

Atmos. Chem. Phys. Discuss., referee comment RC2
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Comment on acp-2022-85

Anonymous Referee #2

Referee comment on "Identification of highly oxygenated organic molecules and their role in aerosol formation in the reaction of limonene with nitrate radical" by Yindong Guo et al., Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2022-85-RC2>, 2022

This study provided a detailed analysis of the HOM formation from limonene reacting with NO₃ radical. These HOMs are potentially important in forming new particles and secondary organic aerosol. In addition, this study provides observational evidence on the formation of HOM-trimer from NO₃ oxidation of limonene, to my best knowledge, for the 1st time. However, I have a few comments to be addressed before this manuscript can be published in ACP.

- The concentration issue: The monoterpene concentrations are still much higher than in most regions. This could be why the dimer/monomer ratio is so high, and why can you observe trimer? However, this is far from the real atmosphere, where dimers concentration is usually too low to react with the other oxidant before condensing to particles. As shown in Fig.5 and Fig. 6, some aerosol exists universally in the atmosphere; they can scavenge HOM dimers so effectively that the dimers have no time to react with oxidants again to form a trimer.
- Self-termination of HOM-RO₂: One of this work's major conclusions is that the HOM-RO₂ self-termination is more important than the previously understood. I believe more evidence is needed to support this point. For example, is it possible C₁₀H₁₅NO_x is formed from C₁₀H₁₅NO_x+NO₃? In addition, what's the potential influence of the differences in instrument sensitivity on detecting carbonyl compounds and hydroxyl compounds?

- I would suggest adding more discussions on the potential influence of ozone oxidation of limonene in the system, as well as the potential role of HO forming via ozonolysis of monoterpene. As shown in Table 2, C₂₀H₃₃NO_x and C₂₀H₃₄N₄O_x are likely from OH oxidation. In addition, the abundance of C₂₀H₃₁NO_x (x=10-15) is considerably high may also indicate the role of O₃ chemistry.

- There are so many details in the study, which is good, but makes the manuscript not so easy to follow. I suggest adding some summary statement in each section.

Detailed comments:

- There is growing evidence that monoterpene-OOMs are also important in urban regions. I suggest adding some discussion in the introduction part, i.e., Liu et al., 2021, ACP; Nie et al., 2022, Nat. Geosci.

- Line 162: what's the concentration of isoprene-HOMs in the chamber? Can they influence the subsequent reactions?

- Line 179-180: More discussion on the mass-independent transmission calibration rather

- Line 410: Can C₁₀H₁₄O_x be formed from proposed NO₃ oxidation pathways?

- 7: Add ULVOC in Fig. 7, and explain why dimer cannot trigger NPF?