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Volatility measurement of atmospheric submicron aerosols in an urban atmosphere in southern China

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The source apportionment method of BC

The total BC (BC_{total}) measured by the aethalometer can be separated into BC emitted by traffic (BC_{tr}) and biomass burning (BC_{bb}) with the aerosol absorption coefficients (b_{abs}) at 470 nm and 950 nm, as shown in the following equations discussed in Sandradewi et al. (2008):

$$\frac{b_{abs}(470nm)_{tr}}{b_{abs}(950nm)_{tr}} = \left(\frac{470}{950}\right)^{-\alpha_{tr}} \quad (1)$$

$$\frac{b_{abs}(470nm)_{bb}}{b_{abs}(950nm)_{bb}} = \left(\frac{470}{950}\right)^{-\alpha_{bb}} \quad (2)$$

$$b_{abs}(\lambda) = b_{abs}(\lambda)_{tr} + b_{abs}(\lambda)_{bb} \quad (3)$$

$$BC_{tr} = BC_{total} \cdot \frac{b_{abs,tr,950nm}}{b_{abs,total,950nm}} \quad (4)$$

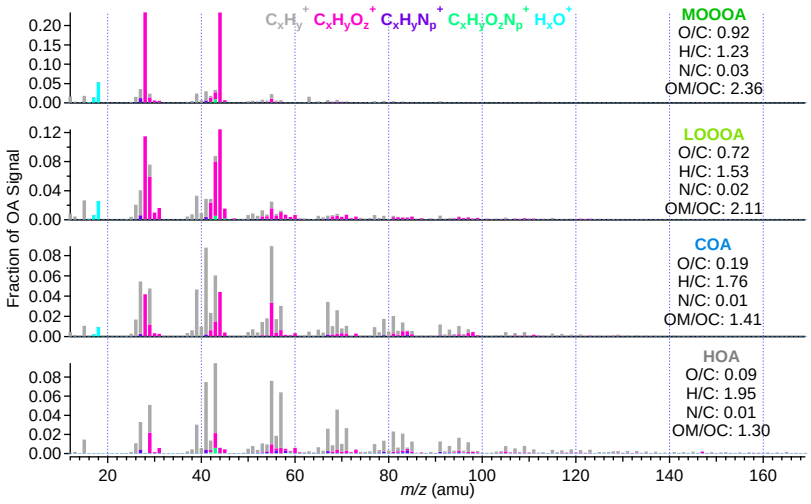
$$BC_{bb} = BC_{total} - BC_{tr} \quad (5)$$

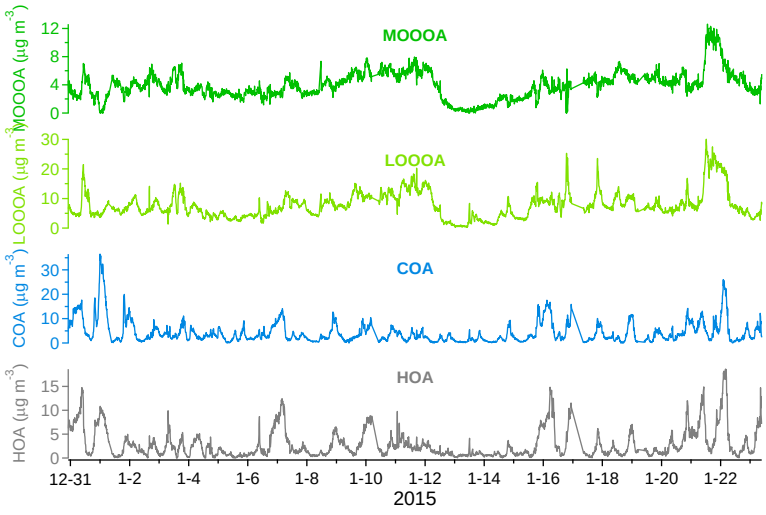
Where α is the absorption exponent and λ is the wavelength. The values of α used for traffic and biomass burning are 0.9 and 1.7, respectively, according to the values used in Xi'an, China, by Elser et al. (2016).

Table S1. The O/C ratios calculated based on the Aiken–Ambient (A-A) method.

