Supplementary Materials

Table 1: Explanation of what all the time series names mean and how do they measure

FamilyCx (rBC[1])	Refractory Black Carbon	Measured from HR-SP-AMS
BC (AE31)[2]	Black Carbon	Measured from Aethalometer AE31
BrC (AE31)[2]	Brown Carbon	Measured from Aethalometer AE31
BC$_{total}$	Total BC from AE31 (BC$_{tr}$+BC$_{wb}$)	
BC$_{tr}$	Black Carbon (traffic emissions)	Measured from Aethalometer AE31
BC$_{wb}$	Black Carbon (Wood Burning)	Measured from Aethalometer AE31
HONO[3]	Nitrous Acid	Measured from ToF-CIMS
HCN[3]	Hydrogen Cyanide	Measured from ToF-CIMS
HCNO[3]	Isocyanic Acid	Measured from ToF-CIMS
Fullerenes[1]	Fullerenes	Measured from HR-SP-AMS from HR-SP-AMS
BC and HULIS[1]	HULIS	Measured from HR-SP-AMS from HR-SP-AMS
pPON[2]	Primary Particulate Organic Nitrate	Measured by Aerosol Mass Spectrometer (AMS) by using 46:30 ratio (Reyes et al, 2018)
sPON[2]	Secondary Particulate Organic Nitrate	Measured by Aerosol Mass Spectrometer (AMS) by using 46:30 ratio.
HOA[3]	Hydrocarbon-like Organic Aerosol	Factor derived by PMF analysis from HR-SP-AMS
BBOA[1]	Biomass Burning Organic Aerosol	Factor derived by PMF analysis from HR-SP-AMS
Sr[1]	Strontium Metal	Measured from HR-SP-AMS
Domestic Burning[1]	Domestic burning	Factor derived by PMF analysis from HR-SP-AMS

[1]rBC, Sr, Fullerenes, Hydrocarbon-like OA, Domestic burning, BBOA, BC and HULIS (Current Case study)

derived by PMF from HR-SP-AMS

[2]pPON, sPON, BC and BrC (AE31) (Reyes et al, 2018)

[3]HCN, HCNO, HONO (Priestley et al, 2018)

9.1 Positive Matrix Factorisation

A range of solutions were obtained using different parameters as part of the PMF analysis and here we present the reasons behind the choice of solution used in the paper. Regarding the number of factors, a 5-factor solution was chosen instead of 6-factor solution because all the five factors are separated from one another and represent a specific soot source (fig S1a, b). In comparison, the 6-factor solution has two 'split' factors representing the same emissions. These are factor 2 and factor 4 in figure S2 and represent domestic wood burning sources because their peaks were evident before and after the bonfire night event (fig. S2a, S2b).
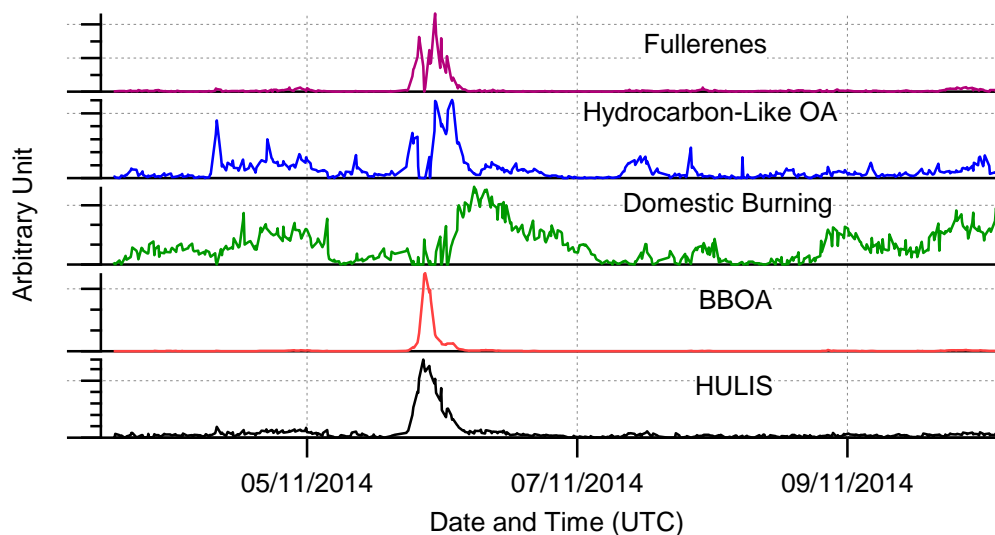
Figure S1a: Time series of five factors solution detected separately under the condition of 0.10 model error.
