Supplementary Information

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

Jing Chen[1, *], Sri Hapsari Budisulistiorini[1], Masayuki Itoh[2], Wen-Chien Lee[1, 3], Takuma Miyakawa[4], Yuichi Komzaki[4], LiuDongQing Yang[1], and Mikinori Kuwata[1, 2, *]

[1] {Earth Observatory of Singapore, Nanyang Technological University, Singapore}

[2] {Center for Southeast Asian Studies, Kyoto University, Japan}

[3] {Division of Chemistry and Biological Chemistry, Nanyang Technological University, Singapore}

[4] {Japan Agency for Marine Science and Technology, Japan}

* Correspondence to: chen.jing@ntu.edu.sg; kuwata@ntu.edu.sg

S1. A brief introduction to the HTDMA setup
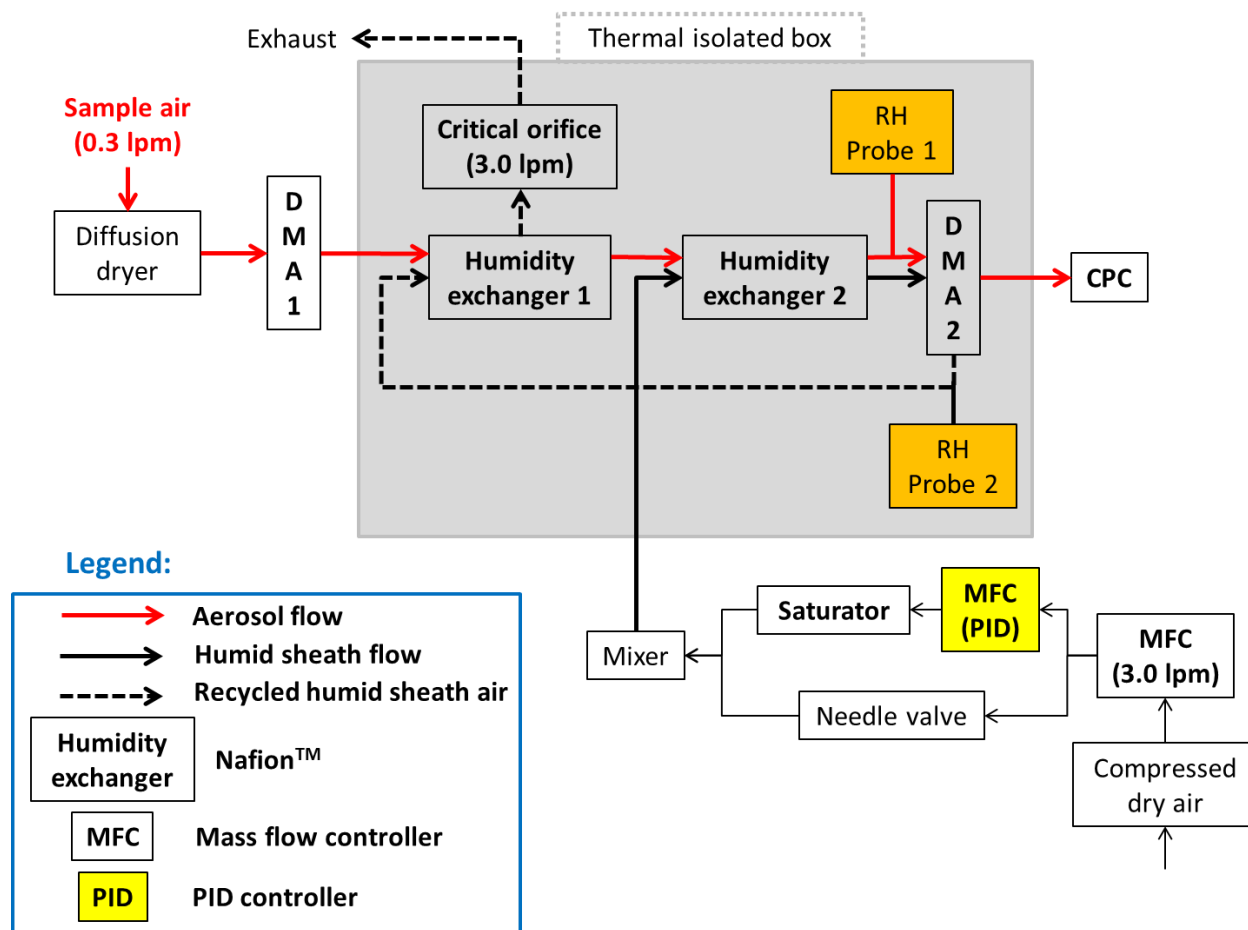
Fig.S1 Schematic diagram of the HTDMA system.

