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Discussions

Interactive comment on "Secondary Organic Aerosol Yields from the Oxidation of Benzyl Alcohol" *by* Sophia M. Charan et al.

Anonymous Referee #1

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This manuscript describes SOA formation from benzyl alcohol. Benzyl alcohol is a volatile chemical product (VCP). VCPs are a class of compounds that may be an important, but previously overlooked, source of SOA. The paper is timely because better laboratory data on SOA formation from VCPs is needed in order to constrain VCP SOA formation in chemical transport models.

Overall this paper is a comprehensive look at SOA formation from benzyl alcohol. Most of my comments focus on organization and structure. The paper seemed to jump back and forth between SOA yields (Section 3), SOA composition (Section 4), and SOA yields again (Section 5). I think it would be easier to follow if all of the discussion of yield was consolidated (e.g., switch sections 4 and 5). Additionally, I am not sure how much value is added by Section 6.

Line 88-89. I am not sure what this means "Multiple FT-IR samples were taken until each spectrum gave the same concentration; this was to ensure a minimal effect from any compound deposited on the instrument walls."

Line 103 - The TSI 3010 used t-butanol? I thought it used 1-butanol.

Figure 1a - why is SOA yield not shown for the first ∼10-15 minutes of the experiment?

Section 3.2.1 - were these wall loss experiments conducted as part of this study? Or are the authors recapping the experiments conducted in Charan et al 2018 and 2019?

Section 3.2.1 describes a fit for k_e and the electric field strength E. Some context would be helpful. For example, is E ∼ 2 V/cm "large" compared to the cases where E is effectively zero? Or is the E fit for each individual experiment effectively "small"?

To clarify - for Table 2 the "no correction" yield is the case where Delta_SOA is the suspended OA measured at the experiment end minus the initial OA mass (which is presumably ∼0)? I'm not sure this Table needs to be in the main text.

Figure 3 and 4 need more discussion. Are there systematic changes in OA composition at different T or [NO]? For example, in 3(c) I can see that the O:C ratios vary from experiment to experiment, but right now the reader needs to scrutinize the figure to see if there is any sort of trend between O:C and T.

Section 5 seems out of order. Perhaps put it with or immediately after section 3. Section 3 has a lot of detail on how SOA yield is calculated, and then Section 4 discusses SOA composition. It felt like a big jump and that I, as a reader, didn't have a sense that the SOA yields are high.

Figure 5 and 6 - Please specify what is meant by "reproduction experiments." I assume that these are nominally identical experiments, but it should be clarified.

Can you explain the choice of experiments shown in Figure 7? There are a number of experiments shown in Fig 6 that are not shown in Fig 7.

I am not sure what value Section 6 adds to the paper, especially since the model seems to perform poorly for many experiments. What do we learn from the modeling that cannot be learned directly from the data?

Regarding the mechanism discussion: I think one of the conclusions of section 6 is that SOA is not formed via the benzaldehyde channel. Does this mean that there is rough closure between SOA and gas-phase measurements? E.g., about a quarter of benzyl alcohol goes to benzaldehyde (no SOA formed). The rest forms products that can make SOA, and the SOA yield is in the neighborhood of 75%. Obviously we need to count the oxygen mass added, but to first order this adds up.

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