## Influence of organic aerosol composition determined by offline FIGAERO-CIMS on particle absorptive properties in autumn Beijing

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Figure S1. The FIGAERO-CIMS temperature ramping protocol applied in this study



Figure S2. The correlation of BC concentrations between the IAP and BUCT site during the sampling period



Figure S3. Daily averaged mass spectra of (a) Ep1 (Nov 3), (b) Ep2 (Nov 8), (c) Ep3 (Nov 14), (d) the clean period (Nov 10) and (e) another clean day (Nov 5)



Figure S4. (a) Boundary layer and UVB, (b) particle size distribution during the sampling period measured by a co-located Particle Size Distribution System (PSD, (Liu et al., 2016;Dada et al., 2020)) as well as OA, SO<sub>4</sub>, NO<sub>3</sub> measured by ACSM and BC measured by aethalometer, (c) 72-h back trajectories of Nov 8 23:00, (d) 72-h back trajectories of 23:00 Nov 10, (e) 72-h back trajectories Nov 14 23:00, (f) daily average size distribution of Nov 8, Nov 10 and Nov 14, (g) emission rate of PM<sub>2.5</sub> from residential emissions in East China for the year of 2015, and (h) emission rate of total PM<sub>2.5</sub> in East China for the year of 2015. Air mass back trajectories (retroplumes) were calculated using FLEXPART (FLEXible PARTicle dispersion model; version 9.02) (Stohl et al., 2005) with ECMWF (European Centre for Medium-Range Weather Forecasts) operational

forecast data ( $0.15^{\circ}$  horizontal and 1h temporal resolution) as the meteorological input. The emission rate of PM<sub>2.5</sub> data is from Zheng et al. (2019).



Figure S5. Time series of integrated signal intensities for different carbon number compounds. The number in the plot represents the carbon number of the compounds and the color indicates the average O:C ratios of the same carbon number compounds.



Figure S6. Time series of the fractions of CHO, CHON, CHOS and CHONS groups and OA concentration from ACSM



Figure S7. Signal fractions to total CHOX for CHON compounds with different numbers of oxygen and carbon atoms, (a) clean period (Nov 10), (b) Ep1 (Nov 3), (c) Ep2 (Nov 8) and (d) Ep3 (Nov 14).



Figure S8. Time series of  $f_{60}$  from ACSM and  $f_{C6H10051}$  from FIGAERO-CIMS. The discrepancy on Nov 6<sup>th</sup> is likely due to the high measurement uncertainties from the low OA concentrations (~10 µg m<sup>-3</sup> and ~0.2 µ/punch).



Figure S9. Signal fractions to total CHOX for CHO compounds with different numbers of oxygen and carbon atoms for (a) Nov 11 daytime, (b) Nov 11 nighttime, (c) Nov 12 daytime (d) Nov 13 nighttime, (e) Nov 13 daytime, (f) Nov 13 nighttime, (g) Nov 14 daytime, (h) Nov 14 nighttime



Figure S10. (a) Van Krevelen (VK) diagram of CHO compounds in Ep1 (Nov 3), (b) VK diagram of CHON compounds in Ep1 (Nov 3), (c) VK diagram of CHO compounds in the Clean period (Nov 10), (d) VK diagram of CHON compounds in the Clean period (Nov 10), (e) VK diagram of CHO compound in Ep2 (Nov 8), (f) VK diagram of CHON compound in Ep2 (Nov 8), (g) VK diagrams of CHO compound in Ep3 (Nov 14), (h) VK diagram of CHON compound in Ep3 (Nov 14), Each dot represents an identified compound with its H/C and O/C ratios and color-coded by carbon number. The size of symbols is proportional to the square root of the normalized relative signal intensity of each compound.



Figure S11. Comparison of identified CHO and CHON compounds in winter 2017 at PKU site and autumn 2018 at BUCT site. (a) Van Krevelen (VK) diagram of CHO compounds during haze period 2017 at PKU site, (b) VK diagram of CHON compounds during haze period 2017 at PKU site, (c) VK diagrams of CHO compounds during Ep3 (Nov 14) at BUCT site, (d) VK diagrams of CHON compound during Ep3 (Nov 14) at BUCT site. The data from PKU site is from Zheng et al. (2021, (to be submitted)).



Figure S12. E<sub>abs</sub> at different wavelengths as a function of (a) POA/EC, (b) SOA/EC and (c) SIA/EC



Figure S13. Normalized time series of (a)  $E_{abs}$  and key 20 compounds for  $E_{abs}$ , of (b)  $b_{abs}$  and key 20 compounds for  $b_{abs}$ .

Sampling date	Sampling time (daytime)	Sampling time (nighttime)
Nov 3 <sup>rd</sup>	9:30–21:00	21:30–9:00
Nov 4 <sup>th</sup>	9:30-21:00	21:30-9:00
Nov 5 <sup>th</sup>	9:30-21:00	21:30-9:00
Nov 6 <sup>th</sup>	9:30-21:00	NaN
Nov 7 <sup>th</sup>	9:30-21:00	21:30-9:00
Nov 8 <sup>th</sup>	9:30-21:00	21:30-9:00
Nov 9 <sup>th</sup>	9:30-21:00	21:30-9:00
Nov 10 <sup>th</sup>	9:30-21:00	21:30-9:00
Nov 11 <sup>th</sup>	9:30-21:00	21:30-9:00
Nov 12 <sup>th</sup>	9:30-21:00	21:30-9:00
Nov 13 <sup>th</sup>	9:30-21:00	21:30-9:00
Nov 14 <sup>th</sup>	9:30-21:00	21:30-9:00
Nov 15 <sup>th</sup>	9:30-21:00	21:30-9:00
Nov 16 <sup>th</sup>	9:30-21:00	21:30-9:00

Table S1 Sampling information

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