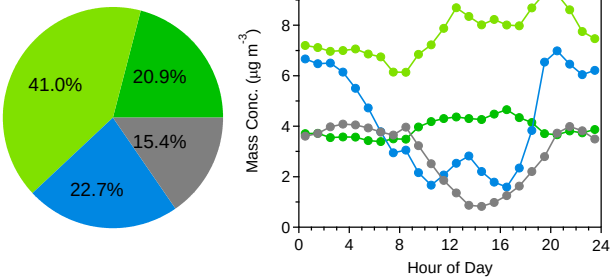
OA species	O/C
average	0.41
HOA	0.073
COA	0.15
BBOA	0.26
LO-OOA	0.58
MO-OOA	0.84

(a) factor=4, fpeak=0, seed=0




MOOOA
LOOOA
COA
HOA
MOOOA (μg m-3)
LOOOA (μg m-3)
COA (μg m-3)
HOA (μg m-3)
12-31
1-2
1-4
1-6
1-8
1-10
1-12
1-14
1-16
1-18
1-20
1-22
2015

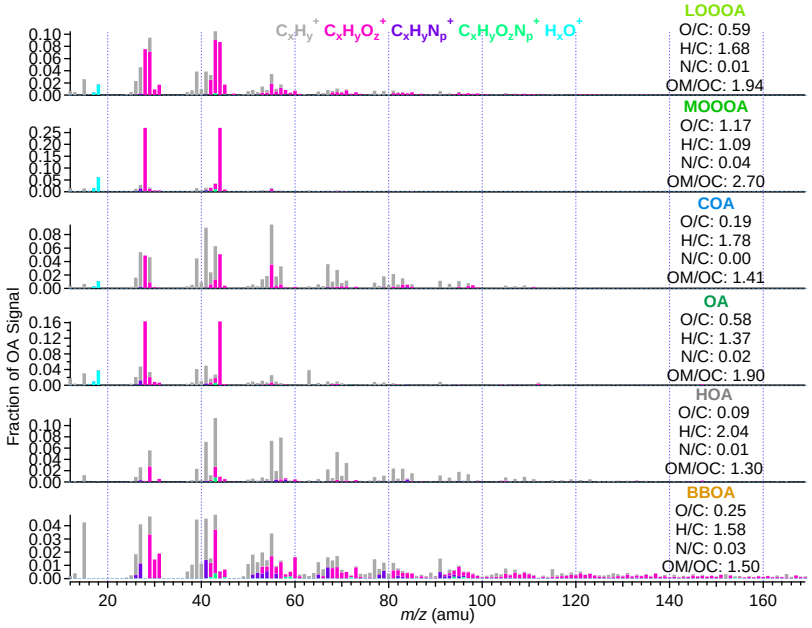
28

