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Atmospheric Chemistry and Physics Discussions

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 #2

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General Comments:

The manuscript presents a laboratory study characterizing the evolution of chromophores and fluorophores of material collected in quartz filters during the combustion of rice straw (RS), corn straw (CS) and pine wood (PW) exposed to O3. The work interprets that O3 causes a reduction in light absorption and fluorescence of biomass burning (BB) brown carbon (BrC) material (captured in the filters), which is associated to a loss of aromaticity with a drop in average molecular weight. The manuscript needs some clarification and improvement in the writing and should considerably improve by connecting the findings with literature that is missing. Specific comments for a major

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revision recommended are provided below.

Specific Comments:

1) In the abstract (in page 1), there are some inaccuracies and confusing terms. For example, in l. 2, how much of "little is known. . ." really? There is some literature missing that has not been considered. In l. 4, what is the meaning of "the transformation of levels. . ."? In l. 11, what are the protein-like components of BB? Is there really much proteins or what do the authors want to explain in the manuscript? Finally, a strong statement is used in l. 27-30 but no connections has been directly provided in the manuscript about how to use the data to parametrize the optical properties of BrC in climate models.

2) Following p. 3 l. 11-29: When explaining that BB-BrC have been studied in the laboratory, the manuscript should connect to the work in the following seven papers by adding a short paragraph summarizing their findings: a) E.A. Pillar et al., Environ. Sci. Technol., 2017, 51, 4951-4959. b) J. Sun et al., Sun, Chem. Eng. J., 2019, 358, 456-466. c) E.A. Pillar et al., Environ. Sci. Technol., 2014, 48, 14352-14360. d) E.A. Pillar et al., J. Phys. Chem. A, 2015, 119, 10349-10359. e) A. Lavi, ACS Earth & Space Chem., 2017, 1 (10) , 637-646. f) A.C.O. Magalhães, ACS Earth & Space Chem., 2017, 1, 353-360. g) Pillar-Little, Environments (2018), 5(9), 104.

It would be fundamentally important to connect the findings of the aromatic structures in the above seven papers with the material in the revision at multiple points of the manuscript such as p. 7 l. 29 and l. 34; p. 9 l. 10, l. 18, and l. 25; p. 10 l. 1; p. 11 l. 10 and l. 15.

3) p. 4 l. 38: What is the metal for the metal mesh holding the biomass materials? What is the temperature of the combustor through operation? Is it constant or variable? Indicate in the revised manuscript.

4) p. 5 l. 1: What is the consideration for the gases adsorbed into the quartz filters?

L. 10: glass garden? Do you mean a terrarium? L. 13: Why is the ozone so high (70 ppm) and how is it environmentally relevant? Why is the relative humidity fixed at 40%? Explain in the revised manuscript.

5) p. 6 l. 2-3: Despite mentioning that more details are in the SI, provide literature references for the concepts of SUVA254, AAE, MAE365, and HIX.

6) p. 6 l. 24: Provide software version and company name that sell it.

7) p. 7 l. 37: Despite what is explained, it appears that in this work there is no soot. How is this point connected to the results?

8) p. 7 l. 12-24; p. 8 l. 12-13; and p. 13 l. 21: Changes in absorption with wavelength for chromophores and/or fluorophores, and the concept of photobleaching, have been investigated in the following seminal papers that introduced the ideas and should be discussed here with the addition of a few relevant statements: a) A.G. Rincon at al., J. Phys. Chem. A, 2009, 113, 10512-10520. b) A.G. Rincon at al., J. Phys. Chem. Lett., 2010, 1, 368-373. c) A.J. Eugene et al., J. Phys. Chem. A, 2016, 120, 3817-3826 d) S.-S. Xia et al., J. Phys. Chem. A, 2018, 122, 6457-6466.

9) p. 7 l. 34: What is the meaning of polycondensation? Clarify.

10) p. 30 l. 30: "...is in good..."

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