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Atmospheric
Chemistry
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Discussions

Interactive comment on “Characterization of high-resolution aerosol mass spectra of primary organic aerosol emissions from Chinese cooking and biomass burning” *by* L.-Y. He et al.

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The manuscript by He et al. is a summary of an interesting set of experiments to characterize AMS markers for different cooking and biomass burning organic aerosols. It is simple and generally well written. There are few aspects though that I see the need for the authors to elaborate on before publishing since they each may affect the results and the interpretations afterward. 1. The effect of dilution on the characteristics of the observed markers (for example the relative contribution of one marker vs. the other) is really not talked about. In Section 2.1, it is mentioned that the smoke is diluted by a factor of 10-100 times. Recent work of Robinson et al. shows that partitioning of semivolatiles can be important for OA formation. Since dilution affects vapor pressure of these semivolatiles, it will be important to note how dilution might have affected the results. Were there experiments with the same primary source which were carried out at different dilution rates? What was the effect on the various markers? Reply: Yes, we agree that dilution ratio is important for the partitioning of semi-volatile species between the gas and particle phases. In this study, the total dilution ratios were arbitrarily set at 50 times for biomass burning due to its heavier smoke and 5 times for cooking due to its lighter smoke, without varying the dilution ratios. The final OA concentrations sampled by the AMS for the experiments were less than 100 μg m-3, which is atmospherically relevant (the above information is clarified in section 2.1 in the revised manuscript). In fact, it is very hard to find a best dilution ratio to be performed in the measurements of source emissions, because the dilution ratio of smoke in the real atmosphere depends on so many factors, such as the fuel amount, fire conditions, wind speed, distance from the source, transport time, etc. On the other hand, the semi-volatile species would also re-partition between gas and particle phases with the variation of atmospheric temperature. Deep investigation of semi-volatile behavior of OA with dilution ratio and temperature is beyond the scope of this study. The samples in this study can be regarded as random samples for biomass burning and cooking emissions, and the MS characteristics based on these random samples were also compared with those derived from PMF-factor analysis of AMS ambient datasets and similar AMS source measurements in the literature, such as Alfarra et al. (2007), Mohr et al. (2009), Allen et al. (2010). As discussed in the manuscript, this comparison has extracted common MS signatures of OA from cooking and biomass burning emissions despite different experimental setups in different papers, suggesting dilution ratio was not a key factor influencing our results and validating the MS signatures.

2. What was the total residence time in the system, from the point of burning/cooking to sampling by AMS? Can SOA also be contributing to the observed OA? Were there any gas phase measurements of NOx, PAN, NOy, O3, VOCs etc. that will clue into secondary processes taking place in the set up? It is somehow an incomplete picture

if one discusses only AMS observations without relating them to any gas phase measurements. Reply: The total residence time from the burning/cooking point to sampling by AMS was calculated to be about 45 seconds. This information has been added into section 2.1. We do not think SOA can be formed significantly during such a short period to affect the results for primary emissions. We measured NOx but it seems to help little with explaining SOA formation. The main purpose of this paper is to investigate the MS profiles of primary OA, similar to the paper by Mohr et al. (2009), and the full picture of gas and particle emission characteristics from cooking and biomass burning needs further special studies.

3. What temperature was the vaporizer in the AMS run at? Was the temperature tested with any chemical sampling? The reason for this concern is that in many AMS's , the thermocouple reading of the temperature is not precise or uniform; This may lead in some cases to have the vaporizer running at a very high or low temperature. In either of these cases, the observed fragmentation pattern may be affected and so generalization out of these observations may not be valid. Reply: We agree that the thermocouple is a problem emerging to AMS users. This problem has been referred to by the web link below: http://cires.colorado.edu/jimenez-group/wiki/index.php/FAQ_AMS_Hardware#My_heater_current_looks_correct_.281-1.1_A.29.2C_but_I_don.27t_think_it_is_600C where it says: "As per Leah Williams' presentation at the 2010 AMS users clinic, the AMS heater current should be in the region 1 to 1.1 Amps for a temperature of 600C. However, if you have this current dialed in, but have reason to believe the heater /= 600C (ie it is glowing red hot or you are not vapourising species), the potentiometers which calibrate the LCD readout may need adjusting." During our experiments, the vaporizer temperature displayed on the screen was stably at ∼580 °C, and the corresponding current was reasonably at ∼1.2 amps. As suggested in the web link, we did not have reason to believe our vaporizer was not performing well. In addition, the good consistency between our results and those in the literature also indicated our AMS vaporizer temperature was not a significant problem during our experiments. Thanks for this comment, we realize

that it is better for us to also test the temperature with chemical sampling in future.

Minor comments: It's unfortunate that there are no line numbers or page numbers on the manuscript. That makes commenting point by point difficult. I'm doing my best here to be clear about where I am suggesting these changes for. 1. Page 3, rephrase as "The Aerosol Mass Spectrometer (AMS) manufacture by Aerodyne Inc. (Billerica, USA) can determine chemical composition of submicron aerosol online with high. . ." Same is true in the first sentence of 2.3. Reply: Rephrased accordingly.

2. Page 3, rephrase as "Mohr et al (2009) reported on. . . and pointed out some of the AMS signatures of. . ." Reply: Rephrased accordingly.

3. Page 4, add ". . .and allows for a better factor analysis of MS. . ." Reply: Suggestion taken.

4. page 4, consider replacing and with 'which' in the sentence ". . .and then goes through the dilution tunnel. . ." Reply: This paragraph has been rephrased.

5. page 7, last sentence of 1st paragraph "..there appears to be more fragments in the range of m/z. . ." Reply: Corrected.

6. page 7, in the middle paragraph, rephrase as "A recent AMS measurement of primary cooking emission from heating of seed oil. . . However, . . .emissions from meat charbroiling. . .Our results suggest that signature of OA generated from frying is more dominant than OA. . ." Reply: Rephrased accordingly.

7. page 8, 2nd paragraph: consider "It is seen in Fig 1 that the major MS signatures, such as the most prominent ions and fraction of oxygencontaining ions, of the COA and BBOA match. . ., supporting the. . ." Reply: Rephrased accordingly.

8. page 10, "When considering rice straw incorporation as a good. . ." Reply: This sentence does not exist in the ACPD version anymore.

9. Fig 1 caption- Indicate that pie charts show elemental composition of the OA for each

panel. Also, clarify that PMF-resolved OA factors are from ambient data. Reply: The caption of Fig 1 has been modified as: “The HR-MS profiles and elemental composition (pie charts inserted) of OA from ten types of Chinese cooking and biomass burning emissions and two PMF-resolved OA factors based on ambient datasets. . .”.

10. Fig 4- are the values of different fragments normalized to total?! Axis label as is indicates they’re not, but if they truly are not fractions, then they very much may depend on total OA signal and as absolute number are meaningless for any comparison. Reply: Yes, all the values of fragments were normalized to total. On the Y-axis of Fig 4, 10E-2 was only displayed with the upper number, which has caused misunderstanding. Now, all the values on the Y-axis are showed in the form of normal decimal.

Interactive comment on Atmos. Chem. Phys. Discuss., 10, 21237, 2010.

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