

Monitoring of particulate hazardous air pollutants and affecting factors in the largest industrial area in South Korea: the Sihwa-Banwol complex

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Table S1. Operating Conditions of GC/MS for PAH Analysis

GC	Agilent Technologies 6890N				
Inlet liner	Dual-taper direct connect liner (deactivated), 4mm id.				
Column	J&W Scientific DB-5MS capillary column (30 m × 0.25 mm × 1.0 μm)				
	Flow rate	1.2 mL/min			
MSD	Agilent Technologies 5973 inert				
	Solvent delay	8 min			
	EM voltage	Run at auto-tune voltage			
	Mass range	100 ~ 350 amu			
	Quadrupole temp.	180 °C			
	MS Source temp.	300 °C			
	Transfer line temp.	280 °C			
Oven	Oven ramp	°C/min	Temp. (°C)	Hold (min)	Total (min)
	Initial	-	70	1	1
	Ramp 1	15	205	0	10
	Ramp 2	8	325	25	50

Table S2. List of PAHs Analyzed in This Study, Together with Their Toxicity Information and QC/QA Data

No.	PAH	Abbreviation	Formula	WOE ^a for Cancer		MDL ^b (pg)	MDL ^c (ng/m ³)	Recovery ^d (%)	MRE ^e (%, n = 14)
				IARC	USEPA				
IS	Naphthalene-d ₈	d-NPHTL	C ₁₀ D ₈	-	-	-	-	-	-
1	Naphthalene	NPHTL	C ₁₀ H ₈	2B	C	13.4	0.008	70.0	-
SS ^f	Biphenyl-d ₁₀	d-BIPH	C ₁₂ D ₁₀	-	-	-	-	-	-
2	Biphenyl	BIPH	C ₁₂ H ₁₀	-	D	-	-	-	-
3	Acenaphthylene	ACNTL	C ₁₂ H ₈	-	D	49.6	0.031	66.9	-
IS ^g	Acenaphthene-d ₁₀	d-ACNTN	C ₁₂ D ₁₀	-	-	-	-	-	-
4	Acenaphthene	ACNTN	C ₁₂ H ₁₀	3	-	70.6	0.044	74.9	-
5	Fluorene	FLURN	C ₁₃ H ₁₀	3	D	66.6	0.042	81.8	-
6	Dibenzothiophene	DBTP	C ₁₂ H ₈ S	-	-	-	-	-	-
SS	Phenanthrene-d ₁₀	d-PHEN	C ₁₄ D ₁₀	-	-	-	-	-	-
7	Phenanthrene	PHEN	C ₁₄ H ₁₀	3	D	62.0	0.039	61.5	4.2
8	Anthracene	ANTHR	C ₁₄ H ₁₀	3	D	38.2	0.024	78.3	23.3
9	4H-Cyclopenta[d,e,f]phenanthrene	CdefPH	C ₁₅ H ₁₀	-	-	-	-	-	-
SS	Fluoranthene-d ₁₀	d-FLRTH	C ₁₆ D ₁₀	-	-	-	-	-	-
10	Fluoranthene	FLRTH	C ₁₆ H ₁₀	3	D	25.7	0.016	80.6	4.5
IS	Pyrene-d ₁₀	d-PYR	C ₁₆ D ₁₀	-	-	-	-	-	-
11	Pyrene	PYR	C ₁₆ H ₁₀	3	D	21.7	0.014	79.5	-
12	Benzo[c]phenanthrene	BcPH	C ₁₈ H ₁₂	3	D	-	-	-	9.0
13	Benzo[g,h,i]fluoranthene	BghiF	C ₁₈ H ₁₀	3	-	-	-	-	-
14	Cyclopenta[c,d]pyrene	CcdP	C ₁₈ H ₁₀	2B	-	-	-	-	-
