

## ***Interactive comment on* “Light absorption by polar and non-polar aerosol compounds from laboratory biomass combustion” by Deep Sengupta et al.**

### **Anonymous Referee #3**

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also see attached file

Review of ACP-2018-161

This study examined the optical and chemical properties of fresh and aged aerosols from laboratory biomass burning (BB). The effect of polarity, pH, molecular weight, biomass fuel type, and combustion conditions [flaming versus smoldering] on the aerosol optical properties were reported. The aged aerosols were produced in an oxidation flow reactor (OFR). The optical and chemical properties of the aerosols were measured using UV-Visible spectroscopy and high-resolution LC-MS, respectively. A spectrally integrated mass absorption efficiency was calculated, and Van Krevelen diagrams were used to visualize chemical information about the extent of oxidation. The study found that non-polar matter in the organic aerosols was more absorbing than the

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polar fraction; although, water soluble matter in the aged aerosol was more absorbing during flaming. Low pH aerosol was less absorbing than at neutral pH. The study also provided convincing evidence that the NO<sub>x</sub> formed during flaming combustion yields organic nitrogen compounds that are strongly absorbing at shorter wavelengths.

This is a useful, well-done study that is within the ACP scope. Biomass burning is an important source of organic aerosol in the atmosphere, and its optical and chemical properties are key to understanding the effects of aerosols on climate, air quality, and human health. The results presented are novel in that aerosol optical properties are measured after being fractionated in-bulk using multiple chemical methods. The investigation of fresh versus aged aerosol also produced an interesting contrast. The examination of peat is something that is in its infancy and more peat burning studies are needed owing to the increasing potential for peat mega-fires forming globally. Mostly, the chemical and optical data synched together nicely and evidence-based conclusions are given. Although, with so many variables, sometimes it was difficult to track the rationale underlying an experiment and the obtained results. The comments below are meant to produce further clarification regarding the experimental results. The paper may also benefit from a forward-looking statement that describes specifically where some of these results may be useful or applied. Such a statement can come in the summary or at the end of the introduction. After these minor revisions, the paper merits publication.

Additional comments:

1. P1, line 10: It sounds like BrC is the only light-absorbing component in BB aerosols. This opening sentence should be re-phrased for clarity sakes.
2. P5, line 23: Please describe the pre-firing technique (i.e., add a temp. and time).
3. P6, line 12: "and" should be or.
4. P7, lines 10 and on: It would be a good idea to tell us how much time it took to complete each type of burn and provide a better idea of the sample time weighting.
5. P7, lines 21-22: It's not clear why the NO<sub>2</sub>/m was handled this way. Is the assumption that the fuel burned the same over the entire test even though

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sampling time was limited? 6. P.9, lines 1-15: Where is the extraction efficiency calculation? It would be useful to see what fraction of aerosol was removed from the filter using each solvent? 7. P10, lines 6-8: This sentence needs to be clearer. 8. P11, lines 1-3: Same thing, this sentence requires clarification. 9. General comment: It would be beneficial if there was some additional discussion about what is expected to happen during the aging in the OFR. Was the OFR producing new particles? Or was it changing the existing particles via heterogenous chemistry? Or both? Which of these processes/mechanisms is likely to dominate? What are the particle loss characteristics of this specific OFR? With the knowledge that BB fuel types produced different aerosol types, is one aerosol type more susceptible to loss than another? More information that helps us assess these results should be added here. 10. P17, line 1-2: Revise this sentence for clarity. 11. P17, lines 13-15: Not 100% convinced about this. It may simply be that one is measuring less of something thus the uncertainty is a larger fraction of the measurement. 12. P17, lines 26-27: The fuels could have been tested for their N content. Are those data available? 13. Figure 5: Mention in the caption that this set of plots is for WSOC. 14. P21, lines 14-15: Regarding DBEs, it sounds like that bias is built into the measurement via the ionization chamber. Should that be further addressed? 15. P26, lines 11-13: Not sure Fig. 8 supports this observation in general for both aged and fresh aerosol. Please clarify. 16. P27, lines 15-18: Does it mean anything that smoldering biomass emits more per unit mass of fuel burned? We're getting deep into the manuscript now, and it may be good to remind the reader that everything is normalized to weight or volume or..... If it is? 17. Figure 10: Why was no attempt made to examine the hexane soluble extracts? May want to briefly raise this point in the Experimental section or while or after discussing the virtues of this result. 18. P25, lines 4-18: This discussion starts earlier at page 21 (lines 14-15), but doesn't really take off until here. 19. Figure 11: This is a nice summarizing figure. Although, why are only select experiments from the current study shown here? Consider showing all the experiments.

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Please also note the supplement to this comment:

<https://www.atmos-chem-phys-discuss.net/acp-2018-161/acp-2018-161-RC1-supplement.pdf>

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