

Reply to editor's comment on "Heterogeneous OH Oxidation of Isoprene Epoxydiol-Derived Organosulfates: Kinetics, Chemistry and Formation of Inorganic Sulfate" by Hoi Ki Lam et al.

Comment #1

Page 1, line 18: I think that the methyltetrol sulfates are the most abundant in the boundary layer, but for the overall atmosphere it has been suggested that it may be glycolic acid sulfate (Liao et al. JGR 2015).

Author Response:

Thanks for the comment. We have revised the sentence in the abstract and added the potential of future investigations on the transformation of glycolic acid sulfate in the conclusion.

Page 1, line 17: "Acid-catalyzed multiphase chemistry of epoxydiols formed from isoprene oxidation yields the most abundant organosulfates (i.e., methyltetrol sulfates) detected in atmospheric fine aerosols in the boundary layer."

Page 7, line 12: "Future investigations on the transformation of other organosulfates, for instance glycolic acid sulfate, which is the most abundant organosulfates for the overall atmosphere, are also desirable (Liao et al., 2015)."

Reference

Liao, J., Froyd, K. D., Murphy, D. M., Keutsch, F. N., Yu, G., Wennberg, P. O., St. Clair, J. M., Crounse, J. D., Wisthaler, A., Mikoviny, T., Jimenez, J. L., Campuzano-Jost, Pedro, Day, D. A., Hu, W., Ryerson, T. B., Pollack, I. B., Peischl, J., Anderson, B. E., Ziemba, L. D., Blake, D. R., Meinardi, S., and Diskin, G.: Airborne measurements of organosulfates over the continental U. S., *J. Geophys. Res.-Atmos.*, 120, 2990–3005, 2015.

Comment #2

Page 1, line 23: In line with some of the reviewer comments. The way it is written the readers will at this stage assume that reaction products were observed. I suggest eliminating the reaction products as argument in the abstract. I do not think this detracts from the main finding, which is the rate constant.

Author Response:

We agree with the comment and eliminating the reaction products in the abstract.

Page 1, line 20: "As a result, we investigate the heterogeneous oxidation of aerosols consisting of potassium 3-methyltetrol sulfate ester ($C_5H_{11}SO_7K$) by gas-phase hydroxyl (OH) radicals at a relative humidity (RH) of 70.8 %."

Comment #3

Page 1, line 27: Also, following up on one of the reviewer comments. The effective rate OH constant is given as it is usually for a gas-phase reaction. It may be useful to explain this in the abstract or provide a context as why it is given as gas-phase when it is a heterogeneous reaction.

Author Response:

Thanks for the comment. We agree the effective OH rate constant is for a gas-phase reaction. In the abstract, we have used the effective “heterogeneous” OH rate constant, which describes it is a heterogeneous reaction.

Comment #4

Page 1, line 28: Please state the assumed OH concentration for this (1.5E6?).

Author Response:

Thanks for the comment. We have added the OH concentration used for determining the chemical lifetime.

Page 1, line 25: “Kinetic measurements reveal that the effective heterogeneous OH rate constant is measured to be $4.74 \pm 0.2 \times 10^{-13} \text{ cm}^3 \text{ molecule}^{-1} \text{ s}^{-1}$ with a chemical lifetime against OH oxidation of 16.2 ± 0.3 days assuming an OH radical concentration of $1.5 \times 10^6 \text{ molecules cm}^{-3}$.”

Comment #5

Page 1, line 31: “absence of functionalization processes” is a little awkward. One could argue that changing an alcohol to an aldehyde or acid, even if it is just formaldehyde and formic acid, is a functionalization process as it changes the functional groups, so perhaps the phrasing could be improved. I think the important aspect is that the results strongly suggest fragmentation, as stated in the next sentence.

Author Response:

We agree with the comments and have revised the sentence.

Page 1, line 29: “Aerosol mass spectra only show an increase in the intensity of bisulfate ion (HSO_4^-) after oxidation, suggesting the importance of fragmentation processes.”

Comment #6

Page 2, line 11: I may be mistaken, but my impression was that the C5-alkene triols are not direct SOA constituents but rather decomposition products from the analytical techniques.

Author Response:

We agree that C₅-alkene triols could be decomposition products from analytical methods and have removed the it from the sentence.

Page 2, line 10: “This multiphase chemical pathway is a key for the substantial production of isoprene-derived SOA constituents (e.g. 2-methyltetrols, organosulfates, 3-ethyltetrahydrofuran-3,4-diols and oligomers) within atmospheric fine particulate matter ($\text{PM}_{2.5}$) (Carlton et al., 2009; Froyd et al., 2010; Surratt et al., 2010; Lin et al., 2012).”