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Atmospheric Chemistry and Physics
Discussions

# *Interactive comment on* "Atmospheric oxidation of isoprene and 1,3-butadiene: influence of aerosol acidity and relative humidity on secondary organic aerosol" *by* M. Lewandowski et al.

**Anonymous Referee #1**

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General comments

This manuscript presents an interesting study about the SOA formation from isoprene and 1,3-butadiene oxidation as a function of particle acidity or relative humidity. Laboratory VOC oxidation experiments have shown that acidic sulfate particles tend to increase SOA yields whereas the influence of humidity on SOA yields is less clear and the its role in the SOA formation is still debated. Contrary to the presence of acid catalysed accretion products such as isoprene and monoterpene organosulfates in ambient aerosols, no clear evidence is presented to indicate that particle acidity enhances SOA formation in ambient aerosols. Much less is known about the relationship between humidity and SOA formation in ambient atmosphere. I have no doubt that the datasets in this manuscript are valuable to the SOA community who are involved in laboratory experiments, chemical mechanisms development or SOA formation modelling; however I have several points that the authors may want to address or discuss in the revised manuscript.

Major comments:

Do the authors think that water vapour plays a role in the VOC oxidation chemistry leading to a lower SOC yield at an elevated humidity level or is it more related to particle phase chemistry such as a lower yield organosulfates, enhanced hydrolysis or reduced absorptive partitioning of organic compounds due to lower organic mass? Can the authors discuss this in the manuscript?

Pp. 29441 Line 21 onwards: Is the sulfate acidity effect purely related to the reactivity of oxidation products to acidic sulfate? I imagine that the layer of SOA formed on the seed particle likely hinders acid catalysed accretion reactions and absorptive partitioning largely controls the subsequent SOA formation. In other words, VOCs with higher $\Delta M_{SOA}$ may not show a strong acidity effect. How do the placements of these VOC relate to $\Delta M_{SOA}$ from neutral seed experiments?

Pp. 29442 Line 19 onwards: Temperature data should be given in Tables 1 and 2. How large was the temperature differences between these experiments? If the temperature had a significant impact on the RH, it is likely that the temperature also had an influence on the $\Delta M_{SOA}$. Can the authors discuss about this in the manuscript?

Pp. 29442 Line 25 and Pp. 29443 Line 21 onwards: There are several thermodynamic models available to calculate aerosol water content and pH values. The authors may want to use one of these tools to estimate the values for these experiments and add them to Tables 1 and 2, and discuss if these parameters had an influence on acid catalysed accretion reactions or not.

Pp. 29444 Line 27: I would like the authors to discuss a bit deeper about the structural differences of oxidation products here. What sort of oxidation products do the authors expect when there is an additional methyl group in a precursor VOC? Does this lead to more reactive intermediate oxidation products towards acidic sulfate?

As other reviewer commented, the authors should discuss their findings in atmospheric relevant context at the end of the manuscript.

Technical comments:

Pp. 29432 Line 2 and elsewhere: I feel that $[H_3O^+]_{seed}$ or $[H_3O^+]_{aerosol}$ is more appropriate for expressing the aerosol acidity. It is very unlikely that free $H^+$ exists in the air under the experimental conditions used by the authors.