S2. RH stability in the humidified DMA (DMA2)
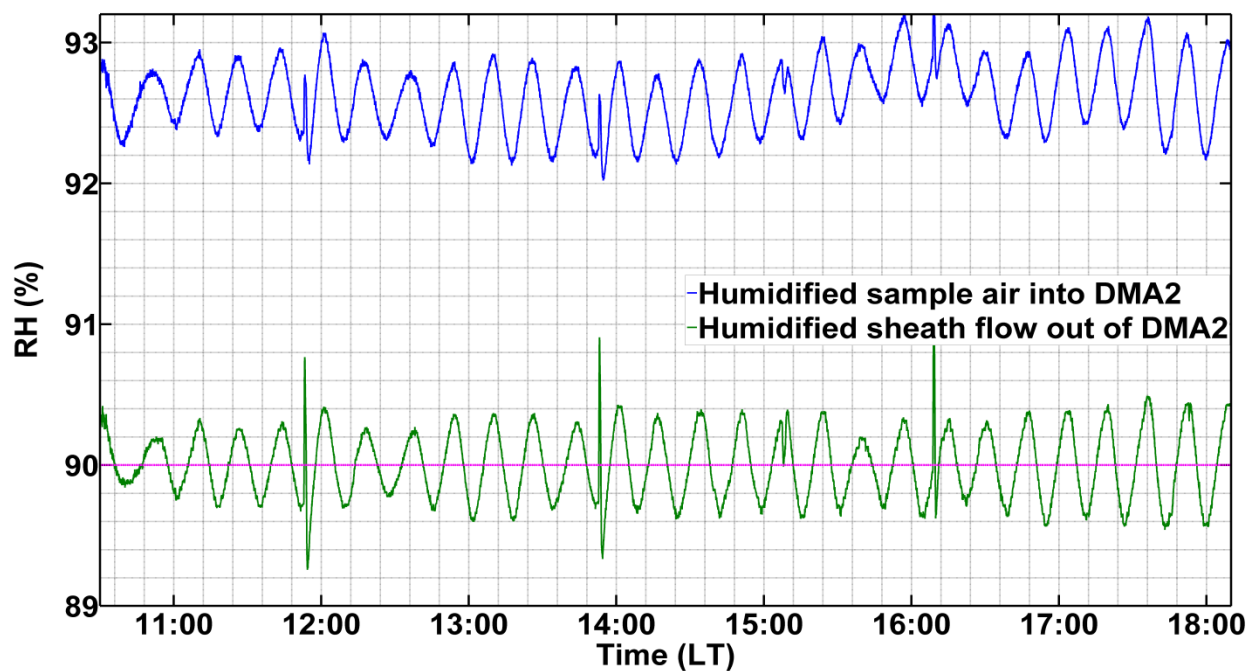
Fig.S2 RH recordings of both humidified sample air and humidified sheath flow are both fluctuating within ± 1% RH (peak-to-peak). RH of the sample flow is always higher than that of the sheath flow. The magenta line denotes the RH set point of 90%.

