

Supplementary Information

Water Uptake by Fresh Indonesian Peat Burning Particles is Limited by Water Soluble Organic Matter

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S1. A brief introduction to the HTDMA setup

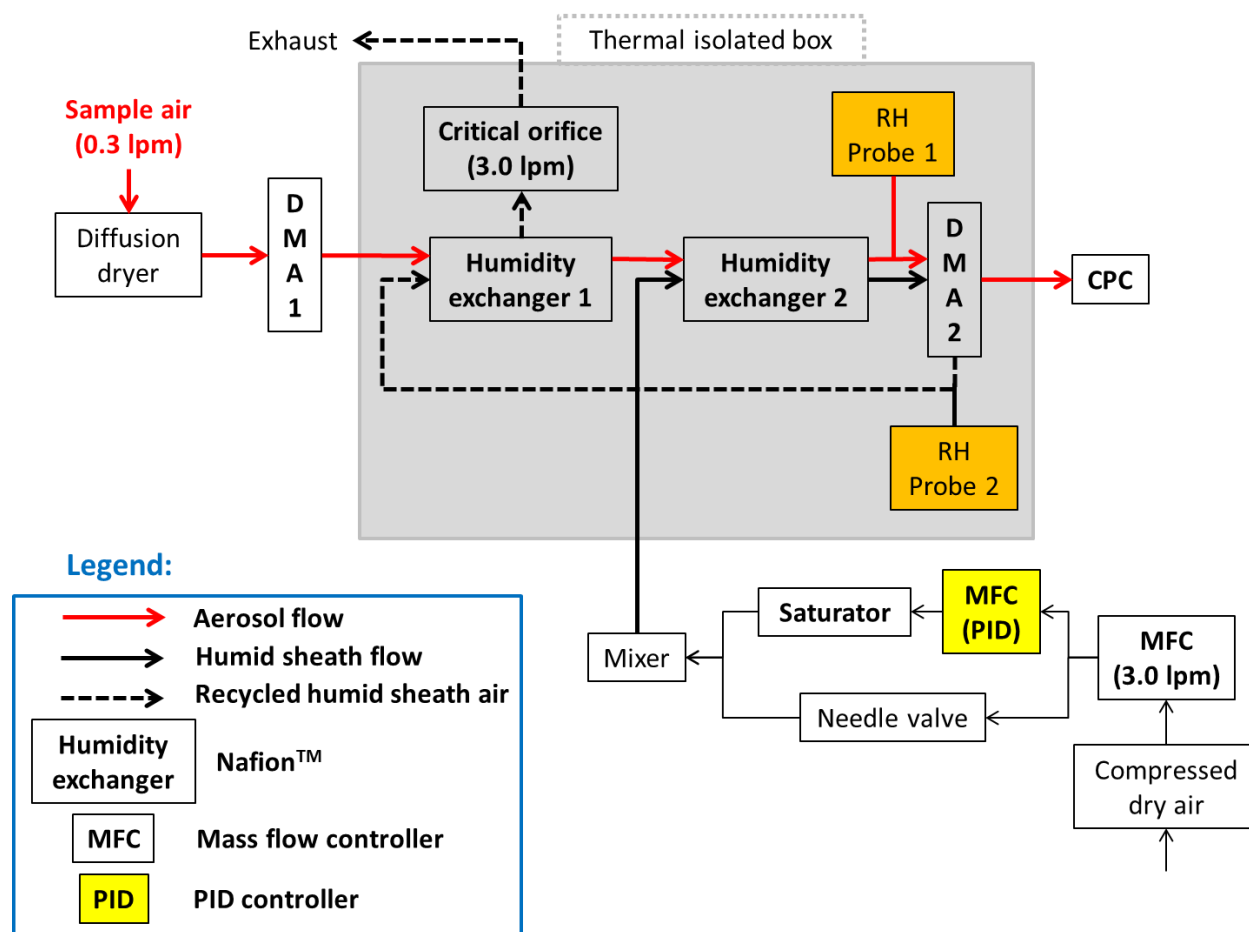


Fig.S1 Schematic diagram of the HTDMA system.

