

Atmos. Chem. Phys. Discuss., referee comment RC2
<https://doi.org/10.5194/acp-2022-127-RC2>, 2022
© Author(s) 2022. This work is distributed under
the Creative Commons Attribution 4.0 License.

Comment on acp-2022-127

Anonymous Referee #2

Referee comment on "Chemical composition of secondary organic aerosol particles formed from mixtures of anthropogenic and biogenic precursors" by Yunqi Shao et al., Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2022-127-RC2>, 2022

General Comments:

This work by Shao et al. is a follow up to the work by McFiggins et al. in Nature 2019 on the impacts of mixed VOC systems on SOA formation. They performed a series of batch mode chamber experiments with single and mixed precursors of biogenic and anthropogenic origin in the presence of NO_x and aerosol seed. Offline analysis of the SOA composition was performed primarily with LC-MS to elucidate which species dominate and dictate the SOA formation in mixtures and identify any cross products. This work is novel and of value to the community, although I find it to be overly verbose and rambling and suggest editing to make it more concise and flow better if possible. This is appropriate for ACP after addressing the other suggestions below.

Specific Comments:

Line 134: I think this is well established and suggest re-wording "might be the reason" to something more definitive

Line 207: What is the residence time in the chamber?

Section 2.4.1: Is it possible for chemical transformations to occur during the 2 hr ambient temperature rest, sonication, or drying? Would this be observable? Can you comment on how this may impact results?

Line 304: Where would the sodium and potassium come from?

Figure 2: Are these common molecular *structures* or molecular *composition*?

Figure 4: Why does essentially all the signal contain nitrogen for cresol and any mixtures with cresol? This is discussed ~line 520 but not the reasoning for why N-containing species are highly dominant.

Line 467: Suggest using HOM definition from Bianchi et al (<https://pubs.acs.org/doi/10.1021/acs.chemrev.8b00395>): highly oxygenated organic molecules

Lines 466-472: This section on HOM is not well fleshed out and doesn't seem to flow with the discussion. Suggest removing or re-writing. Please add a reference for this sentence, or remove: "Autoxidation may therefore contribute to CHO products with carbon numbers 16 – 20 in α -pinene oxidation"

Line 477: Please state how much SOA was formed. It is confusing that this line (and above) states $\sim 0 \mu\text{g}/\text{m}^3$ was formed but the section goes on to discuss the compounds measured in the particle phase

Lines 493-494: This doesn't reflect the current state of knowledge and is an insufficient explanation/discussion. Several recent studies have shown that small particles are detected in SOA as a result of decomposition, typically via thermal processes, during analysis. While this work doesn't utilize heating techniques, it does involve substantial sample prep (see comment on section 2.4.1).

Lines 496-498: I'm confused why the experiment would be designed in a way that is well documented to not make SOA when the stated point of this work is to make SOA and measure the particle phase composition? Please explain the reasoning for this experimental design and how this advances our understanding of multi-component SOA formation.

Line 501: Can you be sure these species are created from isoprene + OH and not impurities in your isoprene source or chamber contamination?

Line 679: Here you mention the possibility of fragmentation of larger species resulting in the smaller species measured in the particle phase. Please include references (e.g. <https://pubs.acs.org/doi/abs/10.1021/acs.est.5b04769>).

Line 765: It isn't clear to me that accretion reactions have occurred during SOA formation rather than alterations during sample prep and analysis. Additionally, if they did occur during the experiment, can you be sure that accretion products would still form under atmospherically relevant precursor and SOA concentrations?

Technical:

Throughout manuscript: NO_x should have a subscript "x" and be NO_x

Throughout manuscript: change instances of "ml" to "mL"

Throughout manuscript: change instances of "ug" to "µg"

Line 222: particles counter → particle counter (plural to singular)