S3. ^{1}H NMR measurements

NMR samples were prepared by dissolving particles collected on a filter in either CDCl$_3$ or D$_2$O. CDCl$_3$ dissolves most of organic compounds, including both water soluble and insoluble species. On the other hand, only water-soluble organic species will dissolve in D$_2$O (Decesari et al., 2000; Graham, et al., 2002). The NMR spectra were measured using Bruker AMX-300 spectrometer at 300 MHz frequency.
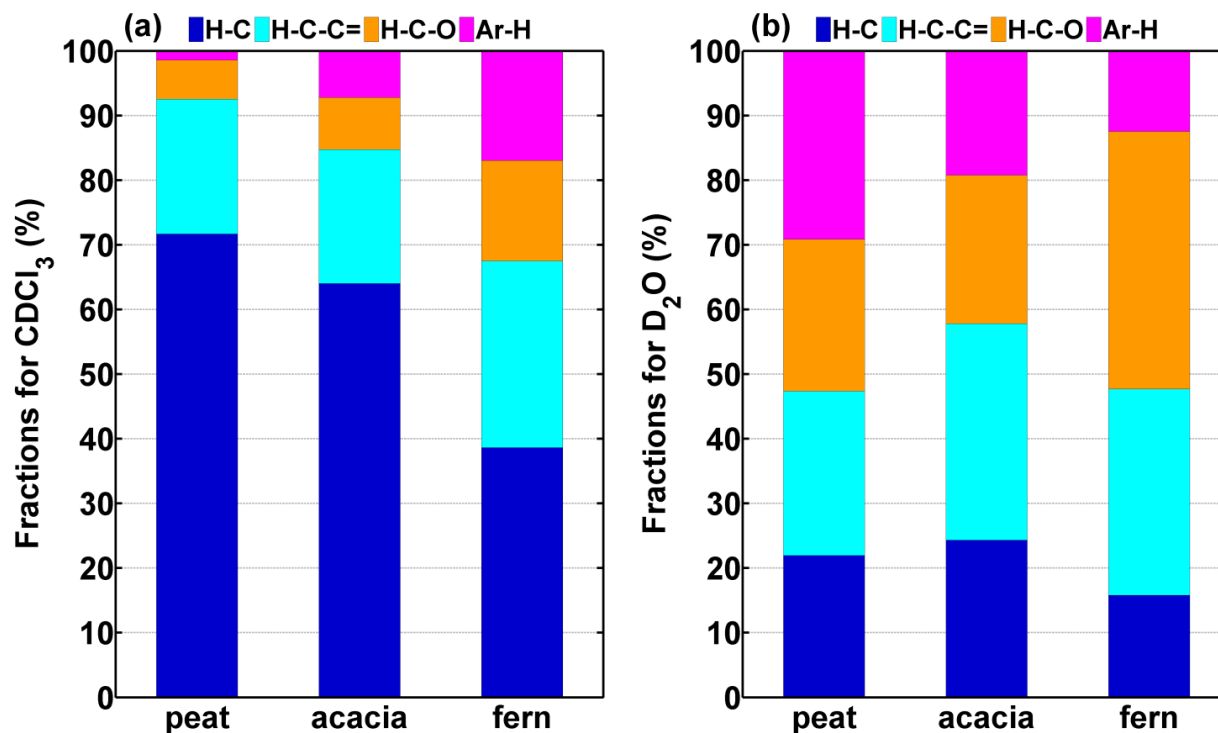
Fig.S3 Functional group analyses for peat sampled from a burnt area (Riau-1), acacia and fern burning particles with (a) CDCl$_3$ and (b) D$_2$O, respectively. Four major functional groups identified from ^{1}H NMR analysis indicate that aliphatic compounds containing the H-C structure are the most abundant 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 ^{1}H NMR spectra for peat burning particles dissolved in CDCl$_3$ can be found in Kuwata et al. (2017). Note that the NMR result of the peat sample in the D$_2$O case is only qualitative due to very weak signals were detected.

S4. Correlations between κ and OM mass spectra (mainly focusing on f_{44} and f_{60})
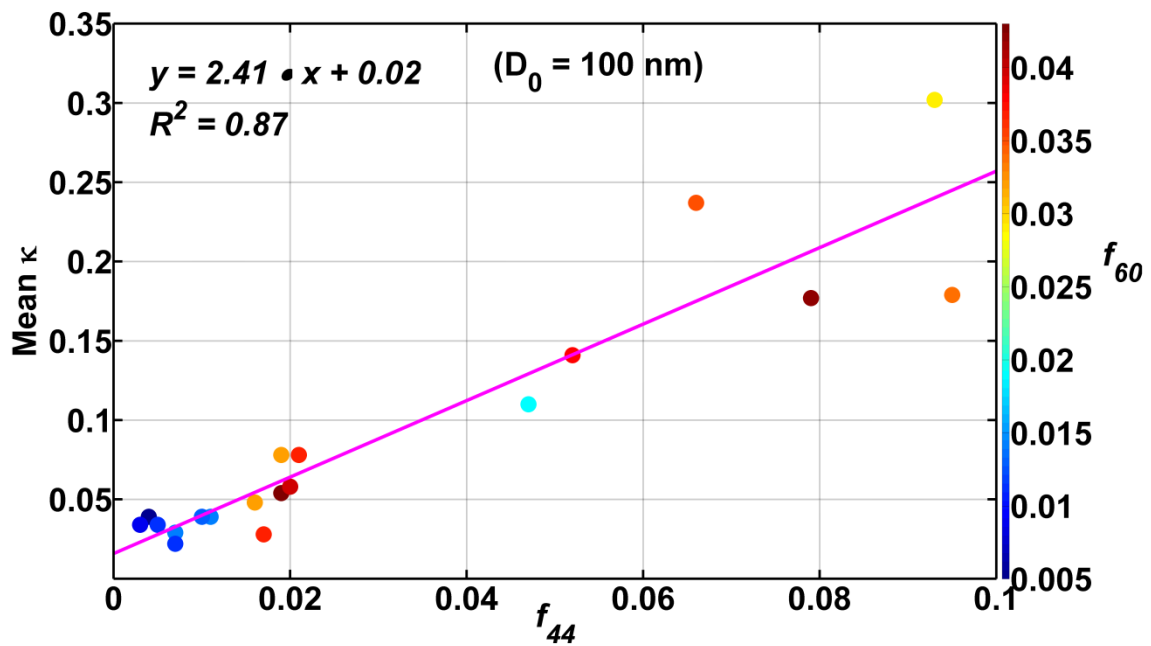
Fig.S4 Correlation of κ and f_{44} for all the online and offline measurements.

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(D1): 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(D20): 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.