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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Volatility and lifetime against OH heterogeneous reaction of ambient Isoprene Epoxydiols-Derived Secondary Organic Aerosol (IEPOX-SOA)" *by* Weiwei Hu et al.

Anonymous Referee #1

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This is a very interesting study about the volatility and lifetime of IEPOX-derived SOA. As the authors point out in the manuscript, studies on heterogeneous reactions of ambient SOA with hydroxyl radicals are missing. This work presents a well-conduct series of ambient measurements and box models that provide supporting evidences for their findings. The study is technically well done and the paper is well written. I think it is suitable for publication in ACP after few minor revisions. My major comment is on the determination of the IEPOX-derived SOA lifetime as discussed below.

Line 70: The authors should consider adding the references and not only cite their previous work. Add these references: Robinson et al., 2011; Budisulistiorini et al., 2013; 2015; Chen et al., 2015, Xu et al., 2015

Line 72: Add Riedel et al., 2015

Line 82: Similar comment as Line 70, add references: Robinson et al., 2011; Lin et al., 2012; Budisulistiorini et al., 2013

Line 85: Add reference: Kroll et al., 2015

Line 114: How did temperature affect the reactivity of IEPOX-derived SOA? Indeed as shown by Lai et al. (2015), small changes in the temperature (20C-30C) could impact OH heterogeneous oxidation.

Line 125: Why did the authors limit the range of OH exposures from 10e+10 – 10e+13 molecule cm-3? Indeed, as previously reported and discussed below, OH uptake and heterogeneous oxidation is impacted by the concentration of OH radicals (Arangio et al., 2015).

Line 154: The authors mentioned other type of oxidants, such as O3 and NO3. If they performed some experiments using different oxidants, it would be interesting to discuss the reactivity of these oxidants (especially NO3) and compare the results with OH radicals. Could the authors provide additional experimental information for the production of NO3 radicals in the OFR?

Line 155: The authors mentioned that they used different methods (i.e. OFR 185 and OFR 254?) but decided to present only results from one. Could they explain the reasons and add some information and/or comparison between both methods?

Line 168-170: The authors mentioned that during the dry season SOA were significantly influenced by biomass burning. This statement is supported by neither references nor experimental data. Additional information is needed to evaluate the importance of BBOA in OA. In addition, how do the authors expect the presence of BBOA to impact the IEPOX-SOA aging?

Line 192: Similar comment as line 82, add the references.

Lines 203-204: Riedel et al. (2016) have recently reported bulk laboratory measurements and determined the reaction rate constants of IEPOX-SOA products from the reactive uptake of IEPOX. The authors didn't consider this study and only use a global rate constant. The rates constants proposed by Riedel et al. (2016) should be added in the model and results from both approaches should be compared in the paper.

Lines 270-271: At which temperature did the authors perform these evaporation experiments?

Lines 295-296: Riva et al. (2016) have shown that IEPOX reactive uptake could be significantly reduced by the presence of organic on seed aerosols. The authors should add this reference and also discuss this potential impact in their model.

Lines 321-323: The authors should better justify the average molar yield used in the model regardless to Riedel et al. (2016).

Line 335: The authors mentioned on Line 125 that the OPR was operated using an OH concentration of 10e+10 – 10e+13 molecule cm-3. At different places in the article, the authors refer to different ranges. This is confusing, thus it needs to be clarified.

Lines 343-347: As it is written in the article, the authors point out that the limitation of the reactive uptake of IEPOX is due to the acidity of the particles. Is it only due to the acidity, or the surface area, or both? Could the authors provide the surface area before and after injection of H2SO4 particles?

Lines 359-360: The statement, "oligomer decomposition could be fast in the ambient air", is not clear and a bit speculative. Could the authors provide more information and/or references to support this statement?

Lines 499-500 and general comment: Here the authors mentioned that they have estimated an OH yield based on range of OH concentrations of 10e+7 – 10e+10 molecule cm-3. However, in the experimental section, the range used was 10e+10 – 10e+13 molecule cm-3. Therefore, it is not clear if the yield was determined from extrapolation

in the model or from measurements. If it is from extrapolation, how reliable is the yield proposed in this study since different studies have shown that OH yield is dependent on the concentration of OH radicals?

In addition, the authors mentioned that they have investigated the impact of OH concentrations on OH yield. Regardless the previous studies, this set of experiments was conducted in a substantially small range to make a conclusion in the dependence of OH yields on OH concentration. Therefore, it appears to be overreached to propose such conclusions, and the question of the larger reactivity of IEPOX-derived SOA using a lower concentration of OH radicals remains present.

Technical comments:

Line 140: O3: subscript "3"

Line 141: s-1: superscript "-1"

Line 277: typo error. "isis" should be "is"

Lines 324/366: acidic NH4HSO4 should be either acidic (NH4)2SO4 or NH4HSO4

Line 418: > 10–14 should be 10-14

References: Arangio et al., 2015; J Phys Chem A; 119; 4533-4544

Budisulistiorini et al., 2013; ES&T; 47, 5686-5694

Budisulistiorini et al., 2015; ACP; 15; 8871-8888

Chen et al., 2015; ACP; 15; 3687-3701

Kroll et al., 2015; J Phys Chem A; 119; 10767-10783

Lai et al., 2015; PCCP; 15, 10953-10962

Lin et al., 2012; ES&T; 46; 250-258

Riedel et al., 2016; ACP; 16; 1245-1254

Riva et al., 2016; ES&T; 50; 5080-5088

Robinson et al., 2011; ACP; 11; 9605-9630

Xu et al., 2015; PNAS; 112, 37-42

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