

Interactive comment on “Particle size distributions from laboratory-scale biomass fires using fast response instruments” by S. Hosseini et al.

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Authors appreciate the reviewer's comments.

Anonymous Referee #2 Received and published: 5 June 2010 The manuscript presents results of a test facility study focused on measurements of particle emissions from burning of different biomass fuels. Obtained particle size distributions (PSD) were measured using fast FMPS and APS particle counting instruments and then were analyzed with respect to burning conditions (modes). Authors suggest and discuss novel approach for data analysis and presentation which employ plots of modified combustion efficiency vs. geometric mean diameters of PSD and assessment of characteristic trends (slopes) observed in those plots. Presented data is novel and therefore can be considered as a subject for the ACP publication. The manuscript can be published

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after the authors will have chance to address a number of issues listed below. Major issue: I second the point raised by the first reviewer that in its present form the manuscript does not contain sufficient information about employed measurement techniques. Their fundamental concepts of operations need be presented and discussed in a context of presented data analysis and interpretation.

=> Answered in the response to the reviewer #1.

Minor comments: I think that Fig 9 could be presented with better clarity, if an entire PSD (not only mean size) would be plotted in a form of 3D plot, i.e. X-axis - MCE, Y-axis - Dp, Z- axis – color coded concentration of particles in different size bins.

=> To our knowledge the suggested 3D graph is impossible. We instead showed time course in the revised Figure 9.

Presentation of Fig 6 requires detailed discussion of differences in mobility and aerodynamic sizes, especially for flaming cases where fractal soot particles dominate emissions.

=> As mentioned in the answer for reviewer #1, we have not observed fractal like particles in the range the APS measures. Also the overlapping size range between the FMPS and the APS are minimal therefore we do not aim to convert aerodynamic diameter to mobility diameter. Instead we conducted error analysis as the reviewer #1 suggested and calculated uncertainties in calculating APS determined mass percentage to the total volume.

Presentation and comparative discussion of combined (FMPS and APS) data for representative flaming and smoldering cases is suggested. Perhaps, interpretation of the time dependent data shown in Figs 7 and 8 can be better assisted and emphasized if corresponding values of MCE were also presented as a function of time for emissions during those selected burns.

=> Below is MCE vs time graph corresponding to Figure 7ab, which will be added to

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Figure 7. Right after ignition CO₂ concentration increases and that leads to increase in MCE. After the MCE reaches nearly one it starts to decrease because $\Delta \text{CO}_2 / \Delta \text{CO}$ decreases. During smoldering phase, $\Delta \text{CO}_2 / \Delta \text{CO}$ increases again mainly due to decrease in ΔCO , which leads to increase of MCE value. The MCE value reaches plateau toward the end of smoldering phase.

=> During flaming phase significant amount of particle emissions occurs for the size range both instruments (FMPS and APS) measure. It is important to note that emissions of ultrafine particle ($D_p < 100 \text{ nm}$) reduces significantly as the combustion phase progresses from flaming, mixed to the smoldering. On the other hand high concentration of particles between 0.5 and 1 μm range persist during flaming, mixed phase and even past smoldering until 400s in Figure 7a. It is noteworthy that near the end of smoldering phase ultrafine particles show bimodal distribution clearly.

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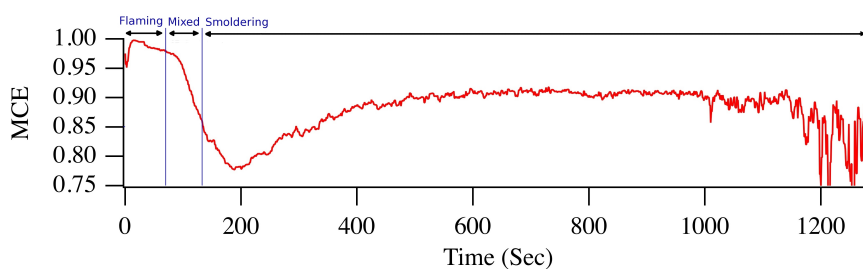


Fig. 1. New addition to the original figure 7

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