Atmospheric
Chemistry
and Physics
Discussions

Interactive comment on "Emission factors for PM$_{10}$ and PAHs from illegal burning of different types of municipal waste in households" *by* András Hoffer et al.

Anonymous Referee #1

Received and published: 18 August 2020

Review of "Emission factors for PM10 and PAHs from illegal burning of different types of municipal waste in households". This work investigates the particulate emissions from the combustion of multiple types of household waste in a simulated wood stove environment. It provides an estimate of the particulate mass emissions and, possibly the first estimate of, PAH emissions from many common materials. I believe this work is within the scope of ACP as it provides insights into the magnitude and composition of non-traditional combustion emissions which could be used to support air quality regulations and modeling. The impact, and quality, of this manuscript, could be improved through a more careful explanation and presentation of the methods and results. Additionally, a few presentation issues (i.e. inconsistent abbreviation usage) need to be

addressed. Thus, I recommend this manuscript be revised before acceptance.

General Comments: Abstract: About 75% of the abstract is background (lines 15-23); the presentation of this work would be more impactful if more of the results were included in the abstract. I recommend more inclusion of the PAH and PM10 emission factors. 1. 57 and results: At first this statement seemed overly broad to me, but upon my own search of the literature I was unable to find many articles looking at emission factors for specific plastic wastes. I still believe the manuscript would be improved if the authors provided an additional discussion of the emissions of PM and PAH from waste mixtures. Or even emissions of other hazardous components from these wastes. These might provide additional perspective into the relative importance of the emissions of the tested materials. In the results section, discussion of the EFs you observe relative to other wastes would also be interesting. Specifically, for the PAH results. Are there any EFs which exist for PAHs for municipal/household waste mixtures? Could we say anything about which materials might be the most important contributors to total PAH or toxicity? 2. How the blanks/standards are treated is very important for accessing the accuracy of results in filter-based studies. I think this manuscript would benefit from additional detail regarding the methods. I've listed a few specific comments around this issue below. 137: What type of blanks are these? Are they just conditioned and unused filters? Or, are they a type of background measurement during times when the coal was being burned? 152: Is the PAH analytical method based on one found in literature or one that the authors developed? If it is from the literature, please include a citation. If it was developed by the authors, please include additional method validation data in the SI. 164: What about recovery from the filter? There is a relatively high potential for matrix effects in complex samples like those from combustion. The best way to account for these and get at the "true" recovery would be to spike a subset of filters (with particulate samples on them) with known concentrations of the target PAHs and examine the recovery including both filter extraction and any matrix effects. As performed, the QA/QC approach cannot account for these. If you are unable to perform these tests now, please provide a discussion of the actual

recoveries that other studies have observed for similar filter extraction techniques and how these recoveries may impact your conclusions.

3. The data EF data that the authors use is drawn from a diluted gas stream. This methodology makes sense given the high particle concentrations associated with combustion. That said, the authors should add additional discussion of how such a sampling method may affect their results. How do the authors think the cooling associated with dilution may affect the particulate mass and composition of the emitted particles? Is it reasonable to expect that this rate and magnitude of rapid cooling would also happen in the atmosphere? This process will affect gas to particle partitioning; do the authors believe this is important for the levels of PAHs or PM they observed?

4. The Authors introduce abbreviations in section 2.1, but do not consistently use them throughout the text. For clarity, I recommend using them any time material is referenced after the abbreviation is introduced.

5. The discussion of PAH's in the manuscript is limited to bulk EFs and estimated toxicity. One interesting finding that could be extracted from these data is the EFs of individual PAHs for specific substances. Although a complete discussion of these data may be beyond the author's scope, at least a cursory discussion of any patterns observed in PAH concentrations would be very interesting. For example, are there any specific PAHs that could be used as a tentative tracer of the burning of a specific waste? I also recommend adding a table of the emission factors of each PAH for each material, either in the supplement or main text. Such a table would add value to this text for the readers. This would also increase the usability of the data to those who are interested in applying it in future emissions studies

6. Results Section: I recommend adding SD values to any reported EF throughout the text. The only reason not to add these would be if there are too few measurements or that conditions were so different between tests that the experiments are essentially measuring different endpoints. If the latter, then these differences should be discussed

in detail. Additionally, there are many points in the results the authors state that their results are similar to those in literature when at first look the values are quite different (see specific comments below). This manuscript could be improved by further delving into the sources of these differences.

Specific Comments Introduction: As written the introduction is all one paragraph. I recommend separating this section into at least 3 paragraphs to help with readability. 47: Be sure to spell out abbreviations the first time they are introduced (OSB here) throughout the text. 49-51: This line repeats much of what is said in line 47. 51-52: This statement should be supported by references since it is essential to the motivation for this work. 53-55: Please clarify what specified means in this context. Do you mean that these emissions are not included in emissions inventories? If so, please provide examples and/or references. 55: Do these reports from NGOs provide any estimations of magnitude? If so, it would be interesting to see them reported here. 53-55: This line is slightly contradictory since it states that emissions are not regulated but are illegal. I would interpret "illegal" as a form of regulation. Do you mean there's no enforcement? 64,65: Add citation for PAH carcinogenic and mutagenic properties. 68-69: Please clarify what you mean here by a single study. Do you mean a single study reporting EFs of PM2.5 and PAHs or a single study with plastic waste in an industrial boiler? What about emissions factors from bulk household waste combustion? 74-102: Some abbreviations are introduced twice here. I would remove the first instance (starting at line 74) or use the abbreviations after they are introduced. 109: As written this sentence is slightly confusing. I believe the authors are trying to communicate that burn conditions were variable, but later they report relatively consistent burning temperatures. 140: Which parameters? 186: For clarity, I recommend using the abbreviations you introduced in your methods throughout the results section. Also, include the EFs for RAG here since they have been included for the other materials. 186-187: If they exist, also report the standard deviation of all measured EF values. 190: Please explain how these values are similar. As written, it looks like the values reported here are $\sim$2x the values found in the literature. 208: Capitalize RAG 212: Your values do not

seem similar to the literature values as you stated. Please comment on the differences. 219-220: I think these are referring to the emissions relative to wood. Using the word "increased" here is confusing because it makes it sound like something is causing the change. I recommend modifying this sentence for clarity. 227-232: add SDs to the reported PAH emission factors. 246: This is a very interesting result, I recommend highlighting it in the abstract. Conclusion: Again, add SDs to all reported EFs.

Figure 2: Clarify which axis is for which CO_2 measure. Although this can be deduced by the reader, it should be explicitly stated. Additionally, it would be interesting the highlight the filtering times on this figure. Tables 1-3: It would not be too difficult, and would increase the clarity of the presentation, to combine all three of these tables into one. This would give the reader a single point where they can access all the results of the study as opposed to the current presentation where they need to jump between 3 different tables.

Interactive comment on Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2020-672, 2020.