SS	Benz[a]anthracene-d ₁₂	d-BaA	C ₁₈ D ₁₂	-	-	-	-	-	-
15	Benz[a]anthracene	BaA	C ₁₈ H ₁₂	2B	B2	22.4	0.014	82.6	-
16	Triphenylene	TRPL	C ₁₈ H ₁₂	3	-	19.5	0.012	80.9	7.1
17	Chrysene	CHRY	C ₁₈ H ₁₂	3	-	-	-	-	-
18	Benzo[b]fluoranthene	BbF	C ₂₀ H ₁₂	2B	B2	30.9	0.019	87.5	6.8
19	Benzo[j]fluoranthene	BjF	C ₂₀ H ₁₂	2B	-	-	-	-	-
20	Benzo[k]fluoranthene	BkF	C ₂₀ H ₁₂	2B	B2	31.8	0.020	89.5	17.3
21	Benzo[a]fluoranthene	BaF	C ₂₀ H ₁₂	3	-	-	-	-	24.5
22	Benzo[e]pyrene	BeP	C ₂₀ H ₁₂	-	-	36.2	0.022	83.0	10.5
IS	Benzo[a]pyrene-d ₁₂	d-BaP	C ₂₀ D ₁₂	-	-	-	-	-	-
23	Benzo[a]pyrene	BaP	C ₂₀ H ₁₂	1	A	38.1	0.024	81.5	8.7
IS	Perylene-d ₁₂	d-PRN	C ₂₀ D ₁₂	-	-	-	-	-	-
24	Perylene	PRL	C ₂₀ H ₁₂	3	-	31.5	0.020	78.3	9.6
25	Dibenz[a,j]anthracene	DajA	C ₂₂ H ₁₄	3	-	-	-	-	27.7
SS	Dibenz[a,h]anthracene-d ₁₄	d-DahA	C ₂₂ D ₁₄	-	-	-	-	-	-
26	Indeno[1,2,3-c,d]pyrene	I123P	C ₂₂ H ₁₂	2B	B2	47.6	0.030	93.0	27.8
27	Dibenz[a,h]anthracene	DahA	C ₂₂ H ₁₄	2A	B2	33.4	0.021	98.5	9.9
28	Dibenz[a,c]anthracene	DacA	C ₂₂ H ₁₄	3	-	-	-	-	-
29	Benzo[b]chrysene	BbCH	C ₂₂ H ₁₄	3	-	-	-	-	13.6
30	Picene	PCN	C ₂₂ H ₁₄	3	-	-	-	-	9.1
IS	Benzo[g,h,i]perylene-d ₁₂	d-BghiP	C ₂₂ D ₁₂	-	-	-	-	-	-
31	Benzo[g,h,i]perylene	BghiP	C ₂₂ H ₁₂	3	D	37.2	0.023	84.3	7.1
32	Anthanthrene	ANTHN	C ₂₂ H ₁₂	-	-	-	-	-	17.1
33	Dibenzo[b,k]fluoranthene	DbkF	C ₂₄ H ₁₄	-	-	-	-	-	-
34	Dibenzo[a,h]pyrene	DahP	C ₂₄ H ₁₄	2B	-	-	-	-	-
35	Coronene	COR	C ₂₄ H ₁₂	3	-	15.9	0.010	69.5	-
36	Dibenzo[a,e]pyrene	DaeP	C ₂₄ H ₁₄	3	-	-	-	-	-

a) WOE: weight of evidence; b) MDL: method detection limit = $SD \times t(n-1, 0.01)$, where SD is the standard deviation of 7 replicates of spiked blank samples, and the Student's t value is 3.14; c) MDL for the air concentration unit calculated by converting from mass MDLs (pg), assuming an injection volume of 2 μ L, a final solution of 1 mL and an air volume of 800 m³; d) Recovery rate estimated from 6 replicates of a spiked standard solution containing 19 PAHs; e) MRE: mean relative error, RE being defined as $|certified\ value - measured\ value| \div certified\ value \times 100$; f) SS: surrogate standard; g) IS: internal standard.

