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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Molecular composition and photochemical lifetimes of brown carbon chromophores in biomass burning organic aerosol" *by* Lauren T. Fleming et al.

Anonymous Referee #2

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This manuscript by Fleming et al. reports an investigation of the chemical nature of brown carbon (BrC) emitted from the burning of biomass fuels, including coniferous and flowering plants, as well as different ecosystem components including duff, litter, and canopy. Using a combination of analytical techniques, BrC chromophores are categorized into several classes: 1) lignin-derived, 2) distillation products, 3) nitroaromatics, and 4) polycyclic aromatic hydrocarbons. An extensive list of chromophores with their relative contribution to overall BrC absorption is presented. The study also investigates the evolution of the BrC chromophores due to photolysis-induced photobleaching. The major findings are that 1) the BrC absorption lifetimes are variable and dependent on the type of fuel burned and 2) other chemical aging mechanisms in the atmosphere,

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Discussion paper

such as OH oxidation, are more important in the evolution of BrC chromophores than photolysis. This paper provides substantial contribution to the understanding of the chemical nature and lifetime of BrC in biomass burning emissions. I encourage the authors to address the following comments:

1) The extraction procedure in the first paragraph of section 2.2 requires further elaboration. What is the rationale behind using the 3 organic solvents in these proportions? Is that based on an already established protocol? Have you verified that none of the BrC precipitates out of the water+DMSO mixture after evaporating the organic solvents? Why are there different extraction protocols for the fresh (water+DMSO) and photolyzed (only DMSO) particles?

2) Line 235: Along the same lines, why is the extraction procedure for UV-vis different from HPLC/PDA/HRMS?

3) The binning of the chromophores into Major, Intermediate, and Weak is informative, but can be confusing. I think it is helpful to stress that these categories involve the combined effects of abundance and absorption efficiency. For instance, an abundant chromophore with moderate absorption efficiency can exist in the same bin as a less abundant chromophore with high absorption efficiency.

4) In addition to integrating the DPA signal over 300nm – 700 nm, can the authors also report wavelength-dependent information? Are there significant differences in AAE across the different chromophores? If yes, integrating absorption over say 4 sections (UV, short visible, mid visible, long visible) can provide interesting information. For example, a chromophore under category W but with say a relatively large AAE might be an I or an M in the UV range.

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