1) HULIS vs aqSOA vs oligomers

As I pointed out previously, not all aqSOA is HULIS and not all HULIS is aqSOA. Therefore, it cannot be used interchangeably. In addition also oligomers and brown carbon are separate products. While there might be overlaps between these compounds groups (aqSOA, HULIS, BrC, oligomers) they all different definitions and should not be used equally.

To clarify and simplify the terminology throughout the paper, I suggest using consistently 'products', 'reaction products' or 'aqueous-phase products'.

l. 94: Did all three studies cited here indeed claim that the investigated reactions yield HULIS? Unfortunately, I do not have access to all of them; however, based on the abstracts, it seems to me that Smith et al., 2016 and Li et al., 2021 only refer to aqSOA or other products. Please verify the terminology in the original literature.

It is not clear how you differentiate between aqSOA and HULIS. Using the

l. 30 vs l. 247 vs l. 601 vs l. 633: While in the abstract you call it HULIS, in the experimental section, you call the products sometimes aqSOA, and sometimes HULIS. Please use consistently only one term (preferably 'reaction products') to avoid confusion.

l. 437f: Here you refer to studies on HULIS in ambient particulate matter. The HULIS found in these samples are not (necessarily) originating from reactions as investigated in the current study. Therefore, your products (aqSOA) are not comparable to these ambient HULIS.

l. 482: 'High molecular weight and conjugated structures' are also present in oligomers. Not all oligomers are HULIS. However, if these oligomers are formed by aqueous phase reactions, they can be termed aqSOA.

l. 550: Here you could simply delete 'of HULIS'.

l. 554 – 560: This text is out of place here and would be redundant if you use 'products'. Also it incorrectly cites the review by Graber and Rudich. 'HULIS' is the acronym for 'HUmic-LIke Substances'. Therefore, the sentence 'So, we inferred most HULIS in this paper was humic-like substance rather than fulvic-like substance' does not make sense.

Graber and Rudich discuss that "HULIS relate to the water soluble fraction, which would include only the fulvic acid fraction of humic substances, and exclude the humic acid (base-soluble) and humin (insoluble) fractions of humic substances."

l. 596: not all light-absorbing compounds are HULIS; and not all HULIS are light absorbing

l. 771: HULIS and brown carbon are not always the same.

2) Atmospheric implications

I suggest that you separate Section 4 into '4. Atmospheric implications' where you discuss more carefully the implications citing appropriate literature and 'Section 5. Summary and conclusions' where your study and the main conclusions for atmospheric implications are briefly summarized. The current, extended section 4 is too unstructured and it is not clear what it is a conclusion from your study vs previous studies.

The conclusions on the ranking of 3C* vs OH reactions depend on the concentrations used in experiments or in the atmosphere, respectively. Therefore, please comment on the radical concentrations in your study. If you were unable to retrieve them, please add a general discussion on OH and *C3 concentration in atmospheric waters and how to relate your findings to such concentrations.

l. 296: What were the OH and 3C* concentrations in the study by Yu et al. (2016)?

l. 328: Please report the concentrations of 3C*, 1O2 and OH as used in the experiments by Laurentiis et al., 2013 and Misovich et al. 2021 to make this comparison to your study more solid.
l. 778: How do you quantify 'important'? How much mass of light-absorbing material is predicted to be formed from eugenol based on your experiments for atmospheric conditions?

l. 781 – 784: Small dicarboxylic acids are usually present to a large extent in particles and only evaporate to a small extent.

l. 797-806: The aqueous phase yields cannot be directly compared to gas phase yields because you have to calculate the fraction of the precursor that is present in either phase and scale the yields by them.

3) Previous work
l. 599: Huang et al., 2018 is not the only study that reported aqSOA yields from phenolic compounds. There are several more, e.g. (Ma et al., 2021; Smith et al., 2014; Sun et al., 2010). Are the reported values similar? Please discuss.

