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Comment on acp-2021-585

Anonymous Referee #2

Referee comment on "Potential new tracers and their mass fraction in the emitted PM_{10} from the burning of household waste in stoves" by András Hoffer et al., Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2021-585-RC2, 2021

In combustion samples, the authors identify organic molecules that could serve as tracers for airborne particulate matter emitted from burning plastic. This article presents data on emissions organic compounds from plastic burning that may serve as chemical tracers of this source in the atmosphere. The article fits within the scope of ACP. The presentation of the article is organized and mostly clear. The scientific methods are described, but are missing validation data in their current form. The stove utilized in these tests should be further described, particularly to provide context to the emissions data and what they represent. The criteria used for recommending that a compound as a tracer needs clarification. Also, the ambient measurements of plastic burning tracers in Bucharest are currently only qualitative, indicating the presence of plastic burning tracers. Prior to publication, these data should be further analyzed quantitatively to gain insight to the amount of garbage burning and the types of plastic that were combusted. Then, more substantial conclusions could be reached.

- In their introduction (line 31), the authors should consider the estimates of waste burning presented by Wiedinmyer et al. in their 2014 article. This modeling study provides the estimates of municipal waste burned around the world (Wiedinmyer et al. 2014).
- In many parts in the manuscript, the authors refer to "illegal waste burning." In many parts of the world, waste burning is not illegal. I encourage the authors to either rethink labeling waste as illegal or to specify the domain that they are discussing.
- In the introduction at line 89-90 in discussing emission factors of 135-TPB, the authors should include results from Jayarathne et al. (2018). Relevant to this discussion, these authors determined TPB emission factors (among others) from plastic and waste burning (Jayarathne et al. 2018).
- The introduction of the paper should describe the stove utilized and its advantages and limitations in this study. In particular, please clarify what the emissions under investigation represent (e.g., geographic region, materials combused, stove design, etc.) Similarly, please discuss how representative these tests are of real world plastic and combustion.
- The term "relative emission factors" is uncommon and somewhat confusing. What the authors present is a mass fraction of organic compounds in PM. "Mass fraction (ug/g)" would be a more clear description.
- The methods description does not yet sufficiently validate the GCMS method.

Specifically, the authors should provide an assessment of the accuracy of the method. This is often done by spike recovery samples, in which a known amount of analytes is spiked onto the filter, extracted, and analyzed. The recovered concentration is then reported relative to the spiked concentration as a percent. This quality control test provides a way of determing how much of the target analyte can be recovered in sample preparation.

- The utilized internal standard was terphenyl, which has three aromatic rings. It appears that it may be semi-volatile and thus subject to evaporative losses during the extraction (especially drying under nitrogen). This could inadvertently bias the measurements of analytes with lower volatility to be higher. To show that there were not volatile losses, the authors should compare the response of the internal standard recovered from the extraction to that of the internal standard solution as prepared.
- The authors recommend many compounds as tracers of plastic burning (e.g., terphenyls at line 195; SSS at 223; section 3.1.5, 3.2). What, specifically are the criteria the authors use to recommend a compound as a tracer? It seems as though the authors seem only to consider the specificity in the samples. Whereas, prior studies have recommended the use of multiple criteria including specificity, gas-to-particle partitioning, atmospheric stability, and detectability in ambient samples.
- The authors should thermodynamically model the gas-to-particle partitioning of recommended tracers. Knowing the fraction in the particle phase at ambient temperature and pressure would build support for their use as PM10 tracers.
- The authors should quantitatively assess the analytical uncertainties associated with the measurements of these compounds in source and ambient PM10 samples.
- In the Bucharest samples (section 3.3), were these tracers identified based on their retention index or retention time of a commercial standard?
- Neither the methods nor the results sections report the date, year or season of the Bucharest PM10 sample collection. Please add this information, as appropriate, to each section. Also, please add discussion of any seasonal and meteorological significance (e.g., wintertime, stagnant conditions, etc.).
- What were the PM10 concentrations in these ambient samples? The tracer-to-PM10 ratio is useful to compare to the mass fractions in the source emissions.
- To Table 1, please add the target ion/qualifier ion ratio observed for commercial standards (i.e. in calibration solutions). This will give an indication of the value in a sample with minimal sample matrix.
- At line 324-324 a sentence begins "It can be seen…." And asks the reader to interpret Table 1. To help the reader in doing so, please mark the compounds that have good agreement versus those that do not, so that this is clear.
- It is suggested that the intensity ratios of the target and qualifier ions across the ambient samples and emission samples vary because of isobaric interferences coming from the sample matrix. Can the authors quantitatively assess how this bias may impact the reported concentrations of the analytes in Tables 1 and S2?
- At present, the ambient measurements are very qualitative and are discussed only in terms of their presence in 3 particular samples. These data should be analyzed more quantitatively to gain insight to the amount of garbage burning and the types of plastic that were combusted.
- In section 3.3, can the ambient measurements be used to estimate the contribution of garbage burning to PM10?
- Also in section 3.3, to what extent do the ratios of the plastic burning tracers indicate the types of plastic that were likely burned? In section 3.2, the relative amounts of established tracers were shown to vary with plastic type. What types of plastic are suggested by the relative amounts of these tracers in ambient PM10?
- To Table S2, please add PM10 emission factors, as well as organic and elemental carbon (OC and EC). These data would help in comparing these measurements to ambient and source samples in future studies.
- Figures – I agree with the other referee that seeing chemical structures for these organic molecules would be helpful. (I had to look them all up when reading, because

they are new to our field and are not yet commonly known.) One way to incorporate these into the paper is to include them in the existing figures in which their concentrations are shown. There appears to be ample white space for these to be added.

- Figures – The grayscale color scheme used in the figures is difficult to follow. In particular, the first and third gray colors are practically indistinguishable. Can the 1st be changed to black and the 3rd be changed to white, perhaps? This would provide better contrast.
- For many of the figures, only the sample(s) with the highest concentration(s) can be seen. To show the features of the samples with low concentrations, could these data be shown on a logarithmic scale?
- Please check, is it "rag" or "RAG"?
- Copy editing needed, some grammatical errors, other times words are missing.
- Figure captions – superscripting missing for units in Figure 1.

Works Cited

Jayarathne, T., C. E. Stockwell, P. V. Bhave, P. S. Praveen, C. M. Rathnayake, M. R. Islam, A. K. Panday, S. Adhikari, R. Maharjan, J. D. Goetz, P. F. DeCarlo, E. Saikawa, R. J. Yokelson and E. A. Stone (2018). "Nepal Ambient Monitoring and Source Testing Experiment (NAMaSTE): emissions of particulate matter from wood- and dung-fueled cooking fires, garbage and crop residue burning, brick kilns, and other sources." Atmos. Chem. Phys. **18**(3): 2259-2286.

Wiedinmyer, C., R. J. Yokelson and B. K. Gullett (2014). "Global Emissions of Trace Gases, Particulate Matter, and Hazardous Air Pollutants from Open Burning of Domestic Waste." Environmental Science & Technology **48**(16): 9523-9530.