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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Temperature Effects on Optical Properties and Chemical Composition of Secondary Organic Aerosol Derived from n-Dodecane" *by* Junling Li et al.

Anonymous Referee #2

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General comments: This work by Li et al. describes measurements of optical properties in relation with chemical composition of n-dodecane SOA under low-NOx and two different temperatures (5ïĆřC and 25ïĆřC). The authors found that under low temperature, the real part of the refractive index (RI) at 375 nm and 532 nm is enhanced, corresponding to substantial oligomer formation. The authors hence conclude that the enhanced oligomer formation under low temperature lead to the higher RI. The results could be relevant to low visibility in urban areas during wintertime. Overall, the manuscript is well written and demonstrates new findings regarding SOA optical properties vs. chemical compositions. But a few major concerns need to be addressed before this manuscript can be considered publishing.

Printer-friendly version

Discussion paper

Specific comments: 1. Line 49 – 52. Although it is true that few studies have examined temperature effects on RI values of SOA, temperature effect studies on SOA formation and composition are not limited. There are many other studies on SOA formation and temperature effects not cited. For example, Warren et al., 2009, 43, 3548, Atmos. Environ.; Emanuelsson et al., 2013, 117, 10346, J. Phys. Chem. A.; Price et al., 2016, 50, 1216, Aerosol. Sci. Technol.; Boyd et al., 2016, 51, 7831, Environ. Sci. Technol.; Zhao et al., 2019, 3, 2549, ACS Earth Space Chem., etc.

2. Line 78. Although details of the chamber can be referred to previous work, important and fundamental characteristics of the chamber still needs to be provided. For example, the material and volume of the chamber.

3. Some important details of the chamber experiments are missing. Why were instruments not connected before temperature was stabilized? SOA mass concentration in each experiment should be reported (in Table 1 or in the main text). How long were filter samples collected and at what flow rate? After the filters were dissolved in filter, were the solutions sonicated? If not, how good were the extraction recoveries?

4. How did the extinction coefficient and extinction efficiency evolve over the course of an experiment?

5. Line 122. It is unclear how was the RI value uncertainty estimated from the various uncertainties. An equation needs to be provided.

6. Line 123 – 124. The description of the RI prediction is not sufficient. A little more background should be provided. It appears molecular formulas are needed as input for the prediction. More details of the input are needed. Also, how the predictions will be used in this study were not mentioned.

7. Line 150. In prior description (Line 122), the authors claimed that the uncertainty for RI values are 0.02 – 0.03. Here, the authors argue that change by 0.02 – 0.03 is a “substantial enhance effect” between the two temperatures, despite this change is

on par with the uncertainty. A better case needs to be demonstrated regarding the enhancement of RI values at low temperature. In particular, this argument is a main result in this work.

8. Section 3.3. and Figure 2. From the chemical composition measured by ESI-TOFMS, the authors claimed that the largely different mass spectra are observed under lower temperature, due to enhanced oligomerization. It is unclear, however, how the changed temperature affected the chemical mechanisms that lead to different products. The discussion of higher oligomer formation under low temperature might be reasonable. But the difference in the monomer range does not make sense. The monomer products should be from the various RO2 chemistry regardless of the temperature. They should follow the same pattern. But in Figure 2, the monomer range in the two mass spectra show very different results. I wonder if the mass spectra shown here are reproducible? Two experiments were carried out for each condition. Do they show consistent mass spectra? Clark et al (2016, 50, 5564, Environ. Sci. Technol.) showed isoprene SOA ESI-TOFMS mass spectra under different temperatures. Similar to this work here, very different results were observed in the oligomer range, but not necessarily for monomers. Better clear discussions are need here, rather than speculations.

9. Section 3.4. It appears to me that the validation of the authors' argument using calculation method is important to extend further. Since it is a short manuscript, I suggest the authors include the results based on the prediction in the main text.

Technical comments: 1. Line 29. Change "heavy" to "heavily".

2. Line 62 – 68. When referring to prior temperature effect studies, it would be helpful to mention at what temperatures were those results observed.

3. In Figure 4, the y-axis between a and c, as well as b and d, are different. I suggest the authors use the same y-aixs ranges for easier comparison.

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