Response to Community Comments by Referee #2 on "Chemical evolution of secondary organic aerosol tracers during high PM2.5 episodes at a suburban site in Hong Kong over 4 months of continuous measurement" by Q. Wang et al.

General Community Comments *by Referee #2*:

The current study has been designed to monitor SOA tracers at a suburban site in Hong Kong for four months. Results showed regional characteristics for anthropogenic and biogenic SOA including for biomass burning SOA. This study also highlights the need of high time resolution organic marker measurement at multiple sites to fully capture the spatial variability and implement control measures. I think such kind of field study should be promoted in future to completely understand the role of SOA formation during haze events.

Response to General Comments: We thank the reviewer for the comments and affirming the importance of our work, which provided the molecular-level evidence of the enhanced SOA formation during the episodic hours in different seasons.

Below is our point-by-point response to each comment, marked in blue. Changes to be made to the main text are also marked in blue in the revised manuscript file.

My suggestions are given below:

1. Please add reference "PM pollution was observed to have a clear seasonal pattern, with lower concentrations in summer and higher in fall and winter."

   Response: Suggestion taken, the following reference was added:

   Lines 41-42: "PM pollution was observed to have a clear seasonal pattern, with lower concentrations in summer and higher in fall and winter (Huang et al., 2014)."

   Huang, X. H. H., Bian, Q., Ng, W. M., Louie, P. K. K. and Yu, J. Z.: Characterization of PM2.5 major components and source investigation in suburban Hong Kong: A one year monitoring study, Aerosol Air Qual. Res., 14(1), 237–250, doi:10.4209/aaqr.2013.01.0020, 2014.

Please add reference" In this work, we define that a PM2.5 pollution episode occurred when the PM2.5 concentration was higher than 35 μg/m^3 (24-hour standard)"

   Response: Suggestion taken. The following reference was added:

   Lines 143-145: "In this work, we define that a $PM_{2.5}$ pollution episode occurred when the $PM_{2.5}$ concentration was higher than 35 μg m^{-3} for at least consecutive six hours at three or more stations. This value (35 μg m^{-3}) is the current annual $PM_{2.5}$ air quality objective by the Hong Kong government, which aligns with the WHO's interim target-1 value for annual $PM_{2.5}$ (WHO, 2005)."

   WHO: World Health Organization. Regional Office for Europe. (2006). Air quality guidelines: global update 2005: particulate matter, ozone, nitrogen dioxide and sulfur dioxide. World Health Organization, Regional Office for Europe, 2005

2. Line 220: What about levoglucosan and nitrocatechol correlation in different periods? Have authors also checked other meteorological parameters? Sometimes meteorology could affect the existing correlation.

   Response: Yes, we've examined the correlation between 4-nitrocatechol and levoglucosan, and the meteorological factors including temperature, relative humidity and wind speed. They did not affect the moderate correlation feature between the two species (Figure R1).

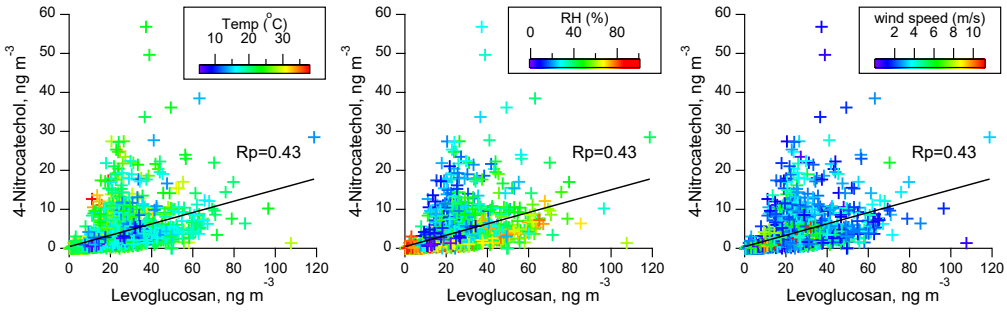

Figure R1. Scatter plots between 4-nitrocatechol and levoglucosan, color coded by temperature, relative humidity (RH) and wind speed.

