

Atmos. Chem. Phys. Discuss., referee comment RC1  
<https://doi.org/10.5194/acp-2021-216-RC1>, 2021  
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## Comment on acp-2021-216

Anonymous Referee #1

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Referee comment on "Mass spectral characterization of secondary organic aerosol from urban cooking and vehicular sources" by Wenfei Zhu et al., Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2021-216-RC1>, 2021

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Review for Mass spectral characterization of secondary organic aerosol from urban lifestyle sources emissions by Zhu et al.

This paper describes the development of a new way to perform source apportionment looking into SOA formation from traffic related and cooking -like emissions, looking into laboratory experiments and testing the results with ME2 analysis of ambient data.

The topic of this paper is interesting to the community and will help on improving future source apportionment studies. I recommend this paper for publication after the authors address the following comments.

I think the conditions of the two experiments should be mentioned into detail, perhaps with a table in the supplement, to identify similarities/differences. For instance, line 84 mentions cooking emissions were diluted 8 times, was this the same for the vehicle experiments?

Also, I could not find a description of the ambient measurements used to test the mass spec generated in the lab experiments. It would be interesting to know about the ambient measurements season, location and type of the site among other details. At the moment the paper seems to go straight into the analysis of the various  $\theta$  values without giving enough details about the lab experiments and ambient measurements.

My main concern in this work is the fact that HOA changes drastically from POA to OOA in 0.6 days (Fig. S4), while COA does not change largely over the OH exposure experiments, maybe the higher RH in the vehicle experiments influenced the SOA formation. At the moment I find difficult to follow the comparison of cooking and vehicle experiments. Were

the experiments repetitive/reproducible or it was only one test per experiment?

The OA source apportionment community tend to not constrain SOA as the SOA of one site is different to another site or even different to the SOA from one season to another one. There should be some caveats mentioned in the discussion/conclusion. What is the message here? For example, to recommend doing this type of experiments with local cooking in order to obtain the ME2 constrains and then do the OA source apportionment? Or to use the mass spec generated in this study as target profiles in future studies? It is worth mentioning that one of the limitations PMF/ME2 have is the fact that the time series generated from the OA deconvolution are average factors over the analysis period and doesn't involve chemical/physical evolution over time, thus constraining SOA is challenging and the user might be producing mixing factors or manipulating the constrains in a subjective manner. It would be also interesting to see how the Q/Qexp and residuals vary in this study.

Other comments:

Line 44. When the authors mention: POA includes vehicle exhaust, this sounds like HOA is only related to vehicles. However, HOA is attributed to fresh emissions from fossil fuel combustion, manly related, but not only, to vehicle emissions. In ambient studies HOA is referred as hydrocarbon like OA rather than vehicle exhaust OA.

In section 2.1. I think it needs more explanation about the experiments. How much food was being cooked? It was cooking all the time while the experiment in the PAM reactor was going on or the reactor was locked? Were the cooking emissions isolated from the laboratory air? Or it could be potential mixing? About engine experiment, How long the engine was running for? Where the experiments carried out continuously or did you leave the engine to cool down between runs? It was only one test by experiments or how many repeats did you do? Also, maybe the size of the PAM reactor. I guess this info is in one of the references but it would be good to understand the details of the experiments without going to other publications, maybe add more details either in section 2.1 or the supplement.

Figure 1. I'm confused with the colours chosen for the experiments and the family groups, for example the sticks on grey refer to the CxHy family or to the 1500rpm\_16Nm experiment?

Line 203. m/z 41, 55 and 57 are traditional markers of COA. If the authors want to identify mixing of POA and SOA should look into the increments of signals in m/z 28 and 44 for example.

Figure 3. Why for COA there is one primary and one secondary OA and for Vehicle both

are SOA? Why there is no vehicle POA?

I know PMF has been widely applied to deconvolve OA factors/sources and the chosen strategy to select the 'optimal solution has been reported in previous publications. However, there is no mention on this work how the PMF/ME2 analysis was performed.

Figure 5. What does other-POA refer to? And how its diurnal look like? It seems that the evening peak from the diurnal concentrations that is lost from cooking and vehicle ME2 might be in this factor and might have OA concentrations from cooking and vehicles apart from biomass burning and coal combustion.

Line 308, the paragraph says that using parameter assumptions of vehicle exhaust, it is estimated that cooking SOA, accounts for 35% of the SOA in downtown Los Angeles through the model. This paragraph is not that clear and it doesn't fit well as part of the conclusions, please elaborate, move it maybe to discussions or delete it.

Figure 5. The figure on the top left shows two LO-OOA for the PMF analysis, were there two LO-OOA factors?

Line 155, remove one of the references.

Figure 2.a The detail on the caption is extensive. Maybe add the description of Fig. S4 somewhere either in the main text or the supplement.

Paragraph lines 213-215, please rephrase, it is not clear in the way is written.