S2. RH stability in the humidified DMA (DMA2)

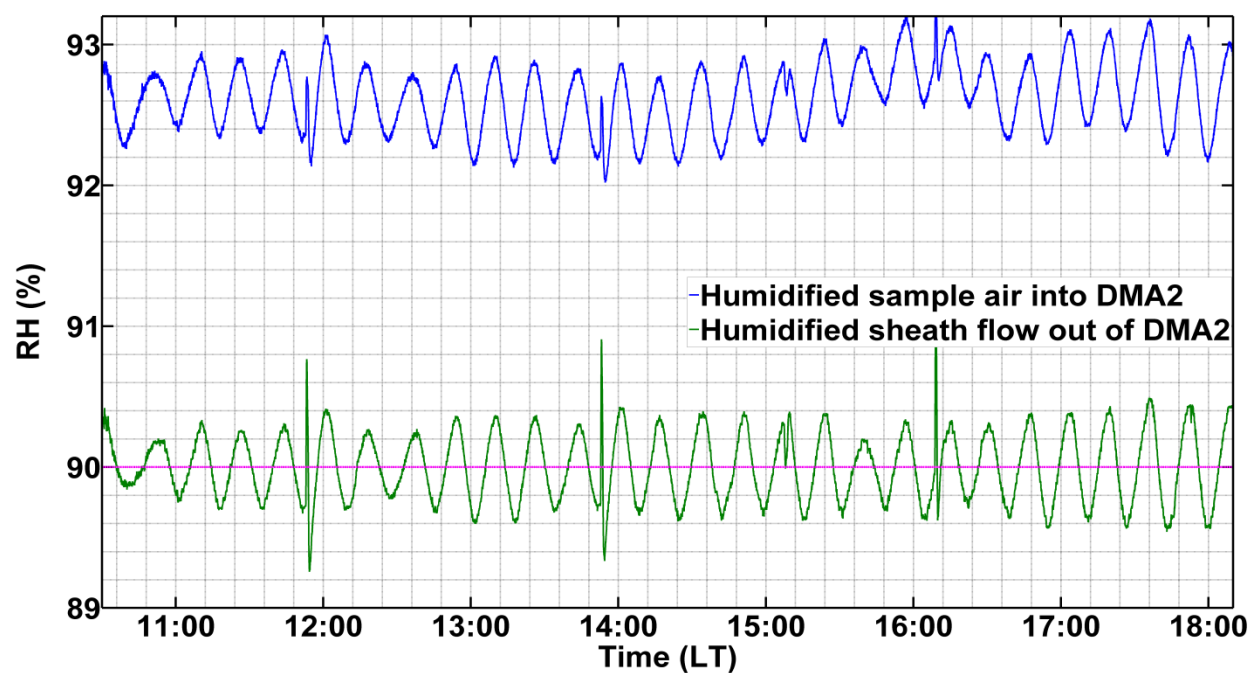


Fig.S2 RH recordings of both humidified sample air and humidified sheath flow are both fluctuating within $\pm 1\%$ RH (peak-to-peak). RH of the sample flow is always higher than that of the sheath flow. The magenta line denotes the RH set point of 90%.

S3. Comparison of normalized particle number size distributions measured with the HTDMA system