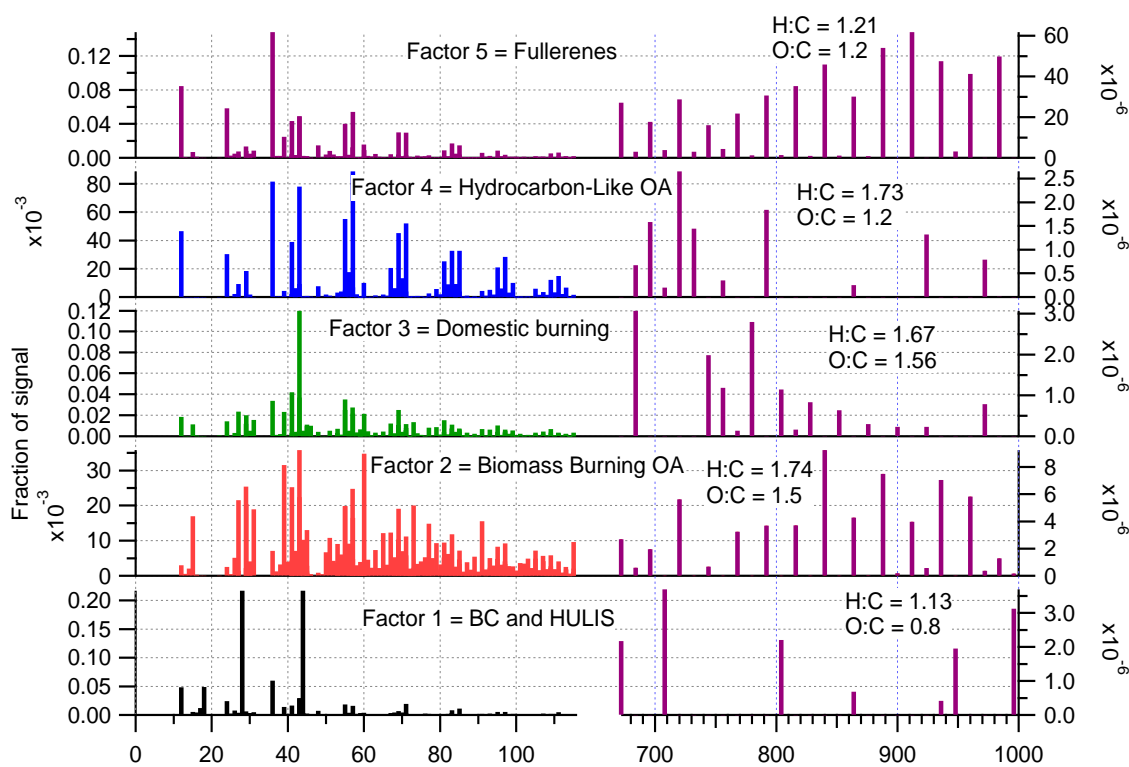
Figure S1b: The factor profile of five factors solution detected separately under the condition of 0.10 model error.