3. Line 230: "This likely reflects that 4-nitrocatechol has precursor sources other than BB and joint measurements of potential precursors (e.g., catechol, phenol, benzene) in the future would help to discern the relative importance of precursors from BB versus anthropogenic sources." Yes, nitrocatechol has other precursors and author should cite those references here.

Response: Suggestion taken, the following reference was added:

Lines 236-238: "This likely reflects that 4-nitrocatechol has precursor sources other than BB (Lu et al., 2019; Yuan et al., 2021) and joint measurements of potential precursors (e.g., catechol, phenol, benzene) in the future would help to discern the relative importance of precursors from BB versus anthropogenic sources."

Lu, C., Wang, X., Li, R., Gu, R., Zhang, Y., Li, W., Gao, R., Chen, B., Xue, L. and Wang, W.: Emissions of fine particulate nitrated phenols from residential coal combustion in China, Atmos. Environ., 203, 10–17, doi:10.1016/j.atmosenv.2019.01.047, 2019.

Yuan, W., Huang, R. J., Yang, L., Wang, T., Duan, J., Guo, J., Ni, H., Chen, Y., Chen, Q., Li, Y., Dusek, U., O'Dowd, C. and Hoffmann, T.: Measurement report: PM2.5-bound nitrated aromatic compounds in Xi'an, Northwest China - Seasonal variations and contributions to optical properties of brown carbon, Atmos. Chem. Phys., 21(5), 3685–3697, doi:10.5194/acp-21-3685-2021, 2021.

Have author checked nitrocatechol to levoglucosan ratio for different season?

Response: The 4-nitrocatechol to levoglucosan ratio is shown in Figure R2. Generally, higher ratios were observed in fall and winter period. The 4-nitrocatechol/levoglucosan ratio from different sources were not available from the literature, thus it is difficult to compare the observational data to the source profiles.

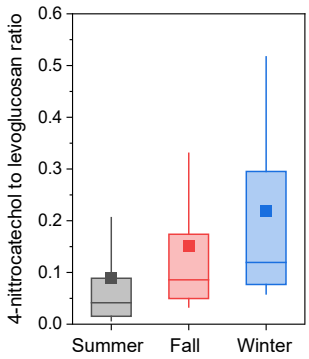

Figure R2. Seasonal variation of the 4-nitrocatechol/levoglucosan ratio in this study.

4. Line 260: Did author suggest the role of ozone in the formation of phthalic acid and DHOPA? I will appreciate if more information can be provided on their formation pathways.

Response: The following will be added to the revised manuscript for clarification and elaboration on the point raised by the reviewer.

Lines 270-273: "Note that we used ozone as an indicator for the oxidant level in the ambient atmosphere, as no measurements of OH radical were available. The formation pathways for phthalic acid and DHOPA are mostly via OH radical oxidation, as reported in previous studies (He et al., 2018; Wang et al., 2007; Zhang et al., 2021)."

He, X., Huang, X. H., Chow, K. S., Wang, Q., Zhang, T., Wu, D., & Yu, J. Z. (2018). Abundance and sources of phthalic acids, benzene-tricarboxylic acids, and phenolic acids in PM2. 5 at urban and suburban sites in Southern China. *ACS Earth and Space Chemistry*, 2(2), 147-158.

Wang, L., Atkinson, R., & Arey, J. (2007). Dicarbonyl products of the OH radical-initiated reactions of naphthalene and the C1-and C2-alkylnaphthalenes. *Environmental Science and Technology*, 41(8), 2803-2810.

Zhang, J., He, X., Gao, Y., Zhu, S., Jing, S., Wang, H., ... & Ying, Q. (2021). Estimation of aromatic secondary organic aerosol using a molecular tracer—a chemical transport model assessment. Environmental Science & Technology, 55(19), 12882-12892.