Comments on bg-2020-manuscript-version4

The authors have made a good effort in revising their manuscript and it is significantly improved. The issue of the headspace in the samples taken for DIC and O_2 does limit the impact of the overall work but I am loath to reject the manuscript on this basis for 2 reasons; (i) the same procedure was applied throughout the experimental design thus the data is still comparable (ii) it provides an opportunity to highlight the importance of the ramifications of including the headspace in future research of this type as it other works have not been clear about this issue in the past and it may be a wider practice in this research community to leave a headspace in the samples without being aware of the implications of this. It is noted that for BGD as the reviews are online then the community would gradually become aware of this issue even if the paper is not ultimately deemed publishable.

Line 226: What exactly were the safety concerns about using mercury chloride that gave rise to the 2 ml headspace? As it isn't explained below despite the statement on this line. It should be made clearer the dangers of using mercury and exactly how the sampling design came about. Was it the risk from overflowing the exetainer? It should also be reported how this procedure was done in the field or lab, as it should be all performed within a tray so spills are contained. Was this procedure carried out with a pipette or a syringe?

Line 250: Is there a possibility that the presence of such a high concentration of Hg^{2+} could have catalysed photoreduction of the CDOM (Luo et al., 2020)? This might lead to greater CDOM losses, it does not seem to have been considered in other works so it is hard to judge and the role or iron CDOM complexes is likely more important here but it is worth considering. It would help here to also explain in more detail how the mercury chloride impacted the CDOM measurements. Mercury chloride has been shown previously to have an absorption maximum around 305 nm (as seen for example in (Dash and Das, 2016)). This obviously would impact any optical measurements and in this case would also increase the amount of photons absorbed in the samples amended with Hg compared to those without and this facet of the work has not been commented on before it seems. It would be good to discuss then a possible alternative to mercury chloride that was optically clear.

Line 250: Information on the headspace in the bottles should be included here.

Line 254: It is not clear from the text if there is a headspace in the quartz tubes as well as for the exetainers (borosilicate vials). This information could be added here so that it is immediately clear how the experimental treatments differed.

Line 259: as for the previous comment.

Line 399: The inclusion of a headspace in the exetainers will also have reduced the apparent oxygen consumption in the samples by bringing introducing oxygen from the air into the solution contained in the exetainer. Thus, likely some of these samples may have been significantly lower in dissolved oxygen at the time of sampling. Handling of the samples (mixing) etc would also have been critical.

Line 532: As noted above the inclusion of a headspace in the exetainers will also have reduced the apparent oxygen consumption in the samples and then coupled with this approach will lead to a further underestimation of the DOC photo remineralization.

References cited:

Dash, H.R., Das, S., 2016. Interaction between mercuric chloride and extracellular polymers of biofilm-forming mercury resistant marine bacterium Bacillus thuringiensis PW-05. RSC Advances 6, 109793-109802.

Luo, H., Cheng, Q., Pan, X., 2020. Photochemical behaviors of mercury (Hg) species in aquatic systems: A systematic review on reaction process, mechanism, and influencing factor. Science of The Total Environment 720, 137540.