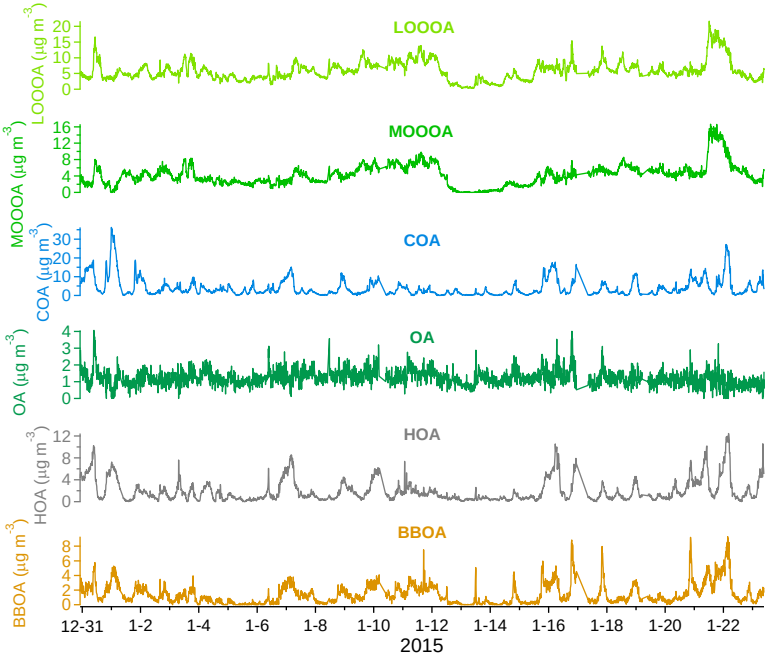

41.0%
20.9%
15.4%
22.7%
MOOOA LOOOA COA HOA
Mass Conc. (μg m-3)
Hour of Day

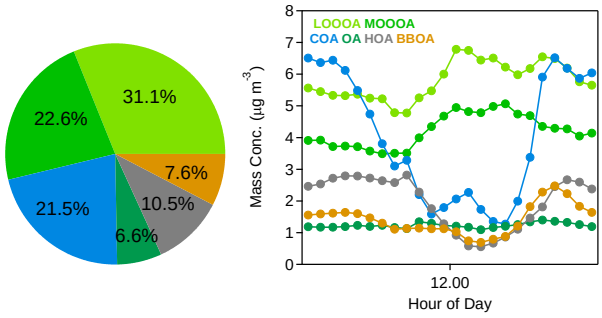
29

30

(b) factor=6, fpeak=0, seed=0







(c)diagnostic plots of results of factor=5, fpeak=0 and seed=0

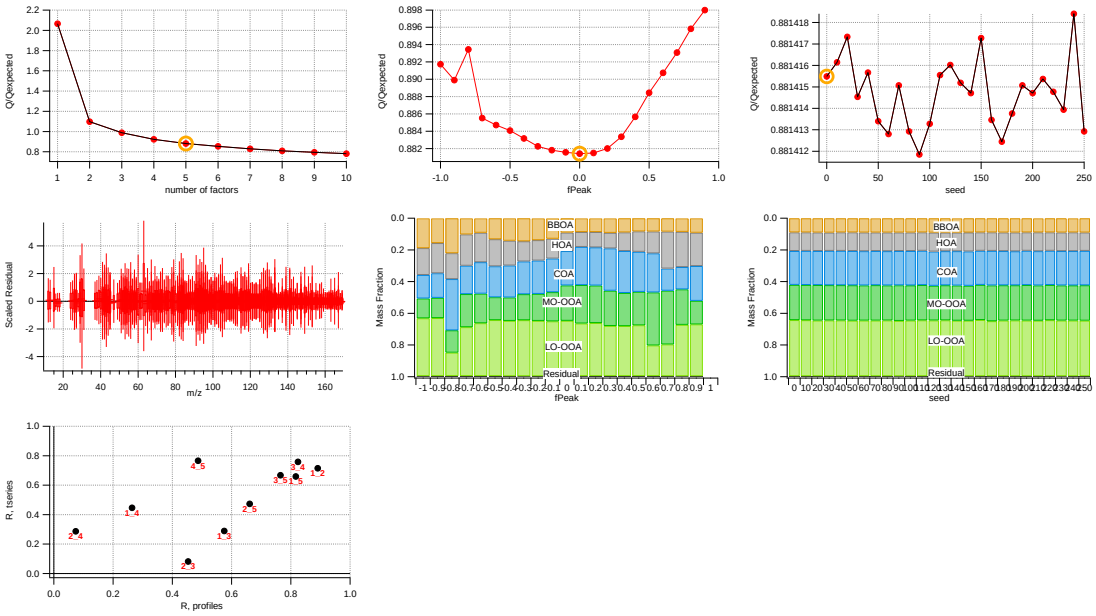
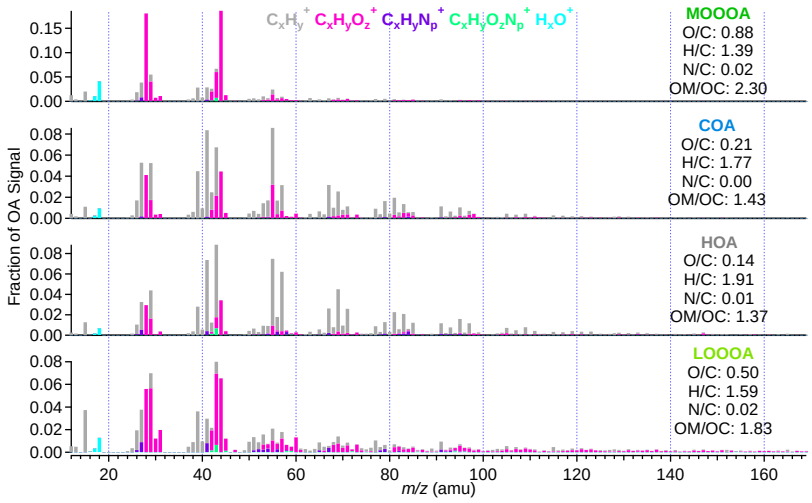


