Atmospheric Chemistry and Physics Discussions

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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 C10H15NOx is formed from C10H15NOx+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, C20H33NOx and 20H34N4Ox are likely from OH oxidation. In addition, the abundance of C20H31NOx (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

than citing a reference.

- How to calculate the wall loss of N2O5 of the chamber?

- Line 209-212: SVOCs can also contribute to SOA formation, especially in the case when SOA monotonic increases.

- Please mark clearly of P1 to P6 in Figure 1. The current version makes the statements in the text a bit hard to follow.

- Line 278-279: why there was only one peak of C10H15NO9?

- Line 296: why the pattern is 16 TH intervals other than 32 TH intervals?

- Line 410: Can C10H14Ox be formed from proposed NO3 oxidation pathways?

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