Supplement to "Emissions of non-methane volatile organic compounds from combustion of domestic fuels in Delhi, India"

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S1 - Breakthrough test

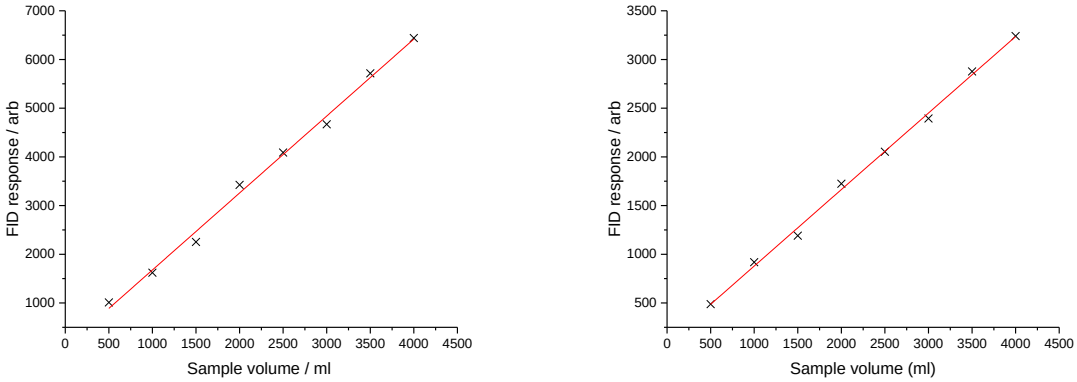

Figure S1. Results of the GCxGC-FID breakthrough test. Left: Benzene. Right: *n*-octane.

S2 – Emission factors

Please see the attached excel file for the emission factors measured in this study.

S3 – Calculation of total volume of air sampled

NMVOC mass in μg m^{-3} was determined from:

$$\mathrm{NMVOC_{mass}} = \frac{\mathrm{NMVOC_{ppbv}\ x\ 12.187\ x\ MW}}{273.15 + T}$$

where $\mathrm{NMVOC_{mass}}$ = NMVOC concentration in μg m^{-3}, $\mathrm{NMVOC_{ppbv}}$ = NMVOC concentration in ppbv, MW = molecular mass in g mol^{-1} and T = temperature in ^{o}C which was measured for each experiment.

The total volume of air convectively moving up the stack was determined from:

$$V_{\mathrm{d}} = \sqrt{\frac{2gP_{\mathrm{s}}}{D_{\mathrm{s}}}}$$

where V_{d} = vertical displacement up the flue (ms^{-1}), g = 9.81 m^{-2}, P_{s} = average stack pressure (mmH_2O) and D_{s} is determined by:

$$D_{\mathrm{s}} = \frac{TD_{\mathrm{a}}}{T_{\mathrm{s}}}$$

where T = ambient temperature (k), D_{a} = density of air (1.1455 kg m^{-3}), T_{s} = average stack temperature (^{o}K). The emission factor (EF) was calculated by:

$$\mathrm{EF} = \frac{tCV_{\mathrm{d}}A_{\mathrm{d}}}{M}$$

where t = time burned (s), C = concentration (g m^3), A_{d} = area of flue, M = mass of fuel burnt (kg).

S4 – Calculation of total emission factor

Table S1 shows a summary of the instruments used to calculate the total emission factor from this study. The total signal from the PTR-ToF-MS had isotope peaks removed as well as reagent ion peaks (< *m*/*z* 31 Th), water cluster peaks (*m*/*z* 37 Th), ammonia (*m*/*z* = 18.034 Th), acetylene (*m*/*z* = 26.015 Th), hydrogen cyanide (*m*/*z* = 28.019 Th), ethene (*m*/*z* = 28.03 Th), propene (*m*/*z* = 43.054 Th), nitrous acid (*m*/*z* = 48.008 Th), butadienes (*m*/*z* = 55.053 Th), butenes, other hydrocarbons (*m*/*z* = 57.069 Th), DMS (*m*/*z* = 63.032 Th), isoprene (*m*/*z* = 69.069 Th), pentenes, methylbutenes (*m*/*z* = 71.084 Th), benzene (*m*/*z* = 79.053 Th), toluene (*m*/*z* = 93.069 Th), C_2 substituted monoaromatics (*m*/*z* = 107.084 Th) and C_3 substituted monoaromatics (*m*/*z* = 121.099 Th). The emission factors for removed species have been incorporated from the DC-GC-FID and the GCxGC-FID.