Figure S1. PMF analysis on the high-resolution organic mass spectra sampled under ambient and TD temperature: (a) PMF results of factor=4, fpeak=0, seed=0; (b) PMF results of factor=6, fpeak=0, seed=0; (c) Diagnostic plots of PMF results of factor=5, fpeak=0, seed=0, including:(1) $Q/Q_{expected}$ vs number of factors; (2) $Q/Q_{expected}$ vs fpeak at 5-factor solution;(3) $Q/Q_{expected}$ vs seed at 5-factor solution; (4) Scaled residual for each m/z; (5) mass fraction of OA factors as a function of fpeak; (6) mass fraction of OA factors as a function of seed; (7) correlations of time series and mass spectra among PMF factors.

47 (a) factor=4, fpeak=0, seed=0



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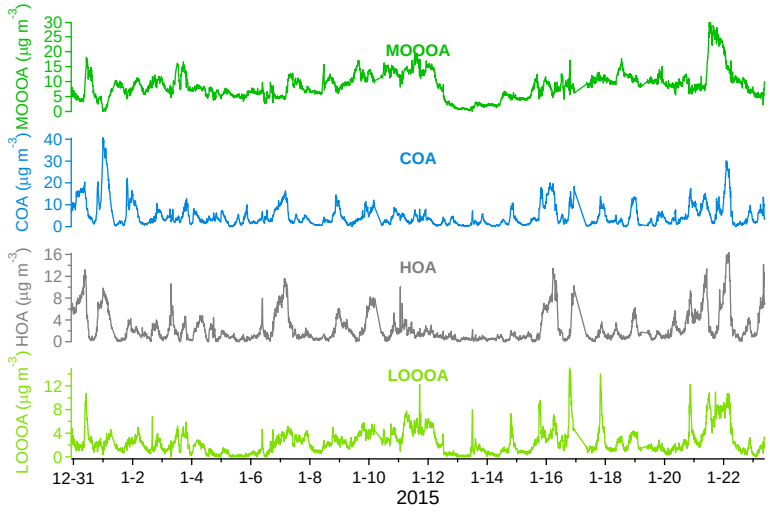

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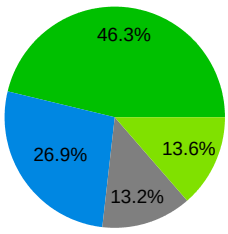