4) Technical comments

l. 113: please write it 'eugenol (allyl guiacol)'

l. 117: 1) 'beech stove' does not seem right here. Do you mean biomass burning of beech wood. ; 2) the study by Liu et al., 2019 does not report on new measurements of emissions; the only cite Bari et al.. Please remove Liu et al., 2019 here.

l. 119: replace 'compounds' by 'compound'

l. 123: 'aerosol mass spectrometer' should be 'aerosol mass spectrometry' to be consistent with the preceding list

l. 175: it should read 'experiments were ...'

l. 193: 'Jenal' should be 'Jena'

l. 221: Is 'some time' necessary here? Either remove 'some time' or quantify the time period.

l. 228: replace 'for distinguish from At' by 'as blank value'.

l. 279: Define BDE here

l. 286-88: This sentence does not read well. Replace by ‘When the photon energy is higher than the bond dissociation energy, chemical bonds can break, leading to 287 decomposition of compounds and possibly further mineralization.’

l. 296: remove ‘A’ at the beginning of the sentence.

l. 302-4: In the headers you use ‘photooxidation’ while in the subsequent text, you use ‘photodegradation’. Unless you mean two different processes here, I suggest using consistent terminology throughout the manuscript.

l. 311: Do you mean ‘Excess concentrations’ instead of ‘Above concentrations’?

l. 332ff: Write (k-kTMP)/k as an equation (as Equation (1) in l. 187) and define k and kTMP. Explain ‘contribution’ here – contribution to what?

l. 339: either ‘One should be cautious to apply’ or ‘It should be cautioned to apply’

l. 342: replace ‘by’ by ‘be’

l. 375-7: This sentence is not clear. Do you mean ‘Since H2O2 was photolyzed at wavelength <300 nm to generate OH radicals, irradiation above 300 nm did not affect the reaction.’?

l. 381: instead of ‘shown later’, refer to the respective section

l. 391: Add ‘conditions’ (O2-saturated and N2-saturated conditions...)

l. 394: Either write OH or ·OH. Both is ok but should be used consistently throughout the text.

Figure 3 is of very low quality. Please provide a figure with higher resolution where the axis labels are clearer and less blurry.

l. 445: replace ‘direct’ by ‘photolysis’

l. 468: What do you mean by ‘over photoreaction’? ‘during the photooxidation’?

l. 468: replace ‘slight’ by ‘light’

l. 524/5: This sentence is not correct, both grammatically and scientifically. There are numerous oligomers from small organic compounds that do not have any fluorescent properties. Either delete this sentence or specify what oligomers you refer to.

l. 536: What do you mean by ‘small organic acid’? Small organic acids are usually referred to as acids with a few (1, 2, ..) carbon atoms. Is this what you mean?

l. 537: Is this ‘phenomenon’ really ‘unexpected’? It is well known that the organic content of ambient aerosol particles is composed of 1000s compounds from many different emission sources, gas phase reactions and condensed phase reactions. Thus, the fact that you do not see one particular peak in a

spectrum upon the reaction of a single precursor is by no means ‘unexpected’. The reference to Xie et al. 2016 seems therefore random and not appropriate in this context.

l. 204 and l. 548: The header text is basically the same whereas the former is a method and the latter reports results. Please refine the headers such that they differ and appropriately describe the section content.

l. 587: replace ‘yield’ by ‘yields’, and ‘value’ by ‘values’

l. 592: replace ‘reason’ by ‘reasons’

l. 623: ‘As we known’ is grammatically wrong and seems redundant here. Replace by ‘The’.

l. 632: Replace this sentence by ‘The final f43 values were almost the same as compared to the initial solution’.

l. 660: replace by ‘based spectra from the NIST database [add reference!] and on the reactants and reaction conditions’ – please check if the content is correct

l. 662: replace ‘dominate’ by ‘dominates’ and complete the sentence. What is less important? ‘..functionalization dominates as compared to...’?

l. 671: What does this sentence refer to? Is it a footnote for the table, or where were eugenol and DMB also shown?

l. 745: ‘weaker’ than what? Why is the weaker correlation unexpected?

l. 678: replace ‘undergo’ by ‘undergoes’

Ma, L., Guzman, C., Niedek, C., Tran, T., Zhang, Q. and Anastasio, C.: Kinetics and Mass Yields of Aqueous Secondary Organic Aerosol from Highly Substituted Phenols Reacting with a Triplet Excited State, Environ. Sci. Technol., 55(9), 5772–5781, doi:10.1021/acs.est.1c00575, 2021.
Smith, J. D., Sio, V., Yu, L., Zhang, Q. and Anastasio, C.: Secondary Organic Aerosol Production from Aqueous Reactions of Atmospheric Phenols with an Organic Triplet Excited State, Environ. Sci. Technol., 48(2), 1049–1057, doi:10.1021/es4045715, 2014.
Sun, Y., Zhang, Q., Anastasio, C. and Sun, J.: Insights into secondary organic aerosol formed via aqueous-phase reactions of phenolic compounds based on high resolution mass spectrometry, Atmos. Chem. Phys., 10, 4809–4822, 2010.