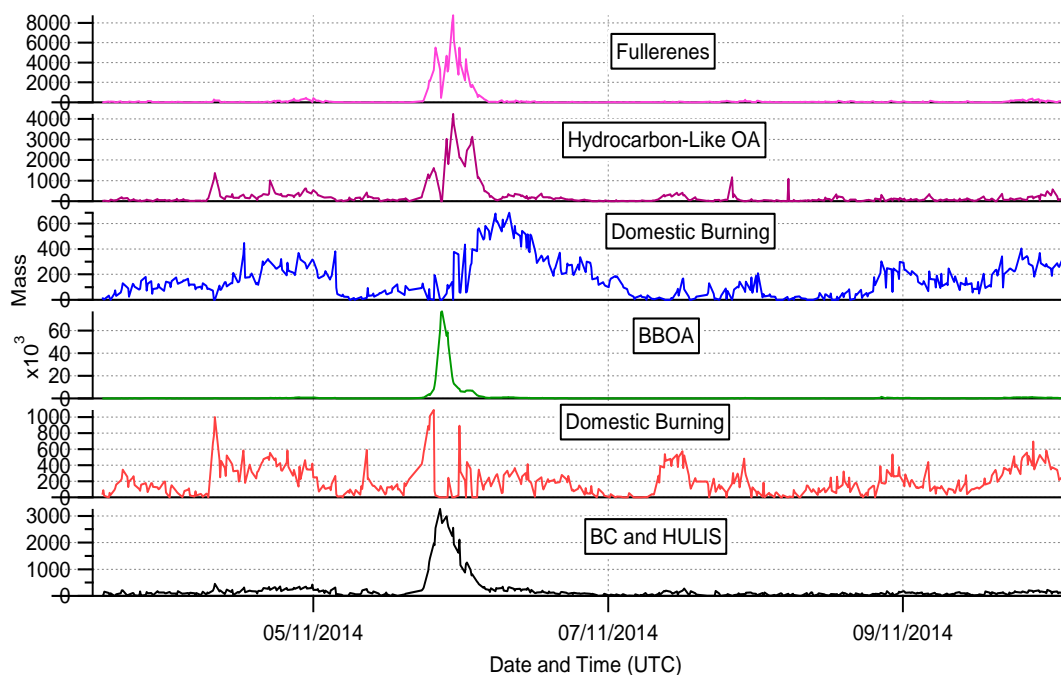
Figure S2a: Time series of six factors solution in which two same factors are split in to two different factors i.e. 2 and 4 under the condition of 0.10 model error.
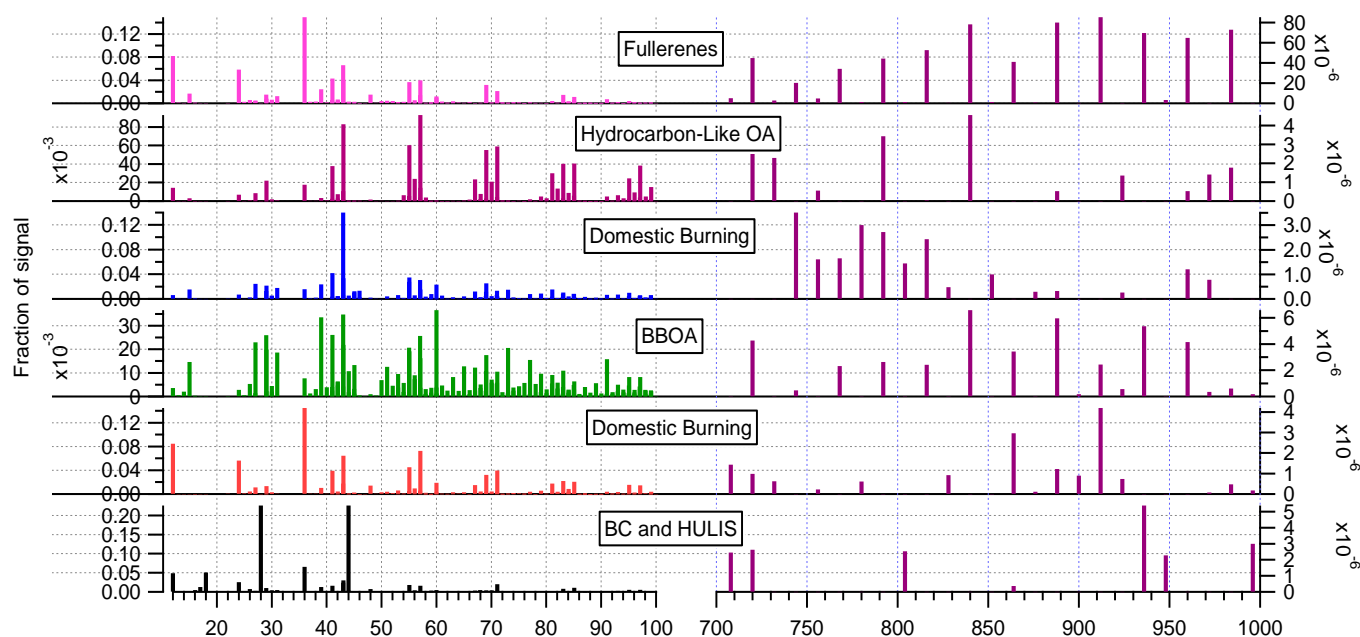
Figure S2b: Factor profiles of the 6-factor solution in which factor 2 and 4 have the same m/z spectrum, under the condition of 0.10 model error.