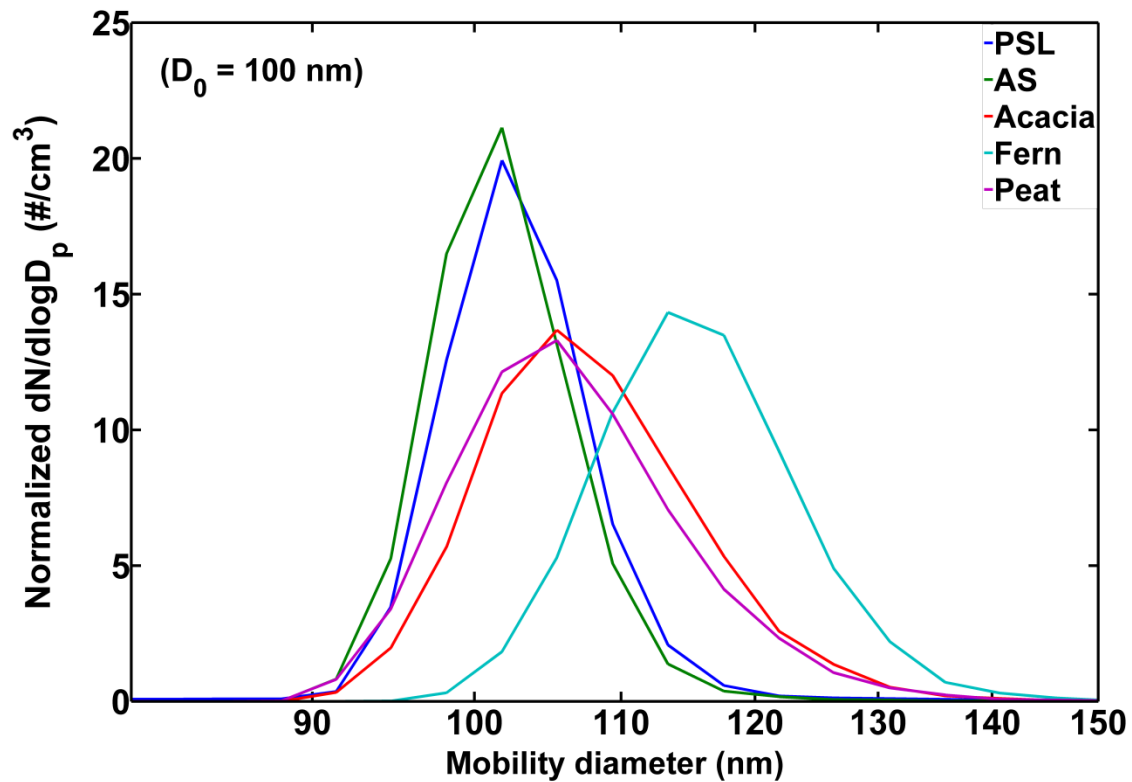


Fig.S3 Normalized particle number size distributions of 100 nm PSL and ammonium sulfate (AS) particles under dry scans ($RH < 10\%$), and of 100 nm peat, acacia, and fern burning particles following humidification ($RH = 90\%$) measured with the HTDMA system.

S3S4. ¹H NMR measurements

NMR samples were prepared by dissolving particles collected on a filter in either CDCl₃ or D₂O. CDCl₃ dissolves most of organic compounds, including both water soluble and insoluble species. On the other hand, only water-soluble organic species will dissolve in D₂O (Decesari et al., 2000; Graham, et al., 2002). The NMR spectra were measured using Bruker AMX-300 spectrometer at 300 MHz frequency.