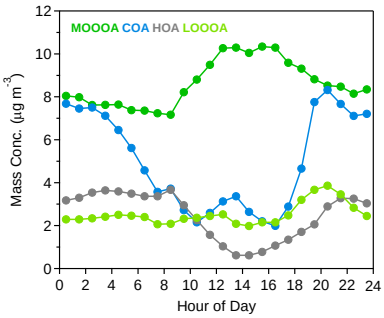

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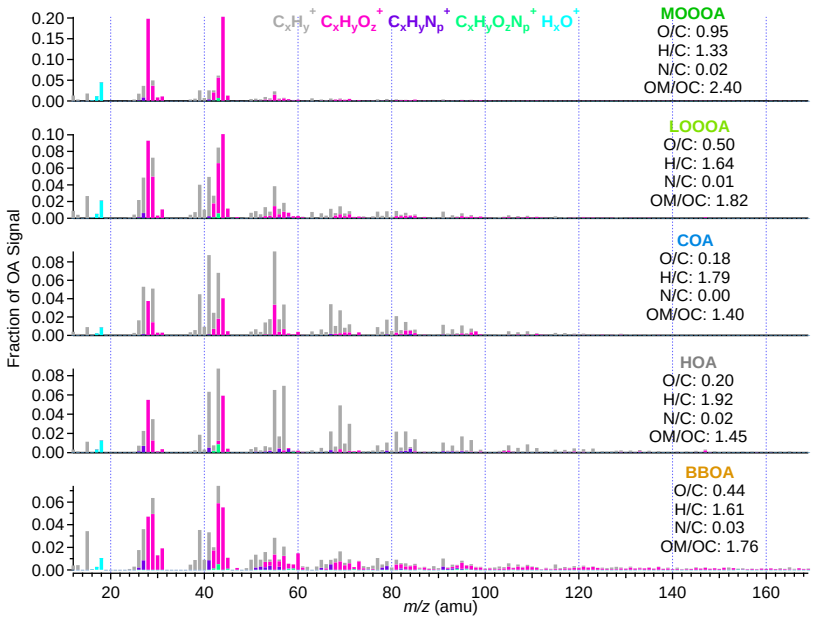
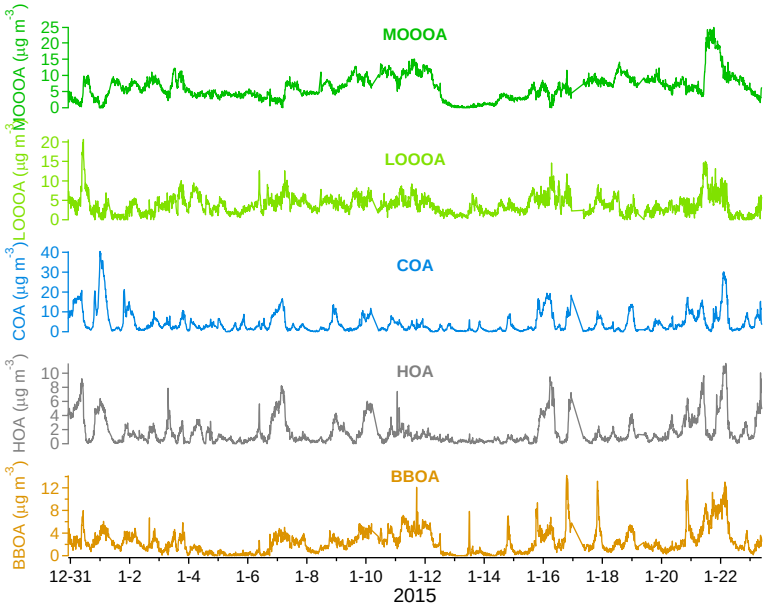
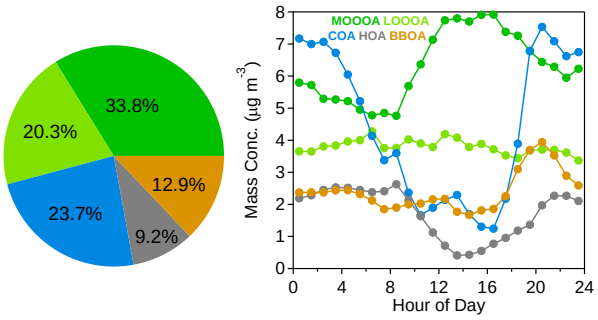
51

