

Atmos. Chem. Phys. Discuss., referee comment RC2  
<https://doi.org/10.5194/acp-2021-895-RC2>, 2022  
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## Comment on acp-2021-895

Anonymous Referee #2

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Referee comment on "Optical and chemical properties and oxidative potential of aqueous-phase products from OH and  $^3C^{\square}$ -initiated photooxidation of eugenol" by Xudong Li et al., Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2021-895-RC2>, 2022

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In this study the authors investigated the degradation of eugenol by three ways i.e. photolysis, excited triplet states, and OH radicals. The obtained results suggest that the excited triplet states are most reactive toward eugenol followed by OH radical induced degradation and photodegradation. The fluorescent spectra indicated formation of HULIS. The use of dithiothreitol indicated formation of harmful species during the oxidation process.

I think that this topic could be interesting for the readers of ACP and the manuscript should be reconsidered upon major revision. I have some comments that I hope can be helpful for the authors to improve the quality of the manuscript. My main comments are mostly related to the experimental details.

The authors used mercury lamps with discontinuous emission spectrum at 313 nm, 365nm, 419nm, and 436 nm to irradiate the aqueous solution consisting of eugenol, which can potentially lead to misleading conclusions. For this kind of experiments, it is more appropriate to use Xenon lamp (solar simulator) with continuous emission spectrum from 300 to 700 nm. It will be useful in Figure S1 to compare the spectral irradiance from the mercury lamp with the sunlight spectral irradiance.

Figure 5a: How it is caused the photolysis of eugenol that absorbs light at 280 nm with mercury lamp irradiating at 313, 365, 419 and 465 nm?

The changes of pH values and the levels of dissolved oxygen before and after the reactions in the aqueous phase are not reported.

Line 88: it should state "several" instead of "sever".

Figure S3: On X axis should be "magnetic field" instead of "magntic field".

Figure 3: It is not correct to state "under OH system". Please revise it.

Line 251: Which chemical bond?

Line 255: In a real world environment the photon energy of the sunlight does not have two peaks at 313 nm and 365 nm.

Lines 375-376: To state that the "role of OH is weak" is not appropriate term here. Moreover, the statement is somewhat misleading as the continuous emission spectrum would probably induce different effect.

Line 389: "the formation of "brown carbon". Did authors observed change of the colour of the solution? Did really becomes brownish?

Please change the title of section 2.3.5. "Products analysis of products" is not right.

Lines 421-422: Please rewrite the sentence starting with "This is likely due.....". It is not clear at all the meaning of this sentence.

My other comments are related to the references. The authors used many self-citations and at first glance the paper looks like that previously not so many groups studied the reactions of phenols and methoxyphenols in the aqueous phase.

For example, lines 57-61: Many recent papers related to the photodegradation of phenolic substances are not cited here.

Lines 66-67: There are other more appropriate references related to OH radical concentrations in the atmospheric aqueous phase. See for example: Chem. Rev. 2015, 115, 24, 13051–13092; Chem. Rev. 2003, 103, 4691-4716.

Line 93: In which sense these compounds can damage human body? Also reference is here needed about the health implications of quinones and PAHs.

Lines 251-255: Please give the reference for the reported bond dissociation energies (BDE) which is by the way more appropriate term than chemical bonds energies.

Lines 406-409: There are many previous studies that have shown the formation of fluorescent compounds associated with HULIS at wavelengths 400-500nm. For example: <http://dx.doi.org/10.1016/j.atmosenv.2013.09.036>, [doi.org/10.1016/j.atmosenv.2019.03.005](http://dx.doi.org/10.1016/j.atmosenv.2019.03.005))