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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Brown carbon absorption in the red and near infrared spectral region" *by* A. Hoffer et al.

Anonymous Referee #2

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Review of acp-2016-452

GENERAL REMARKS

The manuscript presents measurements of the light absorption coefficient of laboratory-generated tar balls in the near infrared spectral region. The authors investigated the absorption Ångström exponent (AAE) of the tar balls and analysed field data from AERONET in order to prove their hypothesis that tar balls make up a major fraction of atmospheric brown carbon (BrC). Although the reported observation of a significant light absorption cross-section of tar balls in the investigated spectral region is of interest for the research field of climate effects of carbonaceous particles, the manuscript over-interprets the presented data and the drawn conclusions are not justified.

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Discussion paper

The study refers to a large extent to the work presented in a previous publication (Hoffer et al., 2016). In that paper, the method of aerosol generation is extensively described and the physical and optical properties of the tar balls are discussed in detail. Since the material presented here does not warrant publication as a full research paper, it is recommended to publish it as Comment or Technical Note with a strong link to the above-mentioned publication.

SPECIFIC COMMENTS

1| New material presented in the manuscript refer to the measurement of the aerosol light absorption coefficient in the near infrared spectrum, i.e., Section 3.2. This section, however, requires major revisions for the sake of clarity of the presented results. In particular the discussion of the AAE determination and error analysis requires more details. It is also recommended to follow the comment by E. Lewis in the discussion section and to present the analysis of the wavelength –dependence of the absorption coefficients as a log-log plot. Only this kind of data representation allows a statement whether or not the wavelength dependence of the light absorption properties can be described by a single exponent.

Then, the calculation of the AAE needs more details. Currently size distribution and refractive index values are taken from Hoffer et al. (2016). At least, the values of the refractive index and the size distribution have to be shown in this manuscript. Furthermore, the section needs to be written in a more quantitative way. Currently, key statements, e.g., on the AAE (page 6, line 2) or on the mass absorption coefficient (MAC; page 6, line 9) are presented as “we propose, that. . .” and “was estimated”.

2| The section on the contribution of tar balls to the absorption at K-puszta station (Sec. 3.3) is speculative and confusing. When deducing the contribution of tar balls to atmospheric absorption from a comparison of Mie calculation and observations, a careful consideration of uncertainties from models and observations is needed for assessing the statistical significance of the results. In the given form, this is not possible. Con-

cerning the separation of light absorption by black carbon (BC) and by tar balls via the AAE approach, it is confusing to read the conflicting statements that the AAE of tar balls is between 2.7 and 3.6 (page 6, line 2) and that the AAE of tar balls and soot is almost similar (page 7, lines 1-4). Recall that fresh BC has an AAE of approx. 1.0.

3| The section on the AERONET data analysis (Sec. 3.4) is also confusing. The authors do not describe the site, where the analysed AERONET data set is originating from. Then, they report an AAE of 1.15 for biomass burning events, which is at the lower limit of the values given by Russell et al. (2010) from AERONET data. Russel et al. report AAE values of 1.11 - 1.45 for biomass burning plumes and 1.05 to 1.12 for urban smoke plumes which are dominated by BC. The AAE results of 1.13 – 1.20 in AERONET data presented in this study can be easily explained by assuming a mixture of BC and BrC. If the authors decide to keep the AERONET part in the study, a detailed discussion of measurement uncertainties and statistical significance of presented results is required. Furthermore, the concluding statement that tar balls are the main BrC type in biomass burning has to be withdrawn, unless reasonable justification is presented.

REFERENCES

Hoffer, A., Tóth, A., NyirÅŚ-Kósa, I., Pósfai, M., and Gelencsér, A.: Light absorption properties of laboratory-generated tar ball particles, Atmos. Chem. Phys., 16, 239-246, doi: 10.5194/acp-16-239-2016, 2016.

Russell, P. B., Bergstrom, R. W., Shinozuka, Y., Clarke, A. D., DeCarlo, P. F., Jimenez, J. L., Livingston, J. M., Redemann, J., Dubovik, O., and Strawa, A.: Absorption Angstrom Exponent in AERONET and related data as an indicator of aerosol composition, Atmos. Chem. Phys., 10, 1155-1169, doi: 10.5194/acp-10-1155-2010, 2010.

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