Supplementary Materials

Title: Size-segregated atmospheric humic-like substances (HULIS) in Shanghai: abundance, seasonal variation, and source identification

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Table S1. The detailed sampling information including meteorological data and PM concentrations in this study.

Sample No.	Start date	Terminal Date	Dur. (h)	T (℃)	Weather	WD	$PM_{2.5}$ (μg/m^3)	PM_{10} (μg/m^3)
Summer 1	2018.6.6	2018.6.7	24	25.5	Cloudy	West	45	51
Summer 2	2018.6.7	2018.6.8	24	25.5	Cloudy	Northeast	26	31
Summer 3	2018.6.8	2018.6.9	24	25	Cloudy	North	23	29
Summer 4	2018.6.10	2018.6.11	24	23	Light Rain	South	40	47
Summer 5	2018.6.11	2018.6.12	24	26.5	Cloudy	East	57	60
Autumn 1	2018.10.23	2018.10.24	24	19.5	Sunny	North	56	57
Autumn 2	2018.10.24	2018.10.25	24	20	Cloudy	East	60	77
Autumn 3	2018.10.25	2018.10.26	24	19.5	Light Rain	Southwest	25	58
Autumn 4	2018.10.26	2018.10.28	48	16.5	Cloudy	Southwest	42	81
Winter 1	2019.1.7	2019.1.8	24	7	Light Rain	Northeast	27	34
Winter 2	2019.1.8	2019.1.10	48	5.5	Overcast	Southeast	38	46
Winter 3	2019.1.10	2019.1.12	48	7	Light Rain	North	16	20
Winter 4	2019.1.12	2019.1.13	24	6	Light Rain	Northwest	78	94
Spring 1	2019.5.10	2019.5.11	24	21.5	Overcast	Northeast	37	51
Spring 2	2019.5.11	2019.5.13	48	23.5	Cloudy	Northwest	38	56
Spring 3	2019.5.13	2019.5.15	48	20	Overcast	Northeast	24	31
Spring 4	2019.5.15	2019.5.17	48	21	Overcast	Southeast	28	32
Spring 5	2019.5.17	2019.5.18	24	22	Overcast	Northeast	32	33

Table S2. The contribution rates of different species in each possible key source.

	Biomass Combustion	Coal Combustion	Secondary Formation	Vehicle Exhaust
Na^+	0.094	0.114	0.115	0.269
NH_4^+	0.043	0.201	0.707	0.412
K^+	0.462	0.136	0.011	0.131
Ca^{2+}	0.020	0.051	0.087	0.003
F^-	0.002	0.001	0.001	0.010
Cl^-	0.045	0.149	0.002	0.286
NO_3^-	0.197	0.352	0.103	0.617
SO_4^{2-}	0.311	0.804	0.109	0.270
WSN	0.016	0.060	0.293	0.126
OC	0.732	0.340	0.227	0.133
EC	0.038	0.010	0.139	0.031
WSOC	0.280	0.084	0.468	0.374
HULIS	0.147	0.079	0.285	0.173

Figure S1. The map of the sampling site and several characteristic emission point sources nearby.

