Atmos. Chem. Phys. Discuss.,
https://doi.org/10.5194/acp-2019-981-RC2, 2020

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Effect of Inorganic-to-Organic Mass Ratio on the Heterogeneous OH Reaction Rates of Erythritol: Implications for Atmospheric Chemical Stability of 2-Methyltetrols" *by* Rongshuang Xu et al.

Anonymous Referee #2

Received and published: 13 January 2020

Xu et al. investigated the OH-initiated heterogeneous oxidation of erythritol particles and particles containing erythritol and ammonium sulfate (AS). Erythritol was used as a surrogate of 2-methyltetrols, one of the most important isoprene-derived SOA products. SOA chemical composition was retrieved using a soft atmospheric pressure ionization source (DART) coupled to an Orbitrap. The reactivity of erythritol was characterized as a function of inorganic-to-organic mass ratio. While the study is well constrained and clearly presents some interesting results, some aspects are not considered within the discussion (see comments below).

Page 2, lines 23-24: The authors stated that the reactivity of 2-methyltetrols has not been tested before. That's not fully correct. Hu et al. (Jimenez's group) investigated the aging of ambient isoprene-derived SOA and found that IEPOX-SOA (mainly producing 2-MT) are fairly unreactive. This study should be cited by the authors and further discuss.

Page 3, lines 3-5: The authors should be careful here and do not overstate the impact of OH reactivity. A chemical lifetime of 2 weeks cannot be really classified as a "significant" reaction/loss.

Page 4, lines 26:The authors should provide more information regarding the experimental conditions: - What was the gas-phase concentration of erythritol? Is it possible that larger IOR lead to higher degassing (e.g., salting-out effect?) - Can the presence of gaseous erythritol decrease the concentration of OH radicals and further impact the heterogeneous reactivity? - Please provide the size, surface area and mass of particles for each condition.

Page 6, dart section: Please provide more information. Was it real-time evaporation or were the particles collected onto a filter prior vaporization?

Page 9: Recent studies have shown that isoprene-derived SOA, especially when formed in the presence of acidic aerosols are highly viscous, further impacting heterogeneous processes (e.e., Surratt's group, Ault's group, Thornton's group). While the assumption that erythritol is well mixed is likely correct, the authors cannot ignore these recent studies and the last paragraph (i.e., atmospheric implications) should mention the impact of the phase and viscosity on the heterogeneous reactivity of isoprene-derived SOA products. In other words, the rate constant/lifetimes proposed in this study are likely an upper limit suggesting that the OH oxidation of 2-methyltetrols is negligible.

Page 9, lines 11-14: Did the particles shrunk? Did the authors estimate a carbon closure?

Page 10, lines 9-10: That doesn't mean that thermal decomposition is not occurring for other types of compounds, e.g., carboxylic acid or other oxygenated species. As the authors did not report any concentrations it is not difficult to make such a statement; i.e., the observed compounds can be only a fraction of the quantity formed. In addition, the measured compounds can fragment into small ions: < m/z 70. It is also unclear why the authors selected such a narrow mass range. To fully investigate the potential fragmentation the authors could have extended the mass range: i.e., 50-400. Please clarify.

Page 10, lines 13-14: Here again the statement is not correct. The authors have to be quantitative in order to make such a statement. For example, did the authors try to generate SOA with one single compound (e.g., carboxylic, polyol,...) and determine if the mass measured with the DART corresponds to the mass measure with an SMPS?

Page 10, line 17: What would be the expected fragment ions? Not all ions were identified in Fig 1 and some fragments ions were not present before the reaction. Please clarify.

Page 10, Fig 2: Please explain the meaning of the error bars. Is it from different experiments?

Page 17, line 15: Is it possible to estimate any branching ratio? Is the DART technique more sensitive/selective for certain types of compounds?

Suggested technical corrections:

page 5, line 5. Should molecule cm-3 s be molecule cm-3 s-1

page 6, line 7. It should be Orbitrap

Interactive comment on Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2019-981, 2019.