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Comment on acp-2022-320

Anonymous Referee #3

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-RC3, 2022

This manuscript investigates the impact of cooking style and oil on the emissions from traditional Chinese cooking. A significant number of chemical species including aromatics, alkanes, oxygenated compounds, and PAHs have been detected. The authors observed that in addition to VOC species, S/IVOCs made up an important fraction of cooking emissions and SOA precursors. In general, dishes cooked by stir-frying and deep-frying styles emit more pollutants than relatively mild cooking styles. A volatility-polarity distribution framework of cooking emissions has been developed. Unlike the emissions that showed great variation, the volatility-polarity distribution of different cooking styles was similar. PLS-DA and MPCA analyses revealed that cooking oil was a critical influencing factor in the 2D distribution. Overall, this is a comprehensive study investigating the relationship among cooking emissions, cooking styles, and cooking materials. The manuscript is well written, and the results are valuable to the literature. I would like to recommend its publication in Atmospheric Chemistry and Physics, subject to minor revisions.

1. Table S1: In regard to oil temperature, how was oil temperature measured and monitored? Was oil temperature controlled and maintained the same during the cooking? There seems to be a positive relationship between oil temperature (Table S1) and emissions (Figure S3). Have the authors tried to cook the dishes at the same oil temperature and compare the emission results?

2. Line 117: What's the dimension of the Tenax TA tube? A flow rate of 0.5 L min-1 was used in this study. Do you have any idea what were the collection efficiencies of chemical species with different volatility under this flow rate condition? How long was the sampling? What about the breakthrough of Tenax TA tubes?

3. Lines 120-131: Chemical analysis using TD may have the following concerns (taking SVOCs as examples):

a) Some of the SVOCs are of relatively low volatility. A TD temperature of 280 â□□ may not be sufficient to thermally released all the SVOCs in a short period of time.

b) SVOCs such as acids may get decomposed during the TD processes.

c) The decomposition of SVOCs may produce small molecules that can be mistakenly identified as VOCs.

Both items a and b lead to underestimations of SVOCs. Item c may result in an overestimation of VOCs. In regard to these concerns, how long was the TD process in this study? Have the authors quantified the desorption efficiency of SVOC standards?

4. Line 126: The authors mentioned that the chromatogram was cut into different volatility bins (B9 to B31 with a decrease in volatility). However, Figure 2 and Table S3 start from "B8_before". Please clarify.

Please add a sentence in the text defining the volatility of each bin (e.g., B8). Please also add a sentence in the text defining the polarity of each bin (e.g., P1). In this way, other studies can compare their results to this study when the volatility-polarity distribution framework is used.

5. Equation 2: SOA yield of VOC can increase with increasing particle loading (Odum et al., ES&T, 1996). Were the values of SOA yields used herein the maximum SOA yields? Please clarify.

Reference: Odum et al., Gas/particle partitioning and secondary organic aerosol yields, ES&T, 1996, 30, 2580-2585.

6. Lines 220-222: The authors mentioned that "an enhancement of ozone formation contribution and a decrease of SOA formation contribution were observed". The sentence is confusing. In regard to "enhancement" and "decrease", what were you comparing? Different types of VOCs, or VOCs vs. S/IVOCs, or VOC emissions from different cooking styles?

7. Lines 236-237: The authors mentioned that "the emission patterns diverged from heated oil fumes as heated sunflower oil and peanut oil emitted more organics". It seems

that this statement conflicts with the results shown in Figure S7 (dishes cooked by sunflower oil had the lowest emission).

8. Lines 265-266: "In contrast, the volatility-polarity distributions of dishes did not vary much when corn oil was used for cooking". Please add a reference to Figure 2.

9. Line 278: SOA production or reduction?

10. Lines 294-295: What do you mean by "physical reactions (evaporation)"? Evaporation of what?

11. Lines 295-296: "MPCA results showed the chromatogram similarities (positive loading) of oils and emissions." Please add a reference to Figure 3d. What is the color bar of Figure 3d?

Technical comments:

1. Line 167: duplicate word "form"

2. Line 174: Change "results" to "result"

3. Line 313: Change "gas-phase" to "gas phase"