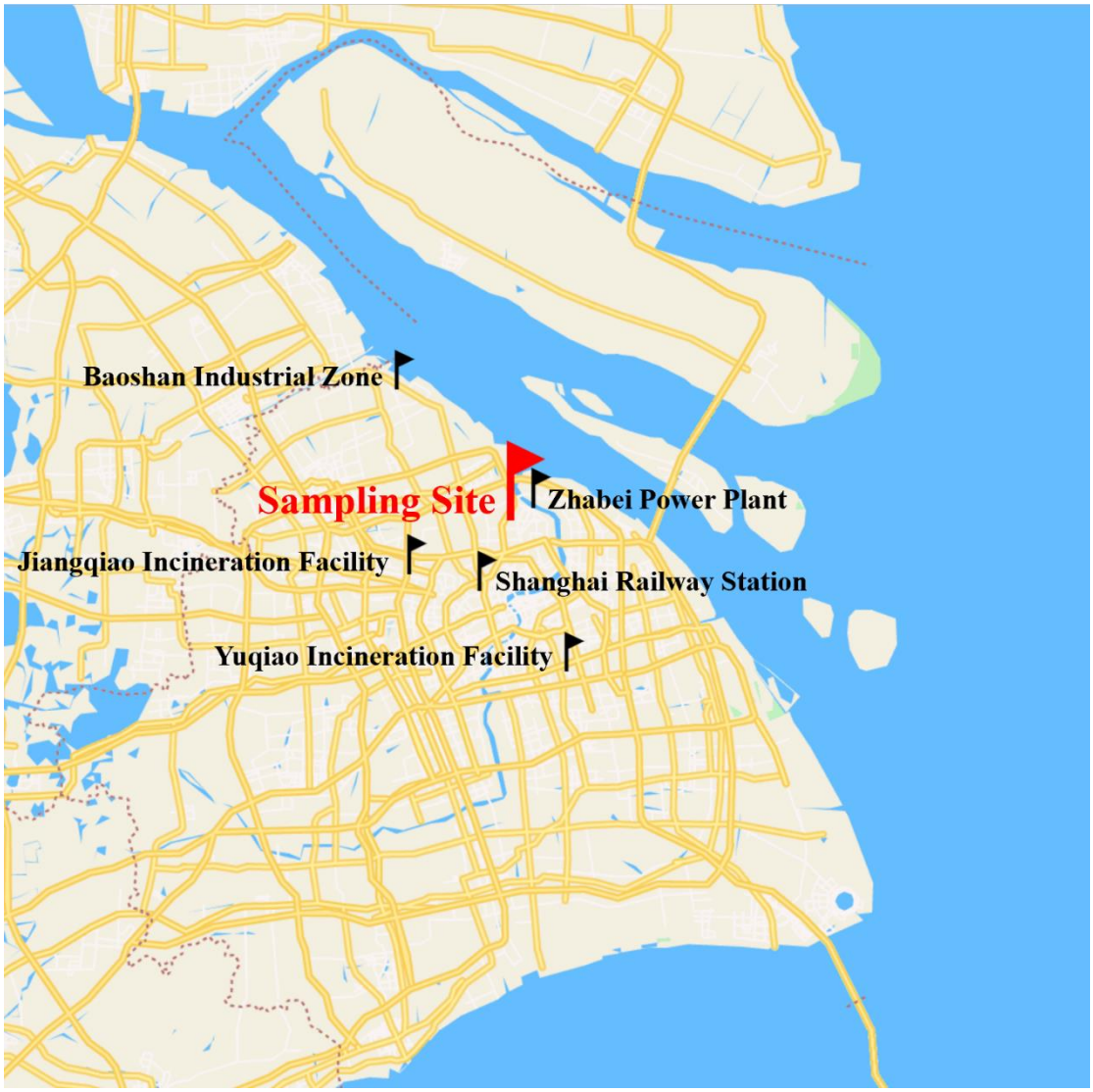

Figure S2. Box plots and distribution curves of size distribution of OC (a), EC (b), WSOC (c) and HULIS-C (d) in the aerosol samples through the whole year.

