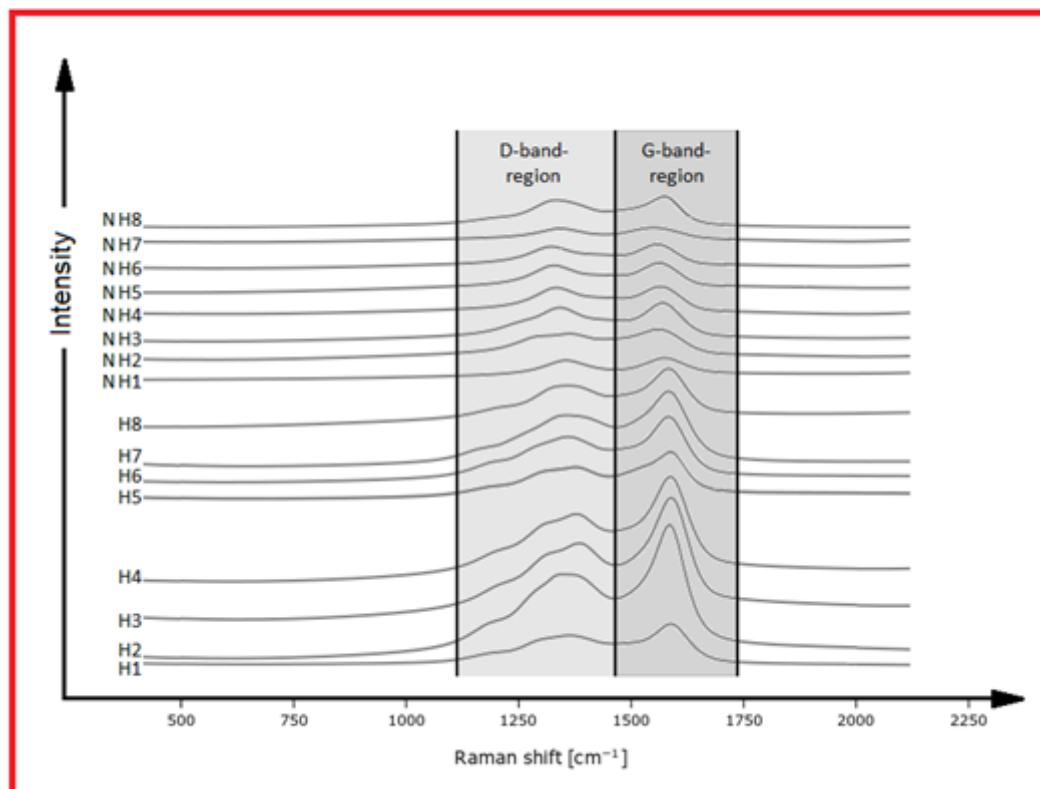**Supplementary Materials:**

Figure S1: Raman spectra of soot in PM$_{2.5}$ collected in Racibórz during heating (H) and non-heating (NH) seasons.

Table S1. EUSAAR-2 temperature protocol used in thermal-optical-transmittance analysis.

Gas	Temperature [˚C]	Duration [s]
He	200	120
He	300	150
He	450	180
He	650	180
He/O$_2$	500	120
He/O$_2$	550	120
He/O$_2$	700	70
He/O$_2$	850	80

Table S2. Mass concentrations (µg m^{-3}) of PM$_{2.5}$, thermo-optically determined organic carbon (OC) and elemental carbon (EC), together with their thermally evolved fractions (OC1-4 and EC1-4), total carbon (TC), and a pyrolized carbon fraction (PC) in samples of ambient soot from Racibórz collected during heating (H) and non-heating (NH) seasons.

Sample: sampling date	PM$_{2.5}$	OC	EC	TC	OC1	OC2	OC3	OC4	PC	EC1	EC2	EC3	EC4
H1: 1.18.17	65	24.77	3.88	28.65	4.31	3.88	1.76	1.97	12.85	2.53	6.83	7.20	0.17
H2: 1.20.17	116	53.16	5.94	59.10	8.46	9.86	4.37	2.56	27.91	4.15	9.34	20.13	0.23
H3: 1.26.17	110	47.48	7.08	54.56	7.37	9.45	3.86	2.80	24.00	4.03	10.15	16.73	0.18
H4: 2.01.17	119	47.27	5.34	52.61	6.67	7.10	3.32	2.51	27.67	4.16	9.65	19.06	0.14
H5: 2.05.17	80	37.85	4.78	42.63	6.92	9.26	3.09	2.44	16.14	3.27	8.10	9.44	0.11
H6: 2.09.17	65	26.74	4.27	31.01	4.72	4.59	1.97	2.71	12.76	2.56	7.07	7.24	0.16
H7: 2.13.17	91	40.71	6.82	47.53	6.37	6.57	3.14	2.99	21.64	3.55	9.60	15.01	0.31
H8: 2.19.17	78	21.78	4.24	26.02	3.62	3.64	1.63	2.33	10.56	2.03	4.79	7.88	0.10
NH1: 6.9.17	10	3.05	0.57	3.62	0.44	0.75	0.51	0.81	0.55	0.08	0.26	0.55	0.23
NH2: 6.25.17	15	4.05	0.38	4.43	0.59	1.16	0.66	0.89	0.75	0.15	0.38	0.44	0.16
NH3: 6.27.17	15	3.43	0.69	4.12	0.52	0.82	0.55	0.92	0.62	0.12	0.32	0.67	0.20
NH4: 6.29.17	11	2.08	0.26	2.34	0.34	0.58	0.41	0.58	0.18	0.02	0.07	0.18	0.17
NH5: 7.1.17	7	1.78	0.18	1.96	0.33	0.50	0.33	0.45	0.18	0.03	0.08	0.14	0.11
NH6: 7.3.17	9	1.69	0.21	1.90	0.31	0.48	0.31	0.48	0.11	0.01	0.06	0.14	0.12
NH7: 7.5.17	13	2.75	0.47	3.22	0.35	0.65	0.46	0.74	0.56	0.14	0.28	0.41	0.19
NH8: 7.11.17	10	2.34	0.34	2.68	0.36	0.62	0.42	0.64	0.31	0.05	0.16	0.28	0.16

