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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Transformation of logwood combustion emissions in a smog chamber: formation of secondary organic aerosol and changes in the primary organic aerosol upon daytime and nighttime aging" *by* P. Tiitta et al.

Anonymous Referee #2

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The manuscript by Tiitta et al., is a very good piece of work presenting important findings on the dark and UV ageing of emissions from small-scale log wood combustion. The study investigates the ageing of primary emissions and the formation of secondary particulate matter using a state-of-the-art experimental facilities and measurement and analytical techniques. The paper is certainly within the remit of ACP and a revised manuscript should be considered for publication after the following comments are addressed:

A. General comments:

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Discussion paper

1. Given that a substantial amount of discussion in the manuscript is made within the context of fast vs slow ignition, the authors should dedicate a paragraph in the results section to discuss the main differences between the two methods in terms of emission profiles in order to help and guide the reader throughout the discussion.

2. PMF Factors: The SOA2 factor suggested to be a result of NO3 chemistry should only be important during dark ageing experiment. The fact that the concentration of this factor remain high (or even slightly increase) in Figure 5 suggest that other oxidation sources are important to its formation or that the light source in the chamber does fully represent day time chemistry in the troposphere. This should be discussed and clarified in the revised manuscript. On a related note, the correlation between SOA2 and NO3 mass in Figure S5 should be supplemented by more information showing (perhaps a lack of) relationship between nitrate and SOA1 and SOA3 in order to confirm the argument suggested by the authors.

B, Minor comments:

1. Page 1, line 21-22: statement about substantial contribution from SOA from small scale wood combustion to global atmospheric PM matter needs to be supported and referenced in the introduction. This issue is more likely to have local/regional impact. In either case, references should be added to support a correct statement.

2. Page 1, line 24: replace “deployed” with “used”, “employed” or “utilised”

3. Page 2, line 21: the phrase “and internally mixed” should be removed from this sentence. The mixing state of these components is not universal and it is known to change depending on source and conditions.

4. Page 3, line 13: change “generateproducts” to “generate products”

5. Page 6, line 3-4: What is the relevance of the extra statement on OH concentrations in China to this study?

6. Page 7, line 15: References should be made to two very recent and important

studies in this area by (Ye et al., 2016 and Krechmer et al., 2016).

7. Page 10, line 21-22: The authors should comment on whether or not the small increase in SO2 from 1.5ppb to 2.5ppb from HONO addition is sufficient to explain the increase in SO4 particle mass from about 1 to 5 ug/m3 shown in Figure 2b?. A comment about the nature of the sulphate particles should be made given the remark made in the manuscript about a “lack of base such as NH3” (page 13, line 21).

8. Page 13, line 16-18: The direct connection made by the authors between the “level of oxidation” and “volatility” of the different types of SOA is not really supported by any volatility measurements in this work. Although it is true that other papers in the literature have made such association for other types of particles (e.g. ambient), it is advised that these statements are either supported directly by measurements or to be appropriately toned down.

9. Page 14, line 9-10: The comment regarding a sharp decrease in POA1 after the UV lights were switched on is not consistent with data shown in Figure 5; none of the plots in this figure show a sharp decrease in POA1. This should be clarified and revised.

References: Krechmer, J. E., Pagonis, D., Ziemann, P. J., and Jimenez, J. L.: Quantification of Gas-Wall Partitioning in Teflon Environmental Chambers Using Rapid Bursts of Low-Volatility Oxidized Species Generated in Situ, Environmental Science & Technology, 50, 5757-5765, 10.1021/acs.est.6b00606, 2016.

Ye, P., Ding, X., Hakala, J., Hofbauer, V., Robinson, E. S., and Donahue, N. M.: Vapor wall loss of semi-volatile organic compounds in a Teflon chamber, Aerosol Science and Technology, 50, 822-834, 10.1080/02786826.2016.1195905, 2016.

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