9.2 Model Error modification:

Here we use the term 'model' error to refer to the additional error term that can be added as part of the PET toolkit, whereby additional error is added proportional to the signal, as opposed to the square root of the signal as is done in the standard AMS error model. In this study, the model error parameter was modified from 0.00, 0.05 and 0.10

by following the recommendations made by Paatero and Hopke (2003). While this is not always done in AMS PMF analysis, this is done here to decrease the signal-to-Noise Ratio (SNR) of the high signals that would otherwise dominate the factorisation. Firstly, the PMF was run with 0.0 model error and Fig. S3a, b depicts that SNR was very high i.e. 1200 SNR for some peaks. For a model error parameter of 0.05, fig. S4a, b shows that SNR was decreased i.e. 18 SNR and improved overall signals of sources, particularly for the fullerenes. For a value of 0.10, the maximum SNR is further reduced to 10 (fig. S5a, b), meaning the error was now dominated by the 'model error' term, and this delivered the most satisfactory solution in terms of distinctive mass spectra, particularly for the fullerenes.
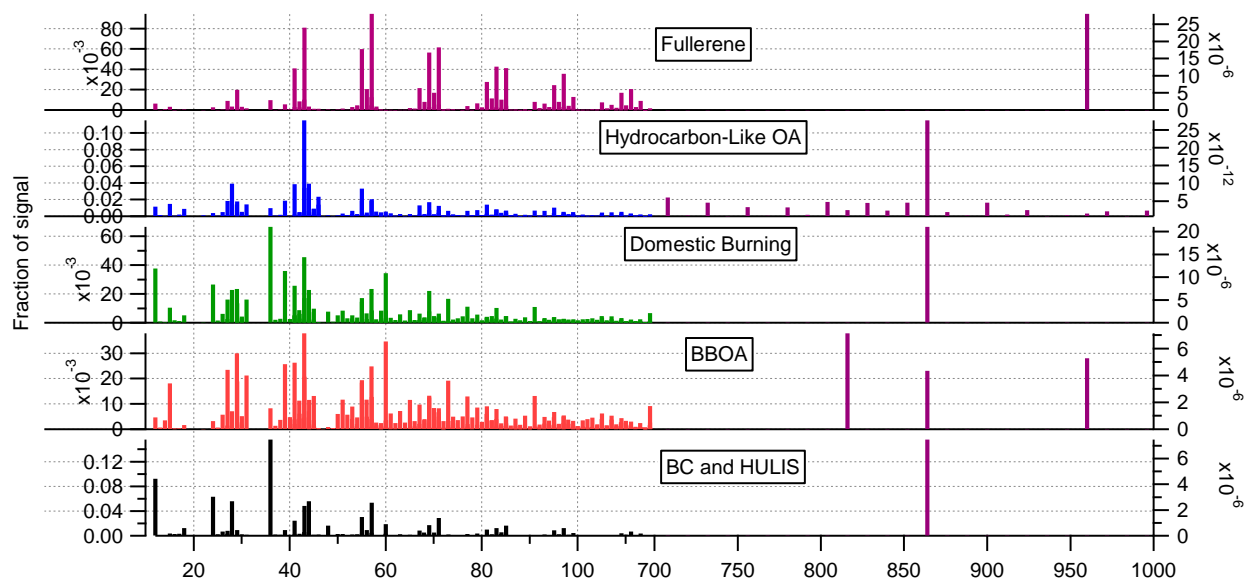
Fig S3a PMF five factors profile detected by the model error 0.0
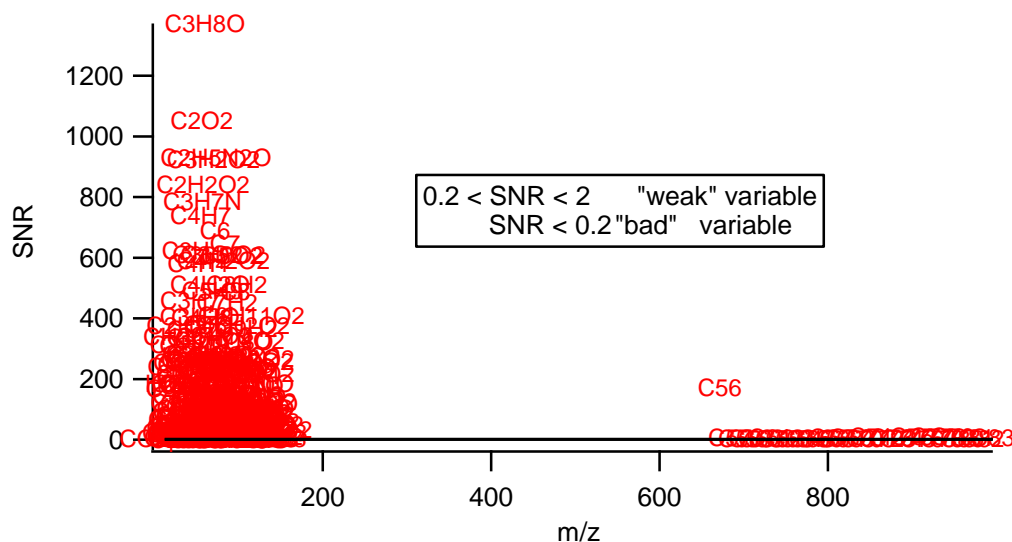
Figure S3b shows the SNR of organics and fullerenes with no modification in the model error value i.e. 0.00
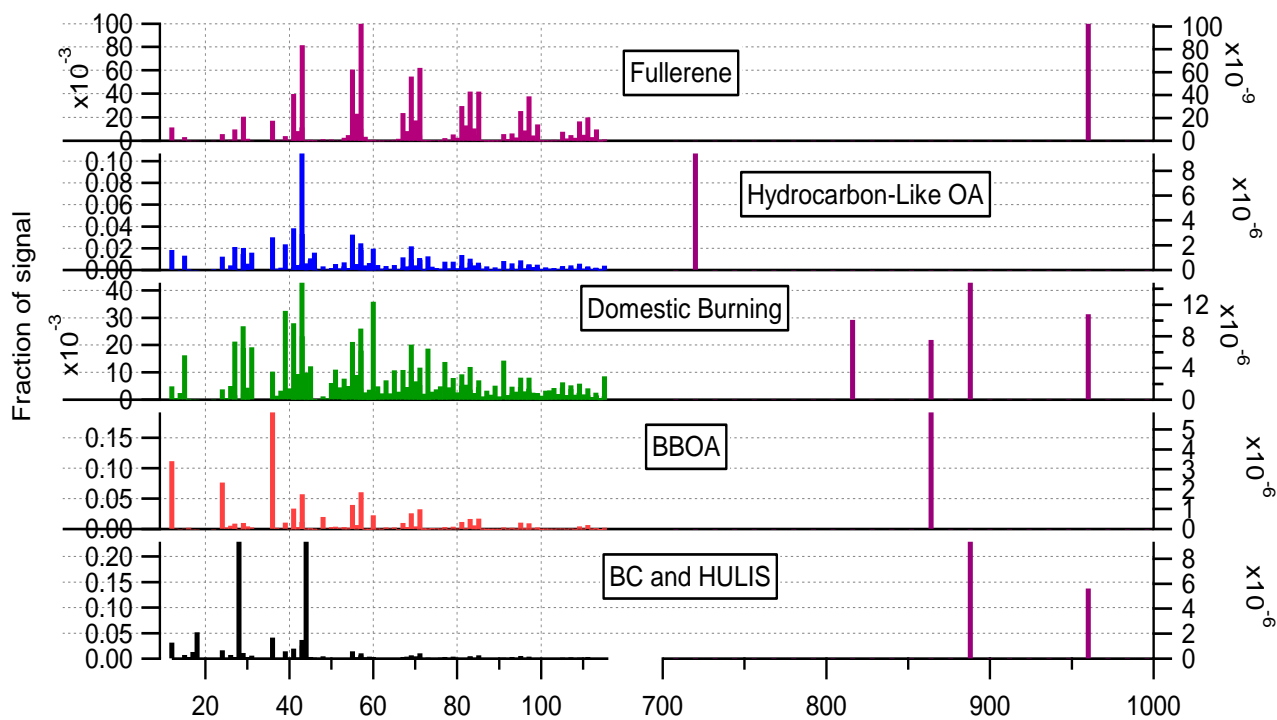
