

Interactive comment on “The evolutionary behavior of chromophoric brown carbon during ozone aging of fine particles from biomass burning” by Xingjun Fan et al.

Anonymous Referee #1

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This manuscript, titled “The evolutionary behavior of chromophoric brown carbon during ozone aging of fine particles from biomass burning”, communicates an in-depth study of brown carbon particulate matter from three fuels, and the consequences of ozone aging. I am impressed by the depth of the study and the thoughtful discussion in the results section. I believe this work is well-suited for publication in Atmospheric Chemistry and Physics, however, I have three concerns that should be addressed before the manuscript be accepted for publication.

Major criticisms and questions

1. The ozone aging experiments are described as taking place for a set of “designed

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exposure times” (page 5, line 20). In the context of atmospheric aerosol aging, it is desirable (if not necessary) to equate reactor times to equivalent atmospheric aging. This is essential to drawing conclusions between laboratory results and in situ, real world observations. I am concerned that exposing the filters to 70 ppm of ozone is not strictly applicable to the real-world atmosphere, where concentrations exceeding 8 ppm are rare, and only found in the upper stratosphere. Some analogy between time spent in the reactor to time spent in the atmosphere would greatly strengthen this manuscript. Can this information be provided, along with the methodology used to derive it? The specific methodology may be relegated to the supporting information.

2. Quartz filters are known to collect some fraction of the gas phase (e.g., Parshintsev et al. 2011). Depending on how quickly the ozone aging was performed after filter gathering was performed (and the storage and handling methods of the filters), gas-phase artifacts (SVOCs and IVOCs especially) may be interacting with the reactor environment in ways that aren't fully explored in the manuscript. The authors should discuss this and other sources of filter artifacts.

3. On page 13, line 20, the authors state "The present study has confirmed that the bleaching of chromophoric BB-BrC dominantly occurs during O₃ aging..." While the authors have presented strong evidence that O₃ aging can certainly bleach BB-BrC, they present no evidence that it is the dominant mechanism for bleaching. In fact, on page 8, they present contradictory evidence from Kumar et al. (2018) who showed that the MAE365 values decreased by up to 2.3 times under OH radical aging, whereas in this study they showed a maximum decrease of 2.2. The authors should address this discrepancy, and provide a thorough meta-analysis of bleaching results from literature investigating different pathways and oxidants.

Minor technical corrections and clarifying questions Page 5 Line 3 – I suggest re-writing the final sentence to “BB particles were obtained from each of the three fuels.” Line 10 – I am unfamiliar with the term “glass garden”. Please explain what this is, and its specific use in the ozone aging experiments. Line 23 – replace “designed” with

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“designated”.

Page 6 Line 19 – replace “series” with “type”. Line 30 – remove “It is obvious that”.

Page 7 Line 13 – remove “It is obvious that”.

Page 11 Line 2 – Change “Detail” to “Detailed”.

References Parshintsev, J., Ruiz-Jimenez, J., Petäjä, T. et al. Comparison of quartz and Teflon filters for simultaneous collection of size-separated ultrafine aerosol particles and gas-phase zero samples. *Anal Bioanal Chem* 400, 3527–3535 (2011) doi:10.1007/s00216-011-5041-0

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