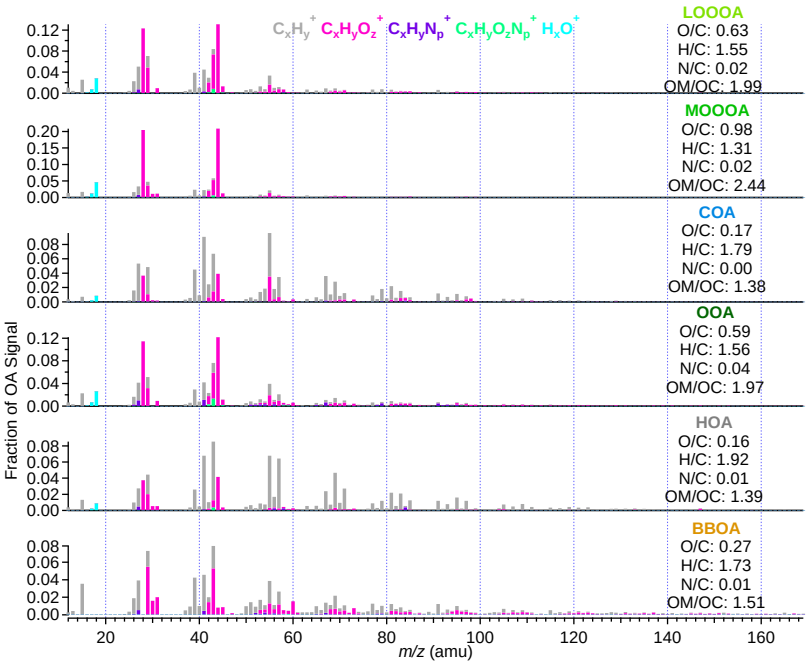
(b) factor=5, fpeak=0, seed=0

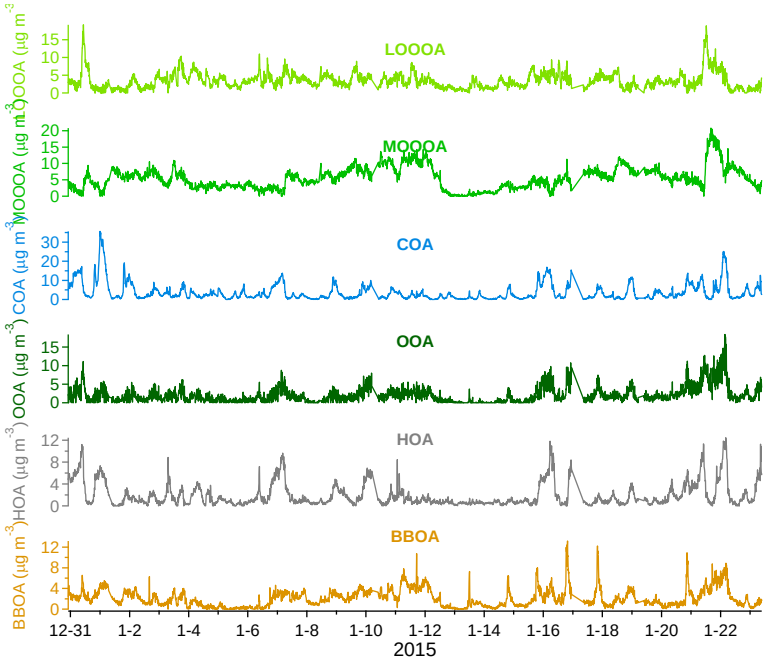






(c) factor=6, fpeak=0, seed=0





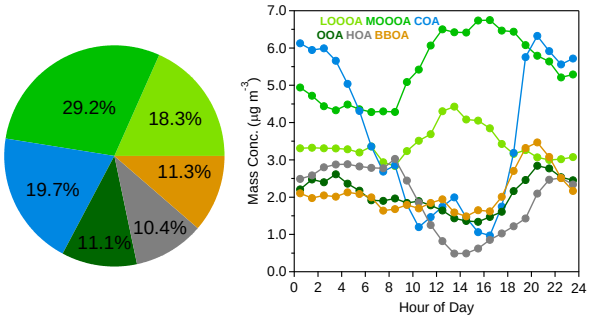


Figure S2. The MS profile of PMF results of data only in ambient temperature, 4-, 5- and 6-factor solution with fpeak = 0 and seed = 0. In the profile of HOA, the higher contribution of m/z 44 can be a result of the mixing of HOA and OOA.

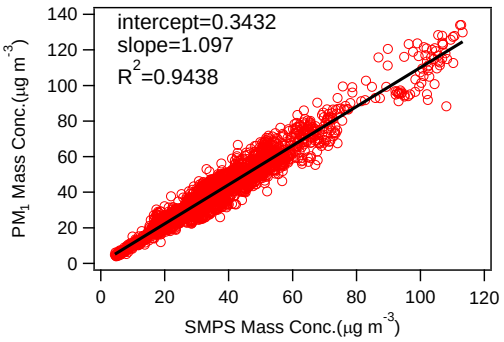


Figure S3. The correlation of the PM_1 mass concentration (summed by the AMS result and BC from aethalometer) and the mass concentration calculated from the number concentration measured by SMPS.

