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Interactive comment on “Secondary organic aerosol yields of 12-carbon alkanes” by C. L. Loza et al.

Anonymous Referee #1

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Loza et al present measurements of SOA yield from the photo-oxidation of four aliphatic hydrocarbons, each containing 12 carbon atoms per molecule (dodecane, cyclododecane, hexyl cyclohexane, and methyl undecane). The paper is the most recent in a series of papers from CalTech investigating SOA formation, organic aerosol dynamics, and gas-phase chemical mechanisms from the oxidation of C12 aliphatic hydrocarbons.

Overall the measurements presented in the paper are appropriate for Atmospheric Chemistry & Physics, and the interpretation of the results is sound. The data are of high quality and contribute to the community’s knowledge of both the studied chemical systems and methods for performing smog chamber experiments. However, there is room for improvement in the manuscript. While I suggest publication after minor

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revision, I hope that the authors will consider the following comments to make the manuscript more readable and hopefully more impactful.

My primary criticism of the manuscript is that some of the key findings are buried in the text, rather than strongly stated and put on display. The primary deliverable of the paper are SOA yields, but along the way the authors raise several interesting observations that can improve future smog chamber experiments. These should be stated more clearly and given focus as outcomes of this work, rather than as links tying this paper to the recent works by Yee et al and Shiraiwa et al on the same chemical system.

For example, the experiments presented in this paper make a strong case for using models such as APE and KM-GAP to interpret chamber data. It should be stated explicitly that future smog chamber studies need to consider such modeling tools, because in many cases, these models are not used. If the authors had relied on “traditional” analysis of the data (i.e., without KM-GAP), the yields obtained with different initial VOC concentrations would be nearly impossible to interpret.

Other comments: -Use consistent jargon for high-NO_x/low-NO_x. The abstract notes that experiments were conducted in conditions where RO₂ react with NO or HO₂ - make it explicit that this is your definition for high-NO_x and low-NO_x, and consider using “NO-dominant” and “HO₂-dominant” in place of high- and low-NO_x.

-Page 20680, Line 27-28 - The light intensities for high- and low-NO_x experiments differ by 50%. How might this affect SOA yields? Especially under low-NO_x conditions there may be the formation of peroxides could therefore photolyze.

-The discussion of dihydrofuran lifetime versus the different oxidants (O₃, OH, NO₃) is confusing. Are you arguing that the experiments have an atmospherically relevant mix of losses for the dihydrofurans? Also, you begin this discussion by claiming that O₃ does not affect SOA yields, which immediately prompts questions about the role of dihydrofurans, and then move into the discussion of relative lifetimes in an indirect fashion.

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-The data averaging in Fig 1 is odd – the points seem to show averages of every hour. Continuous lines might be a better way to present the data.

-Fig 3 is a little inaccessible, primarily because of the experiment labels (e.g., DH1) require referring back to the tables. This is repeated in subsequent figures. Readability would improve if the name of the VOC was printed instead of the experiment code.

-I am not completely clear on what I am supposed to learn from Figures 4 and 5. Figure 2 shows the spread in SOA yield differences between the high and low case, so replotting them here could be viewed as redundant. Is the ordering – e.g., compound A > compound B – dependent on the wall loss correction method?

-Section 3.4 - it seems that uncertainty in vapor wall losses are already considered as part of the upper limit SOA yield, so this section seems superfluous.

-How much can we learn from the C# fragments in the AMS for Figures 8 and 9? The AMS heater and EI impart much of the fragmentation in that instrument, so it's not clear that slight changes in C2 versus C3 fragments are terribly meaningful. There is a fundamental difference between the C# analysis with AMS and with the CIMS, though this is not noted. The CIMS (more-or-less) preserves carbon number, and therefore provides somewhat different information in these plots than the AMS.

Interactive comment on Atmos. Chem. Phys. Discuss., 13, 20677, 2013.

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