**RESPONSE TO COMMENTS**

Title: "Comparison of water-soluble and insoluble organic compositions attributing to different light absorption efficiency between residential coal and biomass burning emissions"

Author(s): Zhang *et al.*,

***Reviewer-2***

**Comments:** In recent years, brown carbon is attracting more concerns due to its potential climate impacts. In this paper, the authors conducted a series of experiments covering various types of solid fuels, and discussed the light absorption properties of aerosol samples from these solid fuels based on chemical compositions on a molecular level. This study provides a wealth of information, and the molecular-level analyses of chemical compositions are pretty valuable for future studies. The scientific discussions are also of high quality. I recommend the publication of this manuscript if the following comments can be addressed.

**Response:** thank you very much for reviewing and valuable comments to improve the manuscript. We revised the manuscript accordingly. Please refer to the following point-by-point response.

**Comments:** 1. Suggest using "WIOC" instead of using "WISOC" throughout the paper, as the former is already widely used and accepted.

**Response:** noted, revised accordingly.

**Comments:** 2. Line 22-23: "sulfur-containing compounds (CHOS+CHONS, SOCs)": I suggest the authors use "SOCs; including CHOS and CHONS" to make the definition easier to follow.

**Response:** noted, the sentence on line 23 was revised as "*……while sulfur-containing compounds (SOCs) including CHOS and CHONS were more intense in the WIOC extracts……*"

**Comments:** 3. Line 30: high -> higher;

**Response:** noted, revised accordingly.

**Comments:** 4. Lines 58-59: this sentence needs re-writing.

**Response:** The sentence on lines 58-59 was revised as "*It was found that water-soluble BrC derived from bituminous coals had higher MAE values than anthracites (Tang et al., 2020). However, the specific chemical components responsible for the differences in light absorption among various fuel types are not yet fully understood at the molecular level.*"

**Comments:** 5. Lines 76-77: I assume the authors mean "fourteen types of coals, five types of biomass pellet, and twelve types of raw biomass"? Or numbers of samples? Please clarity.

**Response:** noted, the sentence on lines 76-78 was revised as "*In the present study, a total of fourteen types of coals with varying maturity degrees, five types of biomass pellets, and twelve types of raw biomass were examined using a laboratory combustion system. Two types of stoves, including a traditional stove (TS) and an improved stove (IS), were utilized for the experiments.*"

**Comments:** 6. Lines 80-81: I think the authors want to say the system is "equipped with monitor", but this sentence is not comfortable for reading in the current way it's written, i.e., equipped with pollutants? Suggest re-writing.

**Response:** noted, the sentence on lines 80-81 was revised as "*The combustion tests were performed in a specially designed system with real-time online monitors (Thermo Scientific Inc., Bremen,*

*Germany), which are capable of continuously measuring gaseous pollutants, including CO, $CO_2$, hydrocarbons, and nitrogen oxides ($NO_X$, including NO and $NO_2$).*"

**Comments:** 7. Line 92, "a 4.9 $cm^2$ was extracted…" I assume the authors mean the filter sample here?

**Response:** noted, the sentence was revised as "*……a 4.9 $cm^2$ filter was extracted……*"

**Comments:** 8. Lines 100-101, the determination of OC: was the OC measured using the same 4.9 $cm^2$ filter sample used for WSOC extraction? The authors need to clarify.

**Response:** noted, the sentence on lines 97-100 was revised as "*…The WIOC was determined by subtracting the WSOC from the total OC loaded on the same 4.9 $cm^2$ area.…*"

**Comments:** 9. Lines 121-122: two "selected" in the same sentence, please modify.

**Response:** noted, the sentence on lines 121-122 was revised as "*For further molecular composition analysis, the WSOC and WIOC extracts from seven selected source samples were subjected to Fourier-transform ion cyclotron resonance mass spectrometry (FT-ICR MS) coupled with electrospray ionization (ESI).*"

**Comments:** 10. Line 159: "in the range of 6.6±0.5 m2/g"... are these the highest and lowest values in this range, or the average?

**Response:** noted, the sentence on lines 159-160 was revised as: "*The $MAE_{365,\ WIOC}$ ranged from 0.49 to 6.6 $m^2/g$ with an average of 2.0±1.3 $m^2/g$.*"

**Comments:** 11. Line 166: "soluble OC"? Does it mean water-soluble, or methanol-soluble OC? I would assume the authors mean methanol-extracted OC in this study, as the authors were just discussing the MAE of WISOC in the previous sentence. Similar problem existed in Line 201, the "soluble BrC". Please clarify.

**Response:** noted, the sentence was revised as "*It was suggested that the MAE values of soluble OC including WSOC and WIOC were dependent on the chemical composition of OC, that is, the chemical structure of the light absorbing chromophores and the ratio of non-light-absorbing organics to the chromophore components (Cao et al., 2021)*" The "soluble BrC" on line 201 was revised as "*BrC in WIOC extract*".

- *Cao, T., Li, M., Zou, C., Fan, X., Song, J., Jia, W., Yu, C., Yu, Z., and Peng, P.: Chemical composition, optical properties, and oxidative potential of water- and methanol-soluble organic compounds emitted from the combustion of biomass materials and coal, Atmos. Chem. Phys., 21, 13187-13205, https://doi.org/10.5194/acp-21-13187-2021, 2021.*

**Comments:** 12. Lines 241-243, figure 2 captions: what do "TS" and "IS" stand for in the figure? The authors are suggested to modify all the figure captions, to provide clear, detailed descriptions of the figure information.

**Response:** noted, the figure captions were revised accordingly.

**Comments:** 13. The abbreviation of sulfur-containing compounds: sometimes the authors use SOCs, sometimes SOC (e.g., Lines 269, 272, and 283, etc.). Please keep consistent throughout the paper. Similar problem exist for "CRAMS", sometimes CRAMS, sometimes CRAMs.

**Response:** noted, that "*SOCs*" and "*CRAMs*" were consistently employed and maintained throughout the entire paper.

**Comments:** 14. Line 310: this is the first time the abbreviation of DBE occurred, please define.
**Response:** noted, the full name of "*the double bonds equivalent*" was added accordingly.