Table S1. Summary of instruments used for calculation of total emission factor.

Species	**Instrument**
Aromatics	
Benzene-C_3 substituted monoaromatics	GCxGC-FID
C_4-C_5 substituted monoaromatics	PTR-ToF-MS
Phenolics	
All species	PTR-ToF-MS
Oxygenated aromatics	
All species	PTR-ToF-MS
Oxygenated aliphatics	
All species	PTR-ToF-MS
NVOCs	
All species	PTR-ToF-MS
Furanics	
All species	PTR-ToF-MS
Monoterpenes	
All species	PTR-ToF-MS [a]
PAHs	
All species	PTR-ToF-MS [a]
Alkenes	
All DC-GC-FID alkenes to C_5	DC-GC-FID
Remaining alkenes [b]	PTR-ToF-MS
Alkanes [c]	

C_2-C_6 alkanes	DC-GC-FID
C_7-C_{12} alkanes	GCxGC-FID
C_{13}-C_{20} alkanes	SPE-GCxGC-ToF-MS

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59 [a] PTR-ToF-MS signal used as may include isomers not measured by GCxGC-FID.

60 [b] Only alkenes not measured by DC-GC-FID.

61 [c] No peaks for > C_6 alkanes in PTR-ToF-MS spectra.

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S5 – Total quantification by sample type

Figure S2 shows that NMVOC quantification was > 90% for all sample types, except *Vachellia spp*. Quantification for this species remained low due to unidentified peaks with significant emission factors at *m*/*z* 45.993, 63.04, 65.023, 78.994, 82.072, 91.039, 98.063, 106.961, 113.131 and 119.95 Th.

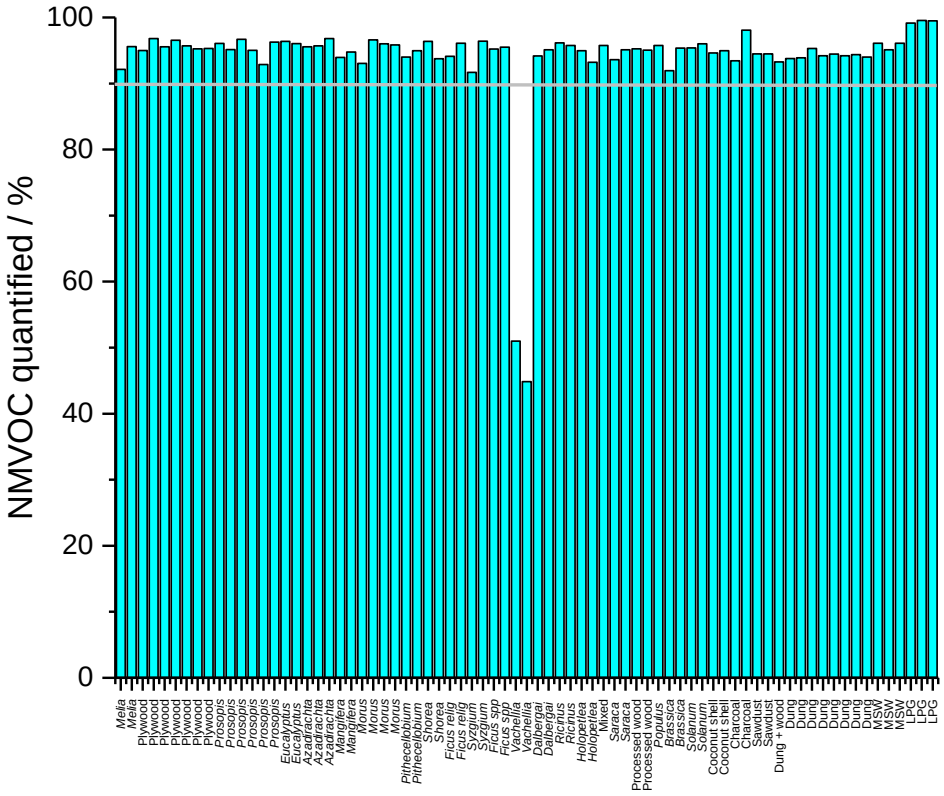

Figure S2. Total percentage quantification by sample type across all experimental burns.