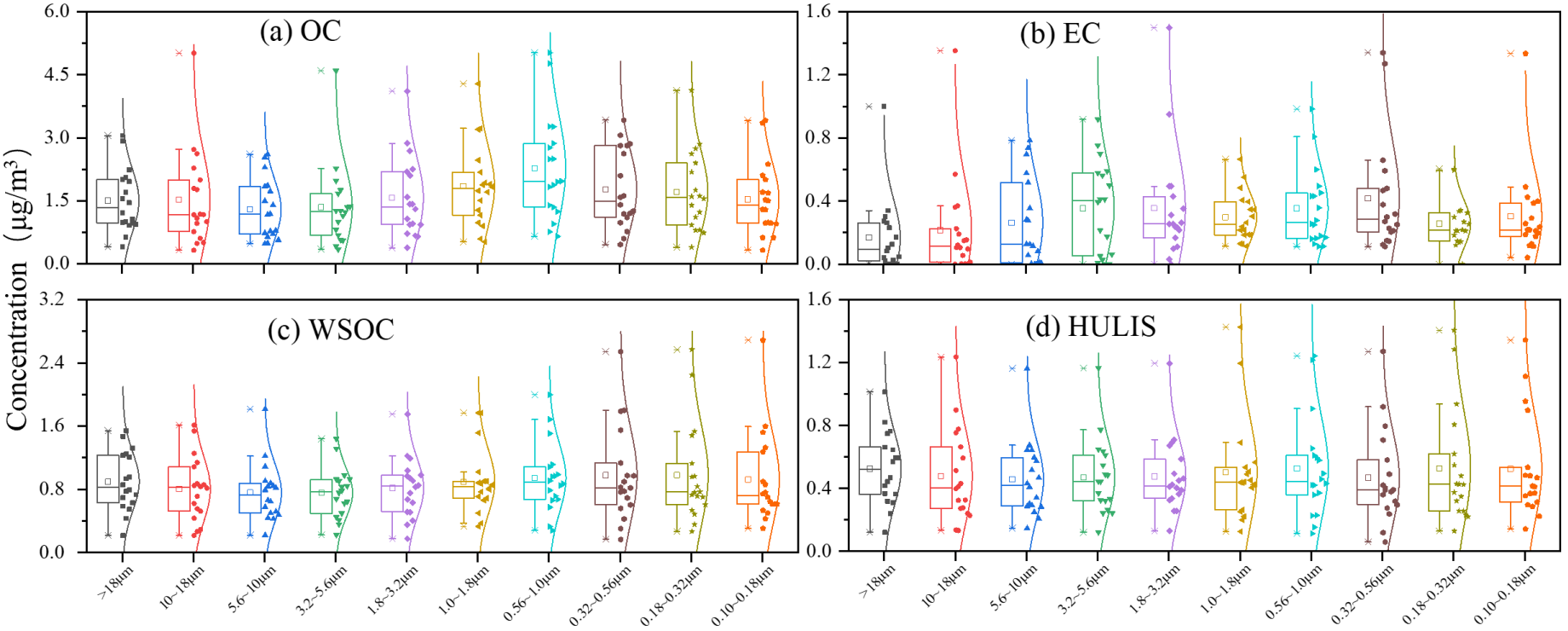

Figure S3. Size distribution of mean concentrations of OC (a) and EC (b) in different seasons.

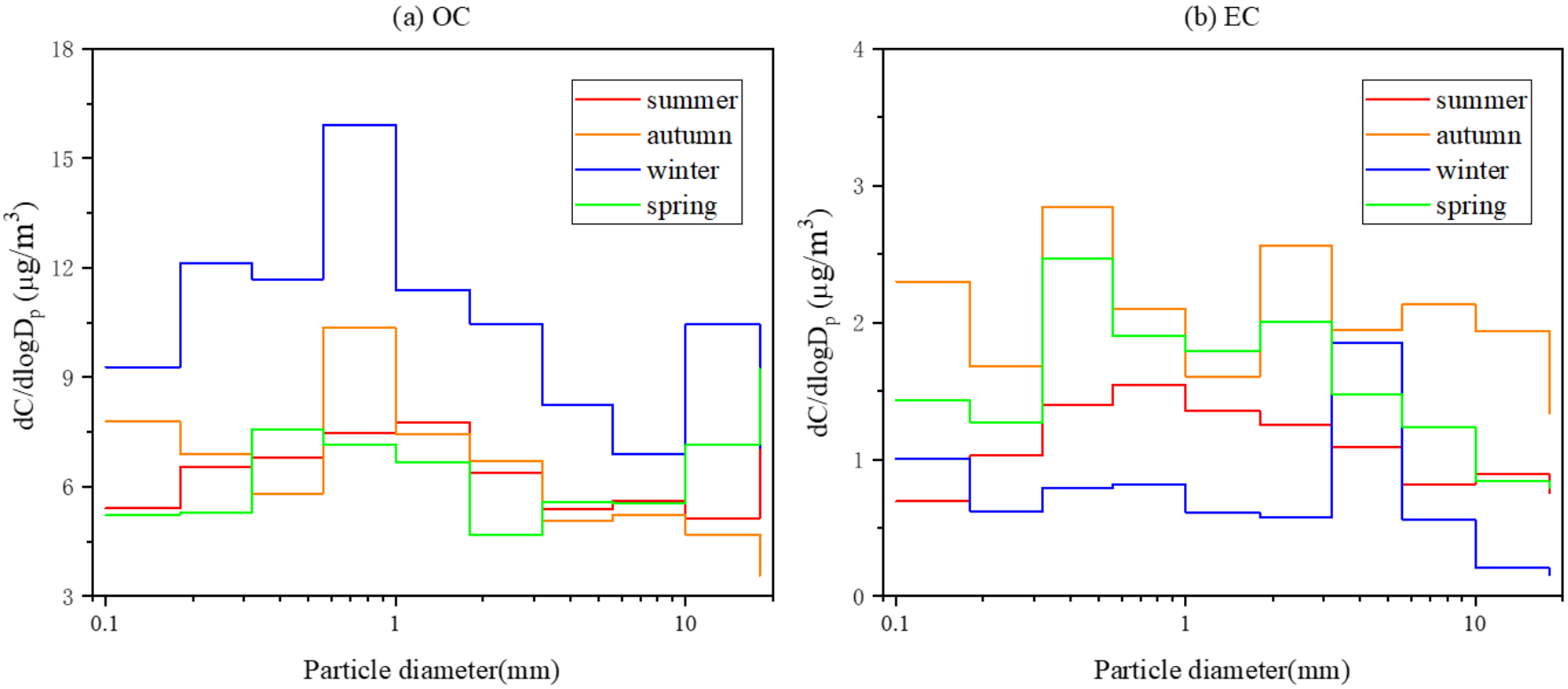

Figure S4. The 72-h air mass backward trajectories (AMBTs) at an arrival height of 29 m (a), 500 m (b), and 1,500 m (c) of the sampling site.