Atmospheric Chemistry and Physics Discussions

Atmos. Chem. Phys. Discuss., referee comment RC2
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Comment on acp-2022-320

Anonymous Referee #2

Referee comment on "Impact of cooking style and oil on semi-volatile and intermediate volatility organic compound emissions from Chinese domestic cooking" by Kai Song et al., Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2022-320-RC2, 2022

General comments:

Cooking emissions are an important source of primary and secondary organic aerosols in the urban environment. However, detailed speciation of non-methane organic gases (NMOGs) emitted from food cooking is lacking. In this study, Song et al. characterized the VOCs and S/IVOCs from cooking typical Chinese dishes using a TD-GC×GC-qMS. They found that the volatility-polarity distributions of gaseous organic species from four dishes were similar. S/IVOCs were predicted to contribute as high as 32% of the estimated SOA formation. The variations of chemical compositions of NMOGs were mainly caused by the cooking oils instead of cooking styles. This paper provides important information to the atmospheric chemistry and air quality community. However, the conclusions are inconsistent with a recent paper published by the same research group (Yu et al., 2022). For example, this study found that aromatics contributed around 59% of the NMOG emissions from kung pao chicken while only a small fraction was reported by Yu et al. 2022. More discussions and clarifications are needed to address the differences between these two studies. Also, the language should be edited and polished. I recommend this paper be published after addressing the following comments.

Specific comments:

The mass concentrations of NMOGs were compared for different dishes. However, the mass concentrations highly depended on the cooking time and sampling time for each dish. Emission rates (mg/min) or emission factors (mg/kg) are more appropriate for comparison of emissions from cooking different dishes.

The chemical composition of NMOGs for cooking the same dish determined using TD-GC×GC-qMS in this study is inconsistent with that determined using VOCUS-PTR-ToF despite that VOCUS cannot measure alkanes (Yu et al., 2022). TD-GC×GC-qMS detected

more aromatics while VOCUS detected more aldehydes. Why is there such a big difference?

The SOA formation potential was estimated by assuming a yield for the potential SOA precursors, which may introduce large uncertainties to the estimation. For example, acetic acid (Table S3) was regarded as an SOA precursor. However, no studies reported that the oxidation of acetic acid can produce SOA. The VOCs used for SOA estimations should have been identified as SOA precursors by previous studies. Also, the SOA estimations are insistent with the measurements by Yu et al. (2022). This study estimated that Kung Pao chicken would produce the highest SOA mass while Yu et al. (2022) measured that Kung Pao chicken formed the lowest SOA mass. The authors should discuss why the estimations are inconsistent with the measurements.

Lines 27-28: The authors stated that "Dishes cooked by stir-frying or deep-frying cooking styles emit much more pollutants than relatively mild cooking methods". However, this is not supported by the measurement. Figure S3 shows that stir-frying cabbage emitted the lowest amount of gaseous species. Which dish was cooked in a mild style? Is it pan-fried tofu?

Lines 116-117: It is helpful to provide the sampling procures of the Tenax tubes. Is there a breakthrough?

Line 183: Figure S3 displays one of the main results. It should go to the main paper. The unit of the y axis is missing.

Lines 217-219: Is there any evidence that these small acids can produce SOA?

Line 235: I would suggest moving Figure S7 to the main paper.

Lines 319-320: I would suggest removing this statement as Yu et al. (2022) already characterized the S/IVOCs from food cooking.

Technical corrections:

Line 66: Please consider changing "clarified" to "investigated" or "studied".

Table S3: Please list the reference for estimating the SOA yield of each compound.

References:

Yu, Y., Guo, S., Wang, H., Shen, R., Zhu, W., Tan, R., Song, K., Zhang, Z., Li, S., Chen, Y., and Hu, M.: Importance of Semivolatile/Intermediate-Volatility Organic Compounds to Secondary Organic Aerosol Formation from Chinese Domestic Cooking Emissions, Environmental Science & Technology Letters, 10.1021/acs.estlett.2c00207, 2022.