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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Composition and volatility of SOA formed from oxidation of real tree emissions compared to single VOC-systems" *by* Arttu Ylisirniö et al.

Anonymous Referee #2

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General Comments

The laboratory study of Ylisirniö et al. investigates the oxidation of monoterpene and sesquiterpene emissions from real Scots pine plants and contrasts them to synthetic mixtures. Gaseous emissions are oxidised in an oxidative flow reactor and subsequent SOA yields, chemical compositions and volatilities are compared. Regarding these properties, the importance of chemical structure for sesquiterpenes is highlighted specifically, as this can affect whether the precursor is SOA enhancing or supressing. The findings of this study highlight the complexities of studying real VOC mixtures compared with synthetic surrogates and in doing so makes an excellent contribution to

further current understanding in atmospheric chemistry.

The methods used are of a good quality, sufficient to describe the systems being investigated and support the conclusions that are drawn. However the methods section requires more detail in terms of instrument and experimental descriptions to ensure replicability.

The presentation of the contents is well thought out and shows a clear process of thought. Although effort has been made to keep extraneous detail to a minimum in order to make the manuscript concise, some parts may benefit from the addition of more information to improve clarity and emphasize the key findings. In some instances, the reduced clarity makes it difficult to understand the statement being made. In such cases it may be beneficial to reword the text.

This manuscript should be considered for publication in ACP after addressing the following comments:

Major Comments

Line 26. "SOA particles from the oxidation of Scots pine emission had similar or lower volatility than SOA particles formed from either of single precursor." Does the single precursors refer to the SQT mixture as well as the alpha pinene? If so that might need rephrasing. This is also true for the title.

Line 30. You state "These results emphasize that simple increase or decrease of relative monoterpene and sesquiterpene emissions should not be used as indicator of SOA particle volatility" but on line 27 you state "Applying physical stress to the Scots pine plants increased monoterpene emissions, which further decreased SOA particle volatility and increased SOA mass yield." Can you clarify or rephrase the statement on line 30 based on the statement from line 27.

Line 87. Could you please provide a brief description on the dynamic dilution system you use to mix your VOCs.

Section 2.2.1/S3 There is some missing information that would be useful. Can you please state the resolution of the ToF-CIMS. A description of your FIGAERO backgrounding methodology and how you account for backgrounds in your analysis is missing. Also a description of your gas and particle sample lines to the ToF-CIMS (material, length, residence time etc).

Line 169. Although you did not correct for wall losses, can you make an estimation or assessment of their importance? This may be important if the yields from this paper are compared with other experiments.

Line 186. Can you provide some more detail on the scrubber / filter for the compressed air.

Line 190. Can you provide more information on the LED lamps.

Line 210. Is the stress response induced by cutting the sapling reduced or altered because it is already stressed by the infestation? Are there any further considerations required as to how these two stresses alter VOC emission regarding the conclusions you can draw?

Line 214. Is it shown that MT concentrations were higher? Experiment 2 shows the highest [MT] concentration (table 1). Do you mean the transition from experiment 3 to experiment 4 specifically?

Line 227. " . . . are about 30% larger, even though SQT/MT was substantially smaller than in experiments 1-3." I find the words 'even though' confusing, can you explain why these findings are unexpected?

Line 241. "We conclude that the increase in SOA yield in the Scots pine experiment 4, compared to the Scots pine experiments1-3, is likely due to the large relative increase in emitted monoterpenes" I think more clarification is needed regarding this conclusion. Can you provide a concise explanation of which factors regarding the MT are important for the increased SOA yield in experiment 4, such as absolute [MT] increase induced

by cutting; MT composition change induced by cutting e.g. β-phellandrene to α-pinene ratio; and the SQT/MT ratio (for suppression).

Line 327. "We suggest that the increased desorption temperatures for the Scots pine experiments 1-3 relative to the α-pinene experiment" Do you mean from exps 1 – 3 you see an increase in Tmax and this is explained by increasing contributions of farnesenes? Or that farnesene concentrations are broadly the same for exps 1 – 3 and have the same (broad) Tmax? Is this why there are only 2 Tmaxes shown on figure 5b, rather than 4?

Line 343. "Some signatures of thermal decomposition are visible as well, but overall this appears to play a minor role, with very small effects on Tmax in most individual ion cases". Please explain what you mean by signatures of thermal decomposition. Do you mean multiple peaks in the thermogram? Please explain how you are treating multiple peaks in thermograms e.g. disregarding or deconvolving multipeak thermograms. Can you be more specific than 'small effects'?

Line 344. "Consequently, the shifts to higher desorption temperatures as observed in the sum thermograms (Fig.5) are essentially seen throughout each respective spectrum of individual unit mass thermograms, although the contribution of thermal decomposition appears to increase concurrently." I am unsure what this means. It sounds like at all unit masses, you are seeing increasing Tmax as you increase the experiment number.

Line 369. " . . . manifests in the disappearance of SVOC . . . ". Disappearance or reduction?

Line 397. Just OH exposure or oxidation in general if ozonolysis is included? Technical Corrections

Line 44. Missing word. "The volatility of a specific compounds in turn is determined by both its molar mass and functional group composition"

Line 300. There is no Sect. 3.4.

Line 432. Some missing words

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