Table S3. Raman parameters obtained from the deconvolution of D and G bands in the spectra of soot collected during heating and non-heating seasons in Racibórz. D_{STA} and G_{STA}– scaled integrated area of D and G bands (standard deviation in parentheses); D_{STA}/G_{STA} – area ratio; D and G bands shifts at maximum intensity (cm^{-1}); I_D/I_G - maximum height ratio; FWHM$_G$ – G-band full width at half maximum (cm^{-1}); RAR – Raman area ratio; and $D1_A/G_A$ – D1 and G area ratio.

Samples: sampling dates	D_{STA}	G_{STA}	D_{STA}/G_{STA}	D	G	I_D/I_G	FWHM$_G$	RAR	$D1_A/G_A$
H1: 1.18.17	281(30)	199(27)	1.41	1372	1596	0.72	92	3.93	0.57
H2: 1.20.17	288(14)	177(13)	1.63	1375	1593	0.61	82	4.02	0.58
H3: 1.26.17	286(18)	170(19)	1.68	1399	1596	0.59	82	2.61	0.96
H4: 1.27.17	287(17)	178(13)	1.62	1381	1599	0.63	88	2.51	0.83
H5: 2. 5.17	288(25)	197(33)	1.46	1377	1601	0.69	76	2.84	1.08
H6: 2. 9.17	277(33)	188(08)	1.47	1374	1595	0.68	90	3.55	0.62
H7: 2.13.17	295(19)	197(27)	1.49	1359	1595	0.68	96	3.52	0.63
H8: 2.19.17	267(17)	180(07)	1.49	1365	1599	0.68	90	2.10	0.88
NH1: 6.9.17	192(04)	174(01)	1.10	1346	1604	0.84	52	0.79	1.27
NH2: 6.25.17	231(39)	199(17)	1.16	1362	1589	0.85	43	1.46	1.31
NH3: 6.27.17	256(12)	207(06)	1.23	1335	1592	0.77	55	1.97	1.06
NH4: 6.29.17	194(05)	171(04)	1.14	1344	1586	0.77	40	0.81	1.96
NH5: 7. 1.17	199(05)	183(03)	1.08	1353	1598	0.98	47	0.80	1.80
NH6: 7. 3.17	197(03)	178(09)	1.10	1341	1589	0.89	46	0.79	1.77
NH7: 7. 5.17	198(08)	175(05)	1.14	1347	1589	0.89	46	0.80	1.75
NH8: 7.11.17	194(04)	174(08)	1.11	1384	1599	0.91	60	0.74	1.35

Table S4. Nonparametric (Spearman) correlation matrix ($\alpha = 0.05$) for I_D/I_G and concentrations of OC, EC (including their thermally evolved components), TC, pyrolitic product (Pyr), and PM$_{2.5}$ ($\mu g\cdot m^{-3}$) calculated for the entire sampling period, and separately for the heating and non-heating seasons. Bold-typed values refer to the statistically significant correlation.

Entire sampling period												
	OC	EC	TC	OC1	OC2	OC3	OC4	Pyr	EC1	EC2	EC3	EC4	PM$_{2.5}$
I_D/I_G	**-0.91**	**-0.92**	**-0.91**	**-0.89**	**-0.89**	**-0.91**	**-0.90**	**-0.87**	**-0.86**	**-0.87**	**-0.92**	-0.20	**-0.92**
Heating season												
I_D/I_G	**-0.78**	**-0.76**	**-0.78**	-0.63	-0.63	**-0.78**	-0.59	-0.66	**-0.71**	**-0.71**	**-0.81**	-0.34	**-0.78**
Non-heating season												
I_D/I_G	-0.48	-0.60	-0.48	-0.45	-0.48	-0.48	-0.62	-0.26	-0.14	-0.26	-0.55	**-0.71**	-0.6