Fig S4a PMF five factors profile detected by the model error 0.05
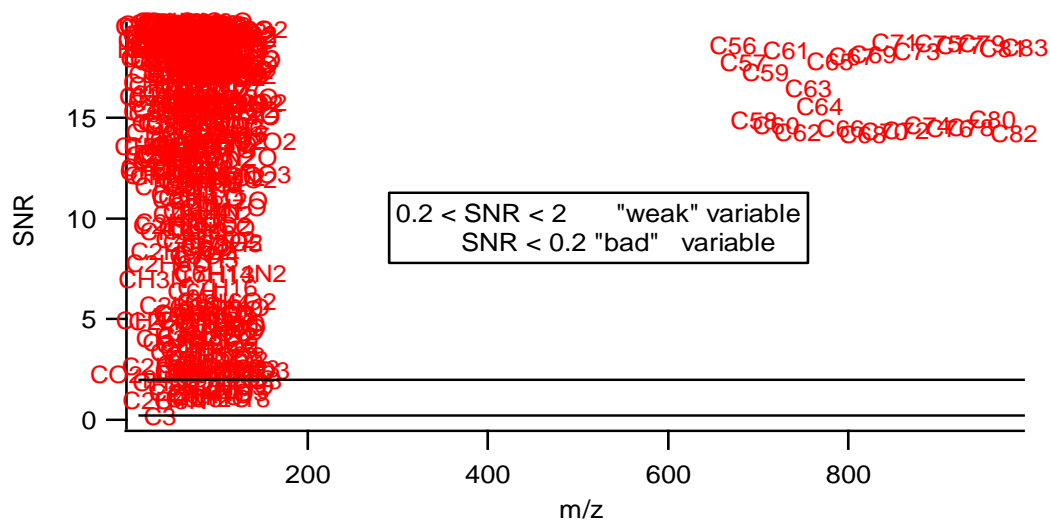
Figure S4b shows the SNR of organics and fullerenes with little modification in the model error value i.e. 0.05
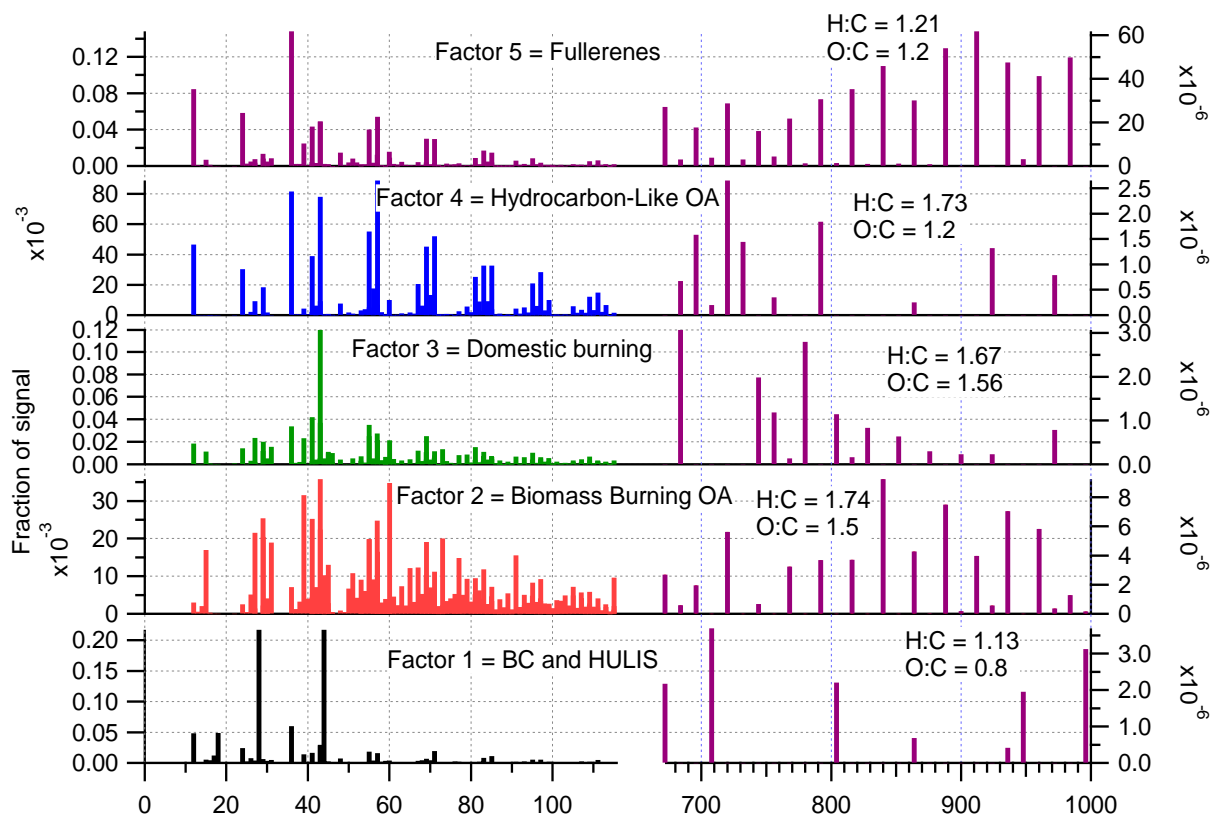
Fig S5a PMF five factors profile detected by the model error 0.10
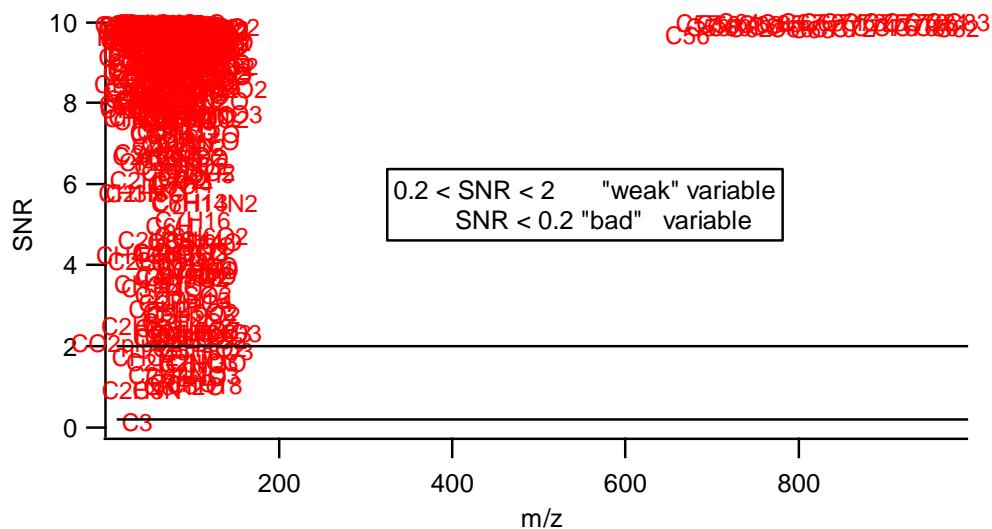
Figure S5b shows the SNR of organics and fullerenes with more modification in the model error value i.e. 0.10.