authors didn't show any high resolution mass spectra of compounds or samples analyzed in this study. For example, North Pacific Ocean sample in Figure 5d. Clear signals of m/z 78 (CH₂SO₂⁺) and 79 (CH₃SO₂⁺) are expected, which were not. Another question is the minimum concentration used for the SVN-AMS analysis. Because “fast MS” mode was used for discrete samples, signal-to-noise ratio could can be an issue for high resolution peak fitting.

The DOM from the North Pacific Ocean is the high molecular weight fraction of the organic material and, as such, has had the lower molecular weight compounds (including any possible methane sulfonic acid) removed. We do not expect signals from methane sulfonic acid derivatives in our samples. The North

Pacific sample is not total DOM, but the polysaccharide fraction (~ 25% total DOM) isolated as described between lines 197 and 204. To further clarify this point, we have explicitly changed the text in the abstract, experimental, and results and discussion to clarify that this is the polysaccharide fraction of DOM. We have also added text to the end of section 3.3 clarifying this:

“Here we demonstrate the analysis of the high molecular weight fraction of the polysaccharide fraction of dissolved organic matter (DOM) with the SVN-AMS. The DOM sample was prepared using a standard protocol for the isolation of this fraction of the organic material (see section 2.3). This preparation removes the lower molecular weight compounds so chemicals such as methane sulfonic acid are not expected to be observed.”

We agree that signal to noise can be a concern for peak fitting. For all analyses at least three replicate injections are carried out. The average mass spectra across these injections is then used for the peak fitting. If the observed signal is low during collection, more replicate injections are carried out to help improve the S/N during analysis.

We have added the following text to the experimental to clarify this:

“For the high resolution peak fitting and the analysis of the mass spectrum and the elemental ratios, the average mass spectrum across all injections is used. For quantification, the total signal under each injection pulse (see below, Figure 2a) is used.”

3. It is not recommended to directly compare the mass spectra between ACSM and AMS. ACSM often presents much higher m/z 44 than AMS [Fröhlich et al., 2015], and O/C estimated with f44 can also have a large uncertainty.

We agree that comparisons between ACSM and the AMS should be carried out very carefully and only present the comparison because no on-line AMS data was available for the Look Rock samples. We have added text to the Results and Discussion section (3.3) highlighting and clarifying this:

“The high degree of overlap in the intensities of the dominant ions between the online (AMS/ACSM) measurements and offline (SVN-AMS) results indicates that the ensemble organic composition for these aerosol samples is generally well-represented by the SVN-AMS measurements (Table 1). However, the estimated elemental ratios from a lower resolution AMS are more uncertain than from the HR-ToF-AMS. Thus, the ratios for these samples in Table 1 are provided only as a demonstration of the overall agreement between the two techniques.”

4. Typos of “FIGERO-CIMS”(line 82) and “Figure 3d” (line 356).

These have been corrected.

Fröhlich, R., et al. (2015), ACTRIS ACSM intercomparison – Part 2: Intercomparison of ME-2 organic source apportionment results from 15 individual, co-located aerosol mass spectrometers, Atmos. Meas. Tech., 8(6), 2555-2576, doi:10.5194/amt-8-2555- 2015.