Dear Editor,

Thank you very much for handling our manuscript submitted to ***Atmospheric Chemistry and Physics*** (**MS No.:** acp-2022-294; **Title:** Effects of OH radical and SO_2 concentrations on photochemical reactions of mixed anthropogenic organic gases).

We have addressed all your comments and revised our manuscript very carefully. To proceed, we have uploaded three files, including 1) our point-to-point reply; 2) the revised manuscript with changes highlighted in yellow; 3) the revised manuscript without track-changes.

On behalf of all the co-authors, I would like to thank you and referees for all the invaluable comments. Please feel free to contact me if you need any further information.

Sincerely,

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1. *Please, update also the last section with atmospheric implications (see below)*

   The last section with atmospheric implications has been updated according to the suggestion of Reviewer 1. (Page 17, line 381-387)

   "Based on the molecular composition detected in the mixed experiments, we propose a mechanism of high-molecular-weight compounds formation from the reaction of intermediate products originated from different precursors. This indicates that high-molecular-weight compounds (some of them are N- and/or S-containing species) in the ambient environment might be formed from the interactions of different precursors in the presence of NO_x and SO_2. When analysing the source of the detected aerosol species in the atmospheric environment, possible interactions from different VOC types need to be considered. In addition, the interactions between VOCs should be taken into account when evaluating the particle formation potential based on the monitored VOCs and oxidants."

2. *The statement "The data used in this study are available upon request from the corresponding author" needs to be changed. Namely, data should be available in the repositories. Please, check the manuscript preparation guidelines for authors. https://www.atmospheric-chemistry-and-physics.net/policies/data_policy.html.*

   This has been changed. (Page 18, line 395-398)

   "Data availability. All data supporting the conclusions of this paper are available either through the links provided below or upon request from the corresponding authors (lihong@craes.org.cn, gemaofa@iccas.ac.cn).

   https://figshare.com/articles/dataset/_acp-2022-294_Effects_of_OH_radical_and_SO2_concentrations_on_photochemical_reactions_of_mixed-anthropogenic_organic_gases/20437134"

Technical comments/ errors:

3. *Line 36: Still not ok. Correct as: »Laboratory studies of long-chain alkanes, as representatives of IVOCs, are mainly focused on the case of a single long-chain alkanes or mixture of various precursors, which include long….*

   This has been corrected. (Page 2, line 36-38)

4. *Line 42: The sentence needs to be corrected in a way: "For the mixture of various precursors including long-chain alkanes, studies are mainly focused on the chemical composition of the mixture gases, the properties of total organic carbon, the amount of SOA generated, …*

This has been corrected. (Page 2, line 42-44)

5. *Line 86:…than in the ambient environment*

   This has been added in the manuscript. (Page 3, line 85)

6. *Line 90: Correct as:"… as the OH precursor; therefore, NO and HONO experiments were designed, as their pathways for generating OH radicals…."*

   This has been corrected. (Page 3, line 89)

7. *Line 102: "Gaseous NOx, SO_2, and O_3 concentrations inside the chamber were monitored in real time by an SO2 analyzer…« Please change as: »…by NOx (),…SO_2 () and O_3 () analyzers.«*

   This has been corrected. (Page 4, line 101-102)

8. *Line 118/119: The sentence can be deleted; but "sulfate and nitrate" can be added in the parentheses after "in aerosols ()" and "nitric acid" after gases ().*

   The sentence has been deleted, and the corresponding contents have been added to the specified location. (Page 4, line 114-115)

9. *Lines 188-191: Can you write more understandable?*

   The figure caption has been modified. (Page 7, line 185-188)

   "Each data point in this figure represents the average value (average OH concentration for Figure 1a, average OH exposure for Figure 1b) during the two sampling time periods. The point at 11:00 am represents the average value of the data during the period from reaction initiation to 11:00 am."

10. *Line 232: Please correct: »to over predict the O_3 concentration in the after 5.5 h«. (after 0.5 or 5.5h?)*

    This has been corrected in the sentence. (Page 9, line 229)

    "to over predict the O_3 concentration in the after 0.5 h".

11. *Line 233: Correct the sentence: "This phenomenon is similar to a study about 1,3,5-TMB, the experiment of which was performed with an outdoor chamber"*

    This sentence has been corrected. (Page 9, line 229-231)

    "Metzger et al. (2008) also reported the phenomenon that the model overpredicted ozone at a later stage of the 1,3,5-TMB degradation experiment, and the experiment was performed with an outdoor chamber."

12. *Line 313: Correct to "Organic chemical composition"*

    This has been corrected. (Page 13, line 311)

13. *Line 347: ….larger concentration of organo-nitrates…*

    This has been added in the sentence. (Page 15, line 345)

14. *Line 358: Instead of organo-surfates should be organo-sulfates"*

    This has been corrected. (Page 16, line 356)

Please, revise/edit:

15. *Conclusions and atmospheric implications: Please revise/edit the last section with atmospheric implications. According to the suggestion of Reviewer 1, you constructed a mechanism explaining the experimental observations; but try (if possible) to use this mechanism in discussion and explanation of the atmospheric implications of your findings.*

    This has been added in Section 4. (Page 17, line 381-387)

    "Based on the molecular composition detected in the mixed experiments, we propose a mechanism of high-molecular-weight compounds formation from the reaction of intermediate products originated from different precursors. This indicates that high-molecular-weight compounds (some of them are N- and/or S-containing species) in the ambient environment might be formed from the interactions of different precursors in the presence of NO_x and SO_2. When analysing the source of the detected aerosol species in the atmospheric environment, possible interactions from different VOC types need to be considered. In addition, the interactions between VOCs should be taken into account when evaluating the particle formation potential based on the monitored VOCs and oxidants."