Manuscript: egusphere-2023-2461

Reviewer #2

General comment. The study by Jiwon Choi et al. "Dual roles of inorganic aqueous phase on SOA growth from benzene and phenol" is a combination of experimental and modeling data that give an insight on oxidation of gaseous benzene and phenol and the formation of secondary organic aerosol. In this work the authors showed negative relation of SOA growth (of phenol and benzene) to NO_x levels in high NO_x regions by using several databases and models. Furthermore, the simulations in the current work showed the aspect of increasing significance of persistent phenoxy radical with decreasing NO_x levels. Significances of persistent phenoxy radicals that are produced during wildfire plumes and their impact on retarding the atmospheric oxidation in urban areas are highlighted. The manuscript is well written and fits well in the scientific scope of ACP. I recommend the manuscript to be published after some minor revision.

Response to the general comment: We would like to thank the reviewer for the time and the constructive comments on our manuscript. The comments are reproduced below along with the author response. Any change made in the manuscript is in the track change mode and that in the supporting information in the blue color.

Minor revision:

Comment Line 63: I suggest to add an author to the UNIPAR model: https://doi.org/10.5194/acp-14-4013-2014 .

Response: Author of the UNIPAR model was added to the revised manuscript.

Comment Line 77: You might specifiy: "In this study, we hypothesize [based on chamber experiments and complex model data] that the production …".

Response: This has been done.

Comment Line 85: citation style changed or the numbers need to be deleted.

Response: The numbers have been deleted.

Comment Line 152: Do you also mean to include the persistent phenoxy radicals or not? "Both organic-phase oligomerization and aqueous reactions of reactive species in inorganic phase yield non-volatile OM in the model".

Response: Reactive species partitioned into both organic phase and inorganic phase can be oligomerized to form non-volatile organic species increasing SOA. In particular, oligomerization is catalyzed by acid in inorganic aqueous phase. The description of the UNIPAR model does not include PPR formation. The production of PPR is described in

Section 3.2.2 PPR Formation. The formation of PPR influences gas oxidation and the rate of production of oxygenated products. Ultimately, the retardation of gas oxidation can slow down the SOA formation predicted by the UNIPAR model. This reads now in Section 3.1 2),

"…The distribution of products was influenced by H-PPR as a function of the amount of sulfuric acid. H-PPR increases the contribution of fresh product distribution."

Comment Line 183: There is a citation/reference missing for the values in the brackets.

Response: Citations for branching ratio have been added to reference of the revised manuscript.

"Jenkin, M. E., Saunders, S. M., Wagner, V., and Pilling, M. J.: Protocol for the development of the Master Chemical Mechanism, MCM v3 (Part B): tropospheric degradation of aromatic volatile organic compounds, Atmos. Chem. Phys., 3, 181–193, https://doi.org/10.5194/acp-3-181-2003, 2003."

"Bloss, C., Wagner, V., Jenkin, M. E., Volkamer, R., Bloss, W. J., Lee, J. D., Heard, D. E., Wirtz, K., Martin-Reviejo, M., Rea, G., Wenger, J. C., and Pilling, M. J.: Development of a detailed chemical mechanism (MCMv3.1) for the atmospheric oxidation of aromatic hydrocarbons, Atmos. Chem. Phys., 5, 641–664, https://doi.org/10.5194/acp-5-641-2005, 2005."

Comment Line 336/337: There is a citation/reference missing for the values in the brackets.

Response: Citations have been added in reference and reads now,

"Yee, L. D., Kautzman, K. E., Loza, C. L., Schilling, K. A., Coggon, M. M., Chhabra, P. S., Chan, M. N., Chan, A. W. H., Hersey, S. P., Crounse, J. D., Wennberg, P. O., Flagan, R. C., and Seinfeld, J. H.: Secondary organic aerosol formation from biomass burning intermediates: phenol and methoxyphenols, Atmos. Chem. Phys., 13, 8019–8043, https://doi.org/10.5194/acp-13-8019-2013, 2013."

"Kwok, E. S.C., Atkinson, R.: Estimation of hydroxyl radical reaction rate constants for gas-phase organic compounds using a structure-reactivity relationship: An update, Atmos. Environ. 29, Issue 14, 1685-1695, https://doi.org/10.1016/1352-2310(95)00069-B, 1995."

Comment Figure S1: Please check the caption of the second y-axis.

Response: Typo has been corrected.

General comments:

Comment: Missing affiliation indication for authors.

Response: Author affiliation indications were added.

Comment: check the subscripts for chemical compounds in the text, figures and figure capitations; check the consistency of the units in the manuscript and remain with one style.

Response: Subscripts were checked. Unit styles were unified.

Comment on Reference Section: please remove the lines under the DOI link.

Response: This has been done.