Table S3. Detection Frequency of Particulate PAHs Measured in This Study

Range	PAH (n = 438)
99 – 100%	Naphthalene, Phenanthrene, Fluoranthene, Pyrene, Benzo[b+j+k]fluoranthene, Benzo[e]pyrene, Benzo[a]pyrene, Indeno[1,2,3-c,d]pyrene
50 – 99%	Benzo[c]phenanthrene, Benzo[g,h,i]fluoranthene+Cyclopenta[c,d]pyrene, Benz[a]anthracene Triphenylene+Chrysene, Benzo[a]fluoranthene, Benzo[g,h,i]perylene
25 – 50%	Biphenyl, Anthracene, Perylene, Coronene
10 – 25%	Acenaphthylene, Fluorene, Dibenzothiophene, 4H-Cyclopenta[d,e,f]phenanthrene, Dibenz[a,j]anthracene, Dibenz[a,h+a,c]anthracene, Picene, Anthanthrene
Less than 10%	Acenaphthene, Benzo[b]chrysene, Dibenzo[b,k]fluoranthene, Dibenzo[a,h]pyrene, Dibenzo[a,e]pyrene

Table S4. Seasonal Concentrations (ng/m³) of PAHs and Heavy Metals in Sihwa-Banwol Area, 2005 to 2007

PAH	2005 Summer (n = 48)				2005 Autumn (n = 48)				2005 Winter (n = 48)				2006 Spring (n = 47)			
	Mean	±	SD	Max	Mean	±	SD	Max	Mean	±	SD	Max	Mean	±	SD	Max
NPHTL	0.10	±	0.06	0.43	0.26	±	0.06	0.37	0.36	±	0.11	0.61	0.19	±	0.05	0.32
PHEN	0.14	±	0.15	1.12	1.02	±	0.69	4.61	2.78	±	1.54	5.48	0.66	±	0.22	1.60
ANTHR	0.02	±	0.04	0.29	0.03	±	0.06	0.16	0.28	±	0.12	0.89	0.02	±	0.04	0.25
FLRTH	0.19	±	0.44	3.13	1.60	±	0.81	4.03	5.74	±	3.10	15.33	1.00	±	0.36	2.08
PYR	0.22	±	0.58	4.12	1.44	±	0.69	3.33	5.55	±	3.24	18.23	0.83	±	0.32	1.87
BcPH	0.01	±	0.03	0.20	0.37	±	0.24	1.53	1.04	±	0.49	2.19	0.09	±	0.09	0.39
BghF+CcdP	0.07	±	0.15	1.08	1.40	±	0.81	5.04	3.91	±	1.70	8.58	0.44	±	0.26	1.30
BaA	0.09	±	0.15	1.04	1.05	±	0.73	4.54	2.86	±	1.34	5.82	0.43	±	0.32	1.52
TRPL+CHRY	0.15	±	0.16	1.07	2.44	±	1.24	7.20	5.12	±	2.08	9.50	1.05	±	0.49	2.48
B[b+j+k]F	0.51	±	0.76	5.42	3.41	±	1.67	9.78	6.19	±	2.38	11.01	1.62	±	0.72	3.79
BeP	0.24	±	0.26	1.92	1.37	±	0.64	3.66	2.23	±	0.84	3.94	0.66	±	0.31	1.56
BaP	0.16	±	0.25	1.79	1.18	±	0.66	4.06	2.47	±	1.14	5.71	0.42	±	0.28	1.34
I123P	0.15	±	0.10	0.62	0.95	±	0.50	3.03	1.73	±	0.71	3.29	0.43	±	0.20	1.09
D[ah+ac]A	0.03	±	0.03	0.12	0.07	±	0.16	0.68	0.29	±	0.27	0.75	0.02	±	0.06	0.24
BghiP	0.32	±	0.17	0.96	1.61	±	0.85	4.98	2.66	±	1.14	5.16	0.73	±	0.36	1.99
Coronene	not detected				not detected				not detected				0.27	±	0.18	0.90
As	2.1	±	2.2	9.2	9.2	±	4.8	20.4	13.9	±	9.9	31.7	10.3	±	6.1	32.6
Cd	4.9	±	6.3	32.3	6.5	±	4.8	27.0	14.3	±	15.4	88.1	7.2	±	9.1	45.3
Co	0.9	±	0.6	2.9	3.7	±	3.6	20.2	8.4	±	14.5	101.0	4.6	±	2.8	12.8
Cr(VI)	not available				not available				not available				not available			
Mn	39.8	±	18.5	88.9	120.9	±	58.7	302.8	171.0	±	97.1	379.9	192.5	±	121.8	581.1
Ni	13.2	±	7.5	38.7	32.7	±	22.8	136.0	36.3	±	21.2	109.9	28.2	±	17.9	83.7
Pb	130.9	±	113.7	482.2	281.4	±	191.2	1008.8	513.0	±	835.8	4600.7	252.8	±	296.7	1633.4
V	4.6	±	2.2	9.6	7.0	±	3.2	14.0	12.8	±	6.9	26.1	18.5	±	12.8	59.4
Zn	425.8	±	274.2	1232.9	818.0	±	494.4	2211.0	1059.8	±	678.3	3847.8	808.4	±	540.5	2729.8
TSP (µg/m ³)	71.3	±	26.4	143.0	194.6	±	88.3	382.9	182.8	±	72.1	322.4	233.5	±	107.2	533.5

