Supporting Information for "Emission Factors, Size Distributions and Emission Inventories of Carbonaceous Particulate Matter from Residential Wood Combustion in Rural China"

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Influence of Fuel Properties and Combustion Conditions

To investigate the influence of fuel properties and combustion conditions on EFs from residential wood combustion, principal Component Analysis (PCA) was taken. Factors include into the PCA including C, H, N, O content, fuel density, moisture, and volatile matter (VM), fixed carbon and ash content, and higher heating value (HHV). The four associations extracted are F1 (C, H, N, O content and fuel density), F2 (volatile matter and fixed carbon content), F3 (moisture and heating value), and F4 (burning rate and modified combustion efficiency, MCE), and about 85% of the total variances can be explained. The results were shown in Table S1. It is likely that the emissions depended on fuel density (F1) which was subsequently related to the fuel composition (positively correlated to C and negatively correlated to N and O). Similarly, heating value, which is moisture- rather than composition-dependent, is one of the most important factors affecting emission rates. Burning rate and MCE, two parameters used for quantifying the combustion conditions, seemed to be uncorrelated to any other parameters measured in this study.

Individually, most of the factors investigated in our study were not significantly correlated with the measured EFs. Since many of these parameters are correlated to one another, the four components derived from the PCA, instead of individual parameters, are used as independent variables in a multiple regression analysis for predicting EFs. It was found that among the four factors, F4 (burning rate and MCE) was the most significant for EF_{PM}, EF_{OC}, and EF_{EC} ($p=4.70\times10^{-2}$, 7.11×10^{-3}, *and* 4.62×10^{-2}, respectively), followed by F1 for EF_{EC} and EF_{OC} and F2 for EF_{PM}.

Table S1. Component Matrix and Variance Explained by the four main component extracted by PCA

	F1	F2	F3	F4
MCE	-0.237	-0.222	-0.413	0.637
R	0.141	0.557	-0.422	-0.540
N	0.837	-0.015	-0.118	-0.447
C	-0.797	-0.439	0.294	-0.087
H	-0.595	0.465	0.348	-0.003
VM	-0.561	0.782	0.054	0.129
Moisture	0.539	0.452	0.623	0.075
Density	0.785	0.277	0.454	0.206
ASH	*0.606*	-0.204	-0.067	*0.576*
Fixed Carbon	0.482	-0.796	-0.044	-0.249
HHV	0.164	-0.266	0.858	-0.031
O	0.710	0.476	-0.338	0.247
Eigenvalue	4.118	2.635	2.025	1.425
Variance Explained, %	34.32	21.96	16.88	11.87
Cumulative, %	34.32	56.28	73.15	85.02