

We gratefully thank the reviewer for the comments. Please find the corresponding answers below. Changes in the manuscript are highlighted in blue.

Reviewer 2

Please use abbreviation consistently. It improves the readability of the manuscript greatly. E.g. RH and relative humidity.

L23 In average -> On average

The manuscript was changed accordingly and now reads:

Page 1, line 23: *On average, α -pinene yielded SOA with about 6 - 7% from NO_3 radicals and 3 – 4 % from OH radical reaction.*

L127: Please give the name of an IC-CD model and manufacturer.

Thermo Scientific Dionex ICS-3000 CD

L150: Please provide a reason for changing the chromatographic condition.

The chromatographic separation was done accordingly to Hoffmann et al., 2007. These authors figured out that these conditions are much better for separation. To emphasize that the method is taken from Hoffmann and co-workers (from our lab), the citation is added.

Page 5, line 149: *For anthropogenic SOA compounds, the separation was done as described above at 15°C and with 0.2 % acetic acid in water as described in Hoffmann et al., 2007.*

L186: Do the authors mean “The values obtained in this study did not agree with previously reported values because OH sources are different”?

Yes, this is correct. As the choice of OH-radical generation is crucial for product distribution (eg. Influence of RO_2/HO_2 ratio etc.), the OH source might have an effect on $\alpha_{1/2}$ and $K_{1/2}$ values.

L239: This should be 3.2. Please change all the section numbers accordingly.

The section numbers were changed accordingly:

Page 7, line 243: *3.2 Influence of RH on SOA yield and growth*

Page 9, line 308: *3.3 Characterisation of particle-phase chemical composition*

Page 13, line 456: *3.4 Atmospheric implications and Conclusion*

Page 14, line 501: *4 Acknowledgment*

Page 14, line 508: *5 References*

Line 262: I am not too sure what the authors mean here by “a decreasing consumption when RH increases”. Do the authors mean “a decreasing consumption of VOC when RH increases”? If so, this seems to contradict what Figures 1 and 2 (limonene/ NO_3) shows. Please clarify this sentence.

This description is not contradicting. As it can be seen in Figure 1, in the case of limonene/ NO_3 the consumption of limonene is lower under dry conditions ($\Delta\text{HC} = 193 \mu\text{g m}^{-3}$) than under humid conditions ($\Delta\text{HC} = 107 \mu\text{g m}^{-3}$). Thus VOC consumption decreases when RH is higher. Additional information is added to make it more clear. The text now reads:

Page 8, line 269: *As can be seen in Figure 1, in the case of limonene/ NO_3 the consumption of limonene is lower under dry conditions ($\Delta\text{HC} = 193 \mu\text{g m}^{-3}$) than under humid conditions ($\Delta\text{HC} = 107 \mu\text{g m}^{-3}$).*

L307: NPOM should be described in line 73.

Page 9, line 316: *Please note, water-soluble organic carbon was determined as NPOM.*

Page 1, line 72: *The chemical composition of formed SOA was characterized for their fraction of organic carbon (OC), non-purgeable organic carbon (NPOM), SOA-bound peroxides and SOA marker compounds.*

L315: It may well be that higher molecular weight compounds do not ionize well in negative ESI, and they aren't present in the LC/MS data. Just in case, do the authors have signals for them in LC/MS data? Signals were present but only few and difficult to interpret. As the ionization efficiency is unknown and matrix effects might play a role, an interpretation of those data were not done.

L346: α -pinene/OH \rightarrow α -pinene/OH

The manuscript was changed accordingly and now reads:

Page 10, line 358: *In general, peroxide fractions of 10 - 80% of the organic mass have been detected from α -pinene/OH experiments.*

L346-347: Why do high peroxide fractions contradict the small SOA yields? Please provide the reason for this explanation.

The sentence is deleted from the manuscript.

Page 10, line 358: *The high peroxide fractions of 10 – 80% are contradicting to the small SOA yields from α -pinene/OH ($Y_{OH} \approx 3.5\%$) is deleted*

L376 Biogenic SOA marker compounds and Figure 6: Does the discussion take the water content of SOA? If not, it makes more sense to discuss data in terms of carbon mass fraction of marker compounds in OC to eliminate the effect of water content.

The effect of LWC on the partitioning behavior and formation processes is discussed in detail at page 11 and 12. As pointed out by the reviewer, the amount of marker compounds is expressed as mass fraction in formed OM. Thus, dilution effects are eliminated.

L865 Figure 4 Caption: non-purgeable organic material (OM) \rightarrow non-purgeable organic material (NPOM).

The manuscript was changed accordingly.

Page 26, line 885: *Comparison of organic mass calculated from SMPS with an offline determined concentration of organic material (OM) and non-purgeable organic material (NPOM).*

L415: Do the authors mean pinonic acid was detected in comparable fractions in both NO₃ and OH oxidation of α -pinene? If so where do these 20-25% come from? For the 75%RH experiments, α -pinene/OH experiment shows much lower pinonic acid fraction. Can the authors clarify this?

Pinonaldehyde was detected from both systems and the amounts were comparable. To clarify, the sentence was re-written and now reads:

Page 12, line 427: *Notably, pinonic acid was detected in comparable amounts from α -pinene/OH and α -pinene/NO₃ with the same RH dependency (Figure 6).*

At this moment, it is unclear why pinonic acid is formed less at RH = 75%. As this was not observed for α -pinene/NO₃ system, water might affect the formation process of pinonic acid during OH-radical reaction. This fact remains still speculative and more work is needed to evaluate this observation.