PAH	2006 Autumn (n=50)				2007 Winter (n=49)				2007 Spring (n=50)				2007 Summer (n=50)			
	Mean	±	SD	Max	Mean	±	SD	Max	Mean	±	SD	Max	Mean	±	SD	Max
NPHTL	0.28	±	0.09	0.45	1.00	±	0.10	1.23	0.41	±	0.06	0.58	0.33	±	0.05	0.52
PHEN	0.48	±	0.22	0.95	2.77	±	1.22	5.55	0.73	±	0.34	1.62	0.13	±	0.04	0.20
ANTHR	not detected				<0.01	±	0.07	0.46	<0.01	±	0.02	0.12	not detected			
FLRTH	0.86	±	0.44	2.12	6.08	±	1.92	12.54	1.19	±	0.60	2.85	0.16	±	0.06	0.35
PYR	0.86	±	0.49	2.91	5.59	±	2.02	13.49	0.98	±	0.44	2.14	0.20	±	0.07	0.38
BcPH	0.12	±	0.17	0.75	1.07	±	0.54	2.84	0.15	±	0.17	0.53	0.19	±	0.16	0.69
BghP+CcdP	0.72	±	0.56	3.47	2.82	±	1.08	6.56	0.52	±	0.27	1.28	0.14	±	0.08	0.39
BaA	0.89	±	0.74	3.62	2.90	±	1.40	7.74	0.58	±	0.33	1.36	0.09	±	0.06	0.25
TRPL+CHRY	1.43	±	0.92	4.45	5.64	±	1.82	11.39	1.23	±	0.54	2.55	0.27	±	0.13	0.56
B[b+j+k]F	3.80	±	2.32	10.85	11.46	±	3.36	23.71	2.50	±	1.10	4.88	0.75	±	0.53	3.23

