

Responses to the Referee's #2 comments

We thank the reviewer for his/her time and effort to provide comments on our revised manuscript.

Corrections:

- 1) **Line 85. α -pinene is not mentioned as the bVOC of study until later in the introduction and should be mentioned earlier.**

We agree that the choice of α -pinene and isoprene in addition to o-cresol in the programme of study might have not been clear in the sentence found in Line 85. We have rephrased this to read as:

“In this work, we extend the system studied by McFiggans et al. (2019; i.e., α -pinene and isoprene) with the investigation of the interactions of an aVOC with the two bVOC. We selected ortho-cresol (hereafter o-cresol), a product of toluene oxidation and also a directly emitted aromatic species, as a representative aVOC.”

- 2) **Line 377. "oxidation state" should be referred to as average carbon oxidation state with the overbar.**

The correction has been made and the sentence now reads as:

“Figure 1 shows the average carbon oxidation state \overline{OSc} against the number of carbon atoms (nC) of for all the products identified in characteristic experiments for each system (Exp. No. 2, 6 and 10; Table 1).”

Furthermore, the OSc has been replaced with \overline{OSc} throughout the manuscript.

- 3) **Line 394. "...and ONO2 addition". You mean NO + RO2 -> RONO2 rather than the addition of -ONO2. Nitration would be more accurate.**

The sentences has been modified as:

“These products are likely result of H abstraction and subsequent OH addition and nitration, respectively, suggesting that they are early generation products.”

- 4) **Section 3.2.1. Some references to the VBS bins are using bin edges (e.g. 3.5-5.5) which is confusing. Referring to bin middles should be fine.**

We agree with the reviewer that this could be confusing. We are now only referring to bin middles instead of edges throughout the manuscript.

- 5) **Point 22 of the 1st response regarding line 478 of the original manuscript, now line 650 of the revised manuscript. "OH addition via hydrogen abstraction" doesn't make sense, these are separate mechanisms. Olariu et al. (2002) state "At 298 K it has been estimated that approximately 9% and 7% of the overall reactions of OH with phenol and o-cresol, respectively, proceed via H-atom abstraction (Atkinson, 1989), the remainder being addition." The hydrogen abstraction pathway is minor (7%).**

Indeed, we agree that this sentence was incorrect. We have altered this sentence to read as:

"In o-cresol experiments, the dominance of products in both gas and particle phases having 7 carbon atoms suggest that the OH addition pathway that mainly leads to ring-retaining products, likely plays a major role in the o-cresol photo-oxidation, consistent with previous observations (Olariu et al., 2002; Schwantes et al., 2017)."

There are a number of identified typos and formatting errors of which some are listed below. This is not an exhaustive list and another effort at error checking should be made.

A thorough check has been conducted in the whole manuscript for formatting/linguistic errors.

- 6) **Line 220. cm-3 formatting**

The correction has been made.

- 7) **Line 636. "This" / "Thus"?**

"This" was replaced with "Thus" and the sentence now reads as:

"Thus potentially explaining the higher fraction of more volatile products with $\log_{10}C^=2$ compared to the other systems (Fig. 3 and 4)."*

- 8) **Line 644. OSc without overbar or subscript (This occurs elsewhere)**

The correction has been made throughout the manuscript, in line with the reviewer's comment #2.

- 9) **Line 724. "resulting into larger" / results in larger**

"Resulting into larger" was replaced with "results in larger" and the sentence now reads as:

"This suggests that the potential molecular interactions are results in larger, more functionalised products that have volatilities at the lower end of the SVOC range, decreasing the overall volatility of the mixture."

10) Line 728. "on SOA" / "in SOA"

“On SOA” was replaced with “in SOA” and the sentence now reads as:

“Previously, Emanuelsson et al. (2013) observed an increase in the volume fraction remaining (and thus a reduction on the volatility) in SOA formed from the mixing various anthropogenic and biogenic precursors reacting sequentially.”

11) Line 737. missing word

The sentence has been rephrased as:

“Previous studies have shown that the ambient OH reactivity (estimated by measurements of OH lifetime) was between ~ 10 and 116 s^{-1} (Whalley et al., 2016), while in our experiments, OH reactivity (calculated as the product of VOC concentration with reaction rate towards OH) was $\sim 404 \text{ s}^{-1}$ ”

12) Line 828. missing word

The word “two” has been added and the sentence now reads as:

“The two volatility estimation techniques showed substantial discrepancies in the obtained $\log_{10}C^$ values, highlighting the complexity in the deriving the volatility distribution and the need for further studies to investigate the thermal evaporation of the organics.”*

13) Throughout. "were having" / "had" and similar e.g Line 767

“were having” was replaced with “had” in that particular example (line 767), while further changes were made in the manuscript after a thorough check for similar grammar mistakes.