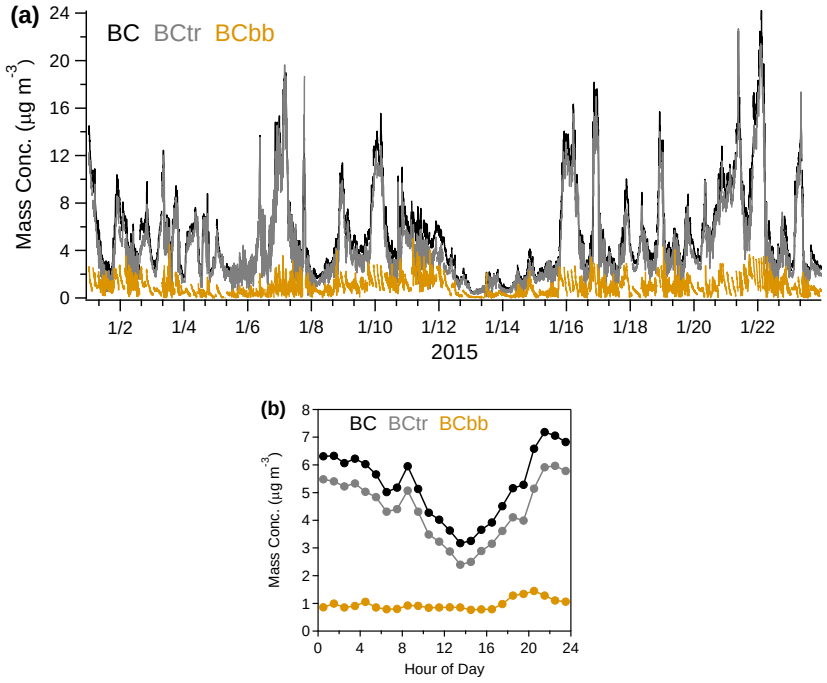


Figure S4. Source apportionment of BC based on the Sandradewi et al. (2008) method with data measured by AE-31: **(a).** time series of total BC, BC emitted by traffic (BC_{tr}) and BC emitted by biomass burning (BC_{bb}); **(b).** diurnal variation of BC, BC_{tr}, BC_{bb}.

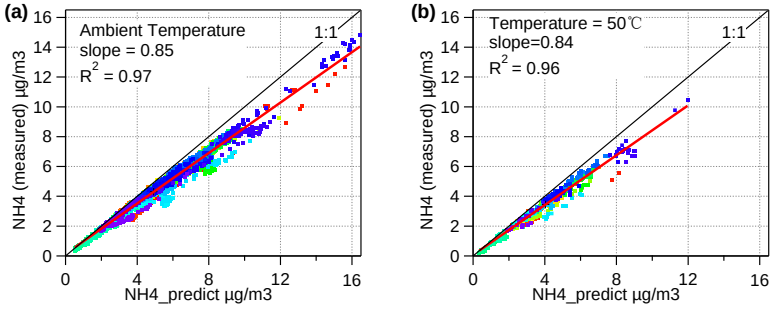


Figure S5. The neutralizaiton of measured and predicted NH_4^+ under ambient temperature and 50 ℃.

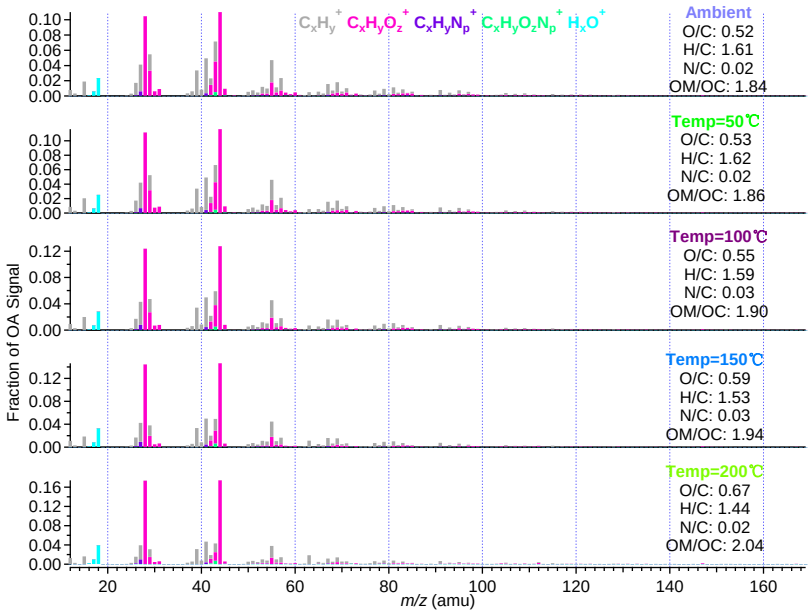


Figure S6. The average mass spectrum of OA under different temperatures.

References

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