BeP	1.51	±	0.89	4.31	3.89	±	1.15	8.08	0.94	±	0.40	1.86	0.28	±	0.19	1.16
BaP	1.31	±	0.92	3.26	3.92	±	1.72	10.41	0.59	±	0.30	1.43	0.14	±	0.07	0.33
I123P	1.04	±	0.61	2.31	2.91	±	0.97	6.63	0.62	±	0.28	1.38	0.19	±	0.11	0.68
D[ah+ac]A	0.08	±	0.17	0.50	0.09	±	0.33	1.60	not detected				not detected			
BghiP	1.80	±	1.04	4.06	4.16	±	1.41	9.14	1.03	±	0.45	2.38	0.36	±	0.20	1.20
Coronene	not detected				1.24	±	1.04	3.49	0.40	±	0.21	0.99	0.22	±	0.11	0.55
As	6.7	±	5.5	18.2	29.75	±	17.8	79.2	11.6	±	6.0	27.3	6.8	±	8.7	58.7
Cd	4.8	±	3.9	19.4	7.79	±	3.0	18.3	5.3	±	3.7	23.7	8.0	±	11.0	47.3
Co	2.6	±	2.3	11.5	2.48	±	1.0	5.5	2.3	±	0.9	4.9	1.6	±	1.0	3.9
Cr(VI)	1.0	±	1.2	5.8	1.79	±	3.7	17.4	0.7	±	0.4	1.8	0.8	±	0.4	2.0
Mn	108.4	±	70.8	316.3	141.91	±	65.0	337.5	109.8	±	36.6	199.3	76.6	±	64.9	443.6
Ni	72.4	±	156.8	743.6	31.27	±	25.5	122.6	23.2	±	13.7	63.2	26.1	±	30.1	183.3
Pb	149.3	±	121.5	461.7	307.91	±	184.6	935.2	224.1	±	138.7	605.2	226.0	±	293.1	1909.7
V	5.0	±	4.3	19.7	11.93	±	3.5	26.2	13.5	±	4.90	23.6	8.8	±	4.0	17.3
Zn	603.3	±	567.3	2913.7	901.60	±	507.7	2635.6	708.4	±	407.4	1948.5	641.4	±	493.0	1891.7
TSP (µg/m ³)	128.7	±	47.9	236.3	181.2	±	45.2	272.5	205.9	±	53.1	321.0	137.0	±	54.9	238.4

Table S5. Summary of the Chemical Components of PM, Air Quality and Meteorological Data (n = 88) at the Sihwa Industrial Site Used for Principal Component Analysis (PCA)

Variable	Mean	SD	Min.	Max.	Variable	Mean	SD	Min.	Max.
Al (µg/m ³)	4.54	5.77	0.29	42.97	Cl ⁻ (µg/m ³)	4.85	4.92	0.06	26.08
Fe (µg/m ³)	4.73	3.14	0.92	22.29	NO ₃ ⁻ (µg/m ³)	8.34	8.02	0.73	37.49
K (µg/m ³)	2.30	1.85	0.26	11.82	SO ₄ ⁻² (µg/m ³)	8.15	6.66	1.00	33.28
Mg (µg/m ³)	0.95	1.07	0.00	8.21	NH ₄ ⁺ (µg/m ³)	4.96	4.54	0.00	20.52
Na (µg/m ³)	3.08	2.28	0.01	12.08	Ca ⁺² (µg/m ³)	1.02	0.63	0.00	2.94
Cd (µg/m ³)	0.01	0.01	0.00	0.03	SO ₂ (ppb)	10.67	6.88	1.75	35.67
Co (µg/m ³)	0.01	0.01	0.00	0.10	O ₃ (ppb)	20.88	12.94	2.08	52.00
Cr (µg/m ³)	0.25	0.15	0.02	0.66	NO ₂ (ppb)	33.03	15.30	9.50	72.17
Mn (µg/m ³)	0.16	0.10	0.03	0.58	CO (ppm)	0.60	0.38	0.13	1.92
Ni (µg/m ³)	0.04	0.02	0.01	0.11	Temperature (°C)	13.32	9.07	-4.20	30.45
Pb (µg/m ³)	0.35	0.32	0.03	1.91	Wind speed (m/s)	1.66	0.92	0.45	6.46
Zn (µg/m ³)	0.92	0.68	0.14	3.85	EW*	-0.08	0.36	-0.80	0.80
As (µg/m ³)	0.01	0.01	0.00	0.08	NS*	0.11	0.30	-0.75	0.87
Ti (µg/m ³)	0.25	0.27	0.03	2.04	OC(µg/m ³)	11.38	7.71	1.65	32.24
V (µg/m ³)	0.01	0.01	0.00	0.06	EC(µg/m ³)	3.28	2.73	0.70	21.43

* Wind directions for East-West and North-South were quantified as θ (0-360 degree) with North = 0 degrees, and the values are as follows; i) $0 \leq \theta < 90$, EW = $\theta/90$ & NS = $1 - \theta/90$; ii) $90 \leq \theta < 180$, EW = $2 - \theta/90$ & NS = $1 - \theta/90$; iii) $180 \leq \theta < 270$, EW = $2 - \theta/90$ & NS = $\theta/90 - 3$; iv) $270 \leq \theta < 360$, EW = $\theta/90 - 4$ & NS = $\theta/90 - 3$.

