

## ***Interactive comment on “ $\alpha$ -pinene photooxidation under controlled chemical conditions – Part 2: SOA yield and composition in low- and high-NO<sub>x</sub> environments” by N. C. Eddingsaas et al.***

**Anonymous Referee #1**

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### *General comments*

This paper presents the aerosol-phase observations and analysis from a series of experiments on the photooxidation of  $\alpha$ -pinene, for which the gas-phase results are presented in another paper (Part 1). The use of ESI mass spectrometry on collected aerosol filter samples enables elucidation of aerosol-phase composition, which combined with gas-phase chemical ionization MS allows the authors to speculate on aspects of the oxidation mechanism under high and low NO<sub>x</sub>, with neutral and acidic seed particles. Because this gas- and aerosol-phase analysis is so interconnected, this reviewer wonders why Parts 1 and 2 were not combined and published as a single

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paper? The paper presents several interesting observations and analyses elucidating the oxidation products of  $\alpha$ -pinene, some of which get a bit lost in the text. A bit of reorganization is recommended to make these major points come across more clearly (see discussion below).

### *Specific comments*

p. 8581, line 24: If you do not combine the papers into one, I suggest a few sentence summary of the major findings of Part 1 here, to help readers understand what information they would find there (and understand why it is not in this paper)

p. 8582, lines 11-14: Last 2 sentences of introduction should be combined: “We compare SOA and gas-phase composition . . .” and omit last sentence. As written this implies that you tuned over a range of acidity.

p. 8583 around line 6, further discussion lines 17-20: Even though you cannot exactly determine NO and NO<sub>2</sub> concentrations because of interferences, it would be nice to give the reader a sense of how different high-NO and high-NO<sub>2</sub> conditions are. Could you estimate the ratios for those 2 cases? Or provide some sort of bounding on how different they might be?

p. 8588 lines 19-20: I don’t understand the sentence about “independent of NO<sub>2</sub> concentration” – clarify. Just that high-NO was equivalent to high-NO<sub>2</sub>? or high-NO<sub>x</sub> equiv. to “low-NO<sub>x</sub>”? Why specifically call out NO<sub>2</sub> here?

GENERAL COMMENT ON SECTION 3.2: Some of your interesting interpretation could easily get lost here. I suggest breaking this up into subsections with more descriptive titles to guide the reader through your discussion better. One option would be to separate out your straight observations (e.g. which products observed in which experiments) from your interpretation (e.g. likely that certain compounds previously observed were from ozonolysis not OH, there must be other pathways to 3-MBTCA). Granted this is a matter of style, so this is simply a suggestion.

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p. 8590 line 3: please write out the chemical name of 3-MBTCA at first instance

GENERAL COMMENT ABOUT STRUCTURES: It might be helpful to readers to include a figure of the important chemical structures that feature in your discussion. In particular, maybe a figure showing the structures in your mechanism discussion on p. 8591, lines 1-4

p. 8593, lines 1-5: (for your "interpretation" subsection . . .): Do you think this is because there is in fact another precursor? Or could acidity control partitioning of one but not the other?

p. 8594 line 3: for completeness, what does van Krevelen say about high-NO? Anything interesting?

p. 8595, line 5-7: is SA or SA/volume the relevant parameter here?

p. 8595 line 20-23: does this mean some species partition more readily to inorganic seeds only? Or is this just a consequence of an overall increase in SA?

line 26: Does uptake of 1st-generation products compete with later-generation gas-phase chemistry?

p. 8596 line 20-21: is the supposed m/z 316 product from apinene or norpinonaldehyde PAN the same molecule or different with same mass? Is the structure known or is this just a mass observed in both cases without knowing what it is?

p. 8597 line 14 remove "levels" and describe conditions / which experiments you're talking about in more details?

around line 17: Can you make some estimate of how much HNO<sub>3</sub> deposition would make H<sub>2</sub>SO<sub>4</sub> irrelevant – is there enough here?

line 25 – p. 8598 line 4: Maybe omit the discussion of coating earlier in the paper so it has more "punch" here? Again – stylistic suggestion to take or leave!

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Might this coating affect WHICH products partition?

line 10-14: again, this is a repeat of earlier discussion of the 3-MBTCA hypothesis. Punchier if you only say this in one place (here is good!)

Fig. 3: Do I correctly understand that you observed greater SOA yield from the lower a-pinene experiment at high-NO<sub>x</sub>? This is interesting and should be discussed in the text!

Fig. 6 caption text about greater a-pin concentration at the beginning of some expts than others should be mentioned in the text, too.

Figs 7-8: this makes a lot of sense to me – you never see NO gas-phase loss for high-mass species, only the very volatile one. Nice! I'm confused about the y-axes, though – I thought you said these experiments weren't quantitative?

#### *Technical corrections*

p. 8580, line 14: Since you have not yet addressed "high-NO" vs "high-NO<sub>2</sub>", suggest changing both instances of "high-NO" in the abstract to "high-NO<sub>x</sub>" for consistency with "low-NO<sub>x</sub>"

p. 8582, line 16: Remove "and pinonaldehyde" from 1st sentence of Experimental. You don't describe any experiments starting with pinonaldehyde here.

throughout: Shouldn't the abbreviation for liter be "L" not "l"?

p. 8583 line 5: insert comma between "chamber" and "resulting"

p. 8584 line 14: omit "the detection of"

p. 8585 line 15: change "a previous publication" to "previous publications"

line 17: "or that are organosulfates . . ."

p. 8586 line 24: change "high-NO<sub>x</sub>" to "high-NO<sub>2</sub>"

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- p. 8588 line 26: remove “presence of”
- p. 8589 line 7: “mass loading”
- p. 8595 line 15: “noticeably”
- p. 8596 line 4: “partitioning”
- line 12: “photooxidation from pre-seeded laboratory...”
- p. 8597 line 5: add high-NO<sub>2</sub> conditions as well?
- line 13: change “betweenhigh” to “in high”
- Fig. 2: mg should be  $\mu$ g?
- Fig. 8: caption text: photooxidation misspelled

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Interactive comment on *Atmos. Chem. Phys. Discuss.*, 12, 8579, 2012.

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