

Atmos. Chem. Phys. Discuss., referee comment RC1  
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## Comment on acp-2022-535

Anonymous Referee #1

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Referee comment on "Chemically distinct particle-phase emissions from highly controlled pyrolysis of three wood types" by Anita M. Avery et al., Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2022-535-RC1>, 2022

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### General comments

This paper by Avery et al. attempts to understand the contribution that pyrolysis makes to the emissions from biomass burning in the form of aerosol production from different wood types. This is important because pyrolysis underpins the processes of combustion and understanding the yield and composition of aerosols from it is important for assessing impacts on climate and human health. This paper examines typical fragments in mass spectra generated by an aerosol mass spectrometer to detail the patterns in terms of yields and emission factors, and tries to explain the processes occurring that make up the aerosols that are measured. It builds upon the experimental work conducted by Fawaz et al. (2021) who characterise the pyrolysis chamber used in the experiment to answer questions as those posed in this paper.

Although the paper attempts to address relevant questions, and produces some interesting and new insights, I find its conclusions weak based on important information missing from the manuscript. Most importantly, is the number of replicate runs done in this study. In lines 169-171 it mentions running one wood type in duplicate only. There is no mention as to how many replicates of the other two woods were examined at the different temperatures and sizes. Indeed, in Table 1, which the authors state in L179 is a full list of experimental conditions, the duplicate results are shown for the one wood type but the other woods and conditions are only shown as one replicate. Also, several of the graphs only show one line for some of the experimental conditions but two for the material that was stated to be run in duplicate. If only one replicate was run, then the lack of replication in the experiment does not give me confidence in the findings of this study and undermines statements made by the authors about high reproducibility.

### Specific comments

L71-76: This is your aim of the study. I suggest moving this to the end of the introduction

L101-103: What is the relevance of mentioning PMF? It's not a technique you use in this study.

L104-109: This reads as justification for methodology. I'd suggest moving this to the methods section.

L127-128: What is the relevance of this statement? You don't do modelling in this paper.

L134-137: Like L71-76, this is part of your aims of the study. I'd suggest moving it to the end of the introduction.

L151-152: Missing reference for the pyrolysis temperatures of cellulose and hemi-

cellulose.

Section 2.1: The title for this section needs to include material characterisation. All, I would expect some basic characterisation of the wood to have been presented. For example, density, proximate or ultimate analysis, cellulose, hemi-cellulose, and lignin contents. The compositional data would be important for explaining f60 and f73 results, for example.

L167-168: The Genus (in Genus species) should start with a capital letter

L176-179: You talk about changing the dilution ratio but don't describe how (either here or in the supplemental material). This is important to know in order for this experiment to be replicated.

L191: Who is the developer of the Squirrel and Pika? Please insert details.

Table 1: Description of abbreviations is not given in the legend. Also, the asterisk seems to have been used for two different purposes. These needs changing for one use and the other use described with the appropriate symbol. Also, what do the plus/minus values represent? Standard deviations, ranges?

L274: Reproducibility should be repeatability – you are using the same equipment, materials etc., all within the same timeframe. However, what metric are you using to demonstrate this? You don't present one.

L278-279: How did you calculate your uncertainties? A comment in the methods section is needed to explain this.

L321 – 323: You need a reference to the FIREX campaign.

L443 – 446: How did you make this connection? Having characteristics of the wood would substantiate this comment.

L520 – 522: What is the implication of this finding?

L523 – 528: If this is important to show why is the graph in the supplementary materials?

L553 – 556: What you are suggesting is coupling the AMS to thermogravimetric analysis (TGA) which is a common technique for pyrolysis studies. There are an abundance of studies on TGA and gas analysis which you could cite, but not on aerosols and their composition.

Figure S3: There is no explanation in the legend of the dashed line at 0.3% being the background f60 as described by Cubison et al. (2011). Nor is there an explanation that the solid lines are the expected relevant ratios for the atmosphere.

Technical comments:

All tables: Does not match the formatting requirements for the Journal i.e your use of vertical lines.

All tables and graph: What are the number of independent samples?