



EGUsphere, referee comment RC1
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Comment on egusphere-2022-585

Anonymous Referee #2

Referee comment on "Winter brown carbon over six of China's megacities: light absorption, molecular characterization, and improved source apportionment revealed by multilayer perceptron neural network" by Diwei Wang et al., EGU sphere, <https://doi.org/10.5194/egusphere-2022-585-RC1>, 2022

This manuscript described the light absorption, molecular characterization, and source apportionment of winter brown carbon over six China's megacities. The BrC light absorption coefficient and the mass absorption efficiency at 365 nm in northern cities were higher than those in southern cities by 2.5 and 1.8 times, respectively. The new method of Positive matrix factorization (PMF) coupled with multilayer perceptron (MLP) neural network analysis were used to apportion the sources of BrC light absorption. The results highlighted that primary emissions made a major contribution to BrC in six megacities. While secondary formation processes made a greater contribution to light absorption in the southern cities. The following comments should be considered to improve the manuscript.

1\ Line 42-44: "BrC... including incomplete combustion of fossil fuels, biomass burning, forest fires, and residential coal combustion (Kirchstetter et al., 2004; Shen et al., 2017; Soleimanian et al., 2020)". Avoid lumping references.

2\ Line 53: Avoid lumping references as in (Cheng et al., 2016; Kim et al., 2016; Mo et al., 2021; Shen et al., 2017). Instead summarize the main contribution of each referenced paper in a separate sentence. For example, "Furthermore, ... in Beijing (Cheng et al., 2016), Xi'an (Kim et al., 2016) ...biomass burning emissions."

3\ Line 63-64: Please briefly describe the results for BrC source elucidation in these literatures after this sentence.

4\ More references on BrC should be involved in the Introduction.

5\ Line 83-94: Please supplement the information about the sampling location, such as what is the main impact on the surrounding environment.

6\ Line 123: Please explain why the light absorption coefficient at 365nm was chosen as a representation of the light absorption characteristics of the BrC.

7\ Please unify to unit format, such as $\text{m}^2 \text{g}^{-1}$ and $\mu\text{g}/\text{m}^3$

8\ Line 154-156: "... this can primarily be attributed to substantial emissions from residential heating in winter in northern China." According to the above-mentioned average OC concentration in northern cities is higher than that in southern cities, it seems difficult to infer that this is caused by heating in northern China in winter. A more logical explanation should be that the burning of fuels used for winter heating in northern cities, such as coal, produces high OC values, resulting in higher OC values in northern cities than southern cities. Please make corresponding modifications.

9\ Line 157-158: Please add a description of the method for calculating POC and SOC using the EC tracer method in the Supplementary information.

10\ Line 191: "The aging or oxidation of aerosols was confirmed to be the major..." The word "was" should be "were".

11\ Fig 2. As I can see, the MAE_{365} is higher in Wuhan, can you give some explanation?

12\ What is the difference between the light absorption coefficient ($b_{\text{abs}365}$) and the mass absorption efficiency (MAE_{365})?

13\ Line 226-228: "...at the Nepal Climate Observatory-Pyramid (3.7–4.0; Kirillova et al., 2016) and in the Los Angeles Basin (4.82 ± 0.49 ; Zhang et al., 2013) ...Tibetan Plateau (8.2 ± 1.4 ; Zhu et al., 2018) ...". The AAE values should be compared in a similar wavelength range. Please add the wavelength range of fitted AAE values in all references cited here.

14\ Line 234-236: "... studies for coal combustion (5.5–6.4; Ni et al., 2021), biomass

burning (4.4–8.7; Xie et al., 2017), and gasoline vehicle emissions (6.2–6.9; Xie et al., 2017).” Please add the wavelength range of fitted AAE values in all references cited here.