Table S6. Result of PCA for Air Quality and Meteorological Data at the Sihwa Industrial Site

Variable	PC 1	PC 2	PC 3	PC 4	PC 5
Al	0.970	-0.063	-0.076	-0.017	0.003
Fe	0.932	0.101	-0.068	0.186	0.156
K	0.949	0.222	0.095	0.063	0.120
Mg	0.968	-0.026	-0.116	0.010	-0.029
Mn	0.834	0.176	0.189	0.355	0.240
Ti	0.961	-0.060	-0.065	0.005	0.032
Na	0.629	0.021	-0.014	0.308	-0.139
Cd	0.041	0.457	0.361	0.584	0.357
Co	0.140	-0.142	0.179	0.640	-0.097
Cr	0.338	0.261	0.054	0.649	0.212
Ni	0.314	0.250	0.149	0.697	0.354
Pb	-0.051	0.303	0.092	0.605	0.488
V	0.082	0.011	0.240	0.402	0.708
Zn	0.067	0.223	0.294	0.625	0.234
As	0.184	0.117	0.241	0.045	0.835
Cl ⁻	0.083	0.228	0.144	0.832	0.116
NO ₃ ⁻	0.139	0.902	0.186	0.060	0.044
SO ₄ ²⁻	0.129	0.927	0.112	0.089	0.032
NH ₄ ⁺	0.035	0.827	0.193	0.189	0.337
Ca ²⁺	0.796	0.312	0.106	0.110	-0.007
SO ₂	-0.037	0.600	0.011	0.221	0.512
NO ₂	0.116	0.421	0.729	0.221	0.193
CO	0.191	0.426	0.676	0.246	0.121
O ₃	0.171	0.131	-0.777	-0.177	-0.073
OC	0.236	0.399	0.605	0.280	0.439
EC	0.095	0.461	0.629	0.168	0.087
Temp	-0.409	0.209	-0.451	-0.308	-0.287
Wind speed	0.183	-0.146	-0.698	0.028	-0.237
EW*	-0.055	0.052	0.744	0.129	-0.146
NS*	-0.123	-0.013	0.064	-0.020	0.073
Eigenvalue	7.230	4.441	4.259	3.751	2.582
% Variance explained	24.1	14.8	14.2	12.5	8.6
Source class	Soil/Road dust resuspension	Secondary aerosols	Vehicular exhausts + Inland heating combustion	Industrial activities + Incineration	Coal/Oil combustions

Table S7. Mean Concentrations (ng/m³) of Selected PAHs During the Cold Season (November to February) in the Sihwa-Banwol Area (this study) and Other Areas in Korea.

City	Sampling location	PM	Year	Data	BaA	CHRY	BbF	BkF	BaP	I123P	DahA	Reference
Daegu	Industrial	TSP	1992-1993	29	4.8	6.8	5.0	2.3	4.2	6.9	1.1	[1]
Siheung	Industrial	TSP	2005-2007	22	2.7	5.2 ^{a)}		8.8 ^{b)}	2.9	2.2	0.2 ^{c)}	This study
Ansan	Industrial	TSP	2005-2007	22	2.7	5.3 ^{a)}		8.7 ^{b)}	2.9	2.3	0.3 ^{c)}	This study
Pohang	Industrial	TSP	2010-2011	10	1.3	1.9	2.7	0.7	1.3	1.0	0.2	[2]
Daesan	Industrial	TSP	2011-2012	14	