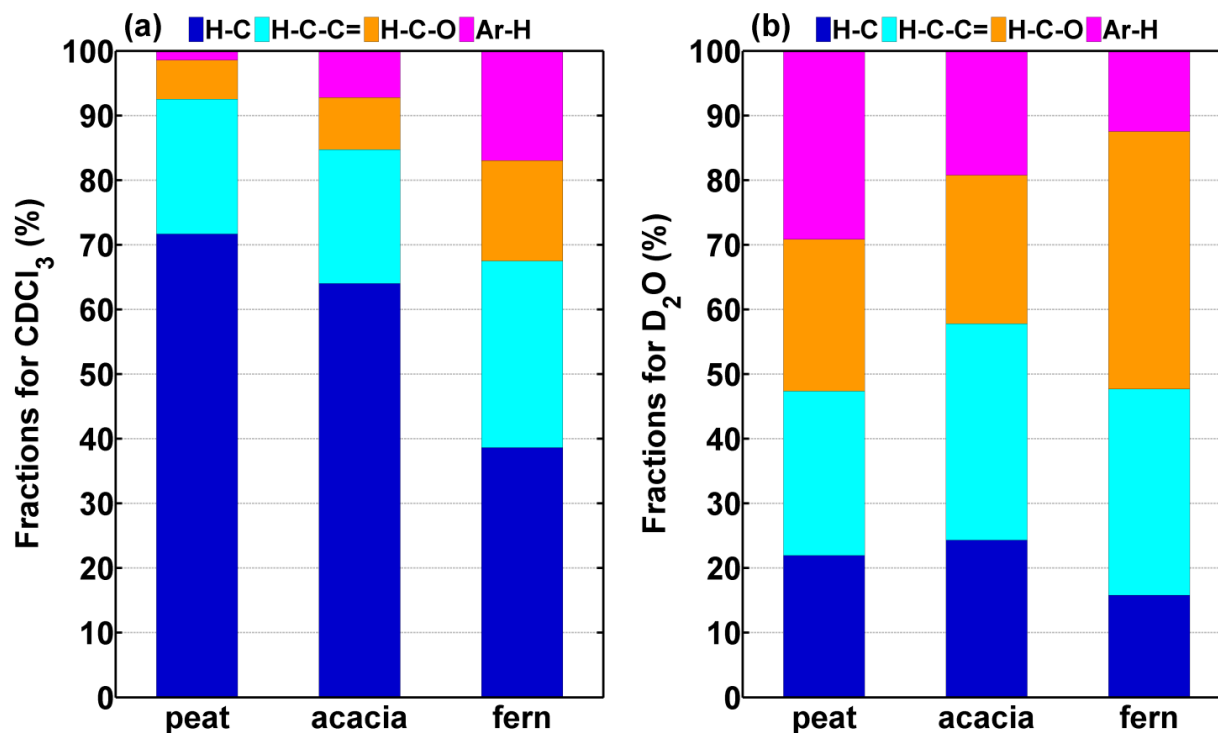


Fig.S3-S4 Functional group analyses for peat sampled from a burnt area (Riau-1), acacia and fern burning particles with (a) CDCl₃ and (b) D₂O, respectively. Four major functional groups identified from ¹H NMR analysis indicate that aliphatic compounds containing the H-C structure are the most abundant in fresh Indonesian peat, fern and acacia burning particles, while oxygenated compounds containing the H-C-C= and H-C-O groups are more likely to dominate in water soluble organic materials (Lee et al., in preparation). An example of the corresponding ¹H NMR spectra for peat burning particles dissolved in CDCl₃ can be found in Kuwata et al. (2017). Note that the NMR result of the peat sample in the D₂O case is only qualitative due to very weak signals were detected.

S4S5. Correlations between κ and OM mass spectra (mainly focusing on f_{44} and f_{60})

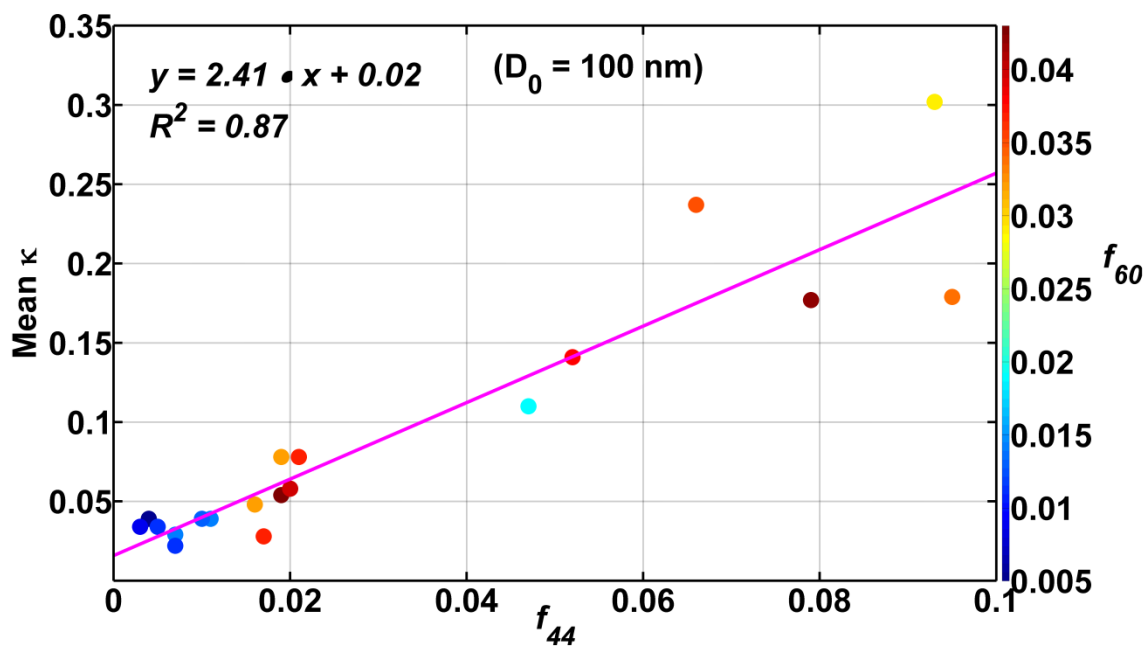


Fig.S4–S5 Correlation of κ and f_{44} for all the online and offline measurements.

References:

Decesari, S., Facchini, M. C., Fuzzi, S., Tagliavini, E. (2000). Characterization of water-soluble organic compounds in atmospheric aerosol: A new approach. *J. Geophys. Res. Atmos.*, 105: 1481-1489.

Graham, B., Mayol-Bracero, Olga L., Guyon, Pascal, Roberts, Gregory C., Decesari, Stefano, Facchini, M. Cristina, Artaxo, Paulo, Maenhaut, Willy, Köll, Peter, Andreae, Meinrat O. (2002). Water-soluble organic compounds in biomass burning aerosols over Amazonia 1. Characterization by NMR and GC-MS. *J. Geophys. Res. Atmos.*, 107: 8047.

Kuwata M., F. M. Kai, L. Yang, M. Itoh, H. Gunawan, and C. F. Harvey. (2017). Temperature and Burning History Affect Emissions of Greenhouse Gasses and Aerosol Particles from Tropical Peatland Fire. *J. Geophys. Res. Atmos.*, 121: 1281-1292.