Atmos. Chem. Phys. Discuss.,
https://doi.org/10.5194/acp-2020-1043-RC1, 2020
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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Characterization of secondary organic aerosol from heated cooking oil emissions: evolution in composition and volatility" *by* Manpreet Takhar et al.

Anonymous Referee #1

Received and published: 9 November 2020

The manuscript presents some interesting measurements of cooking SOA by TD-GC/MS. The authors adopt a new method to achieve molecular speciation of the SOA, where SOA complex mixture was deconvoluted using mass spectral fragmentation patterns to extract useful information about functional groups and carbon numbers. They also derived the parameterizations for aldehyde oxidation and used the derived parameters to predict SOA mass. The model results generally well captured the amount of SOA formed and its chemical characteristics, e.g., O/C. Overall, this paper makes a valuable contribution to current cooking SOA understanding.

Hydroxyl radicals as major oxidants are produced through the ozone photolysis in the

flow tube. However, ozone concentration would be high in the flow tube. What is the influence of ozone oxidation of aldehydes in the experiments?

What are the criteria in selecting the model compounds (Table S2) in each functional group class (e.g., different carbon number range used for different classes)?

Figure 3: The author mentioned there is an increase in the average oxidation state (from -0.6 to -0.24) and a decrease in the average carbon number (from 5.2 to 4.9) with increasing photochemical aging (line 15 and 1ine 188-193 and Fig.3 caption). The decrease in carbon is not so significant, and from the figure, the mole fraction of carbon 7-9 compounds is even higher in the 1.7d photochemical aging condition than those in 10.7h condition. The conclusion of dominant fragmentation should be better elaborated. The SOA concentration actually increased with further oxidation (Table S1).

Figure 5 compares the measured and modeled mass thermograms for canola oil SOA. A mass accommodation coefficient of 0.03 was used in the model prediction. How sensitive is the predicted results to the accommodation coefficient? When using different accommodation coefficients of 1 and 0.03, the differences between MFR are only around 30% (at the same TD temperature). Maybe be better to add some thermograms using middle accommodation coefficient values between 1 and 0.03.

Line 291-294: Other unidentified I/SVOCs may also play a role in the unexplained SOA mass.

Line 314-321: When deriving the parameters for aldehyde oxidation, six tunable parameters were used to fit the measured SOA concentration. Compared with other systems, a lower mfrag was used in this study. The author attributed this to the greater fragmentation in this SOA system. However, the relative strength of these six parameters used to fit SOA concentrations is different for heptanal, 2-heptenal and 2,4- heptadienal oxidation experiments (Fig. S10). For example, mfrag used in heptanal experiment data is one order of magnitude lower than that used for the other two aldehydes. In ad-

dition to mfrag, what are the corresponding processes of the other five parameters? Are those related to gas-particle partitioning, functionalization, reactions with oxidants, or condensed-phase chemistry mentioned earlier (line 308-309)? It would be interesting to discuss the relationship between these parameters and their corresponding chemical or physical processes and how they behave in this system.

In real cooking emissions, POA are also emitted with the aldehydes and other gas-phase precursors. It would be useful if the authors can project how the inclusion of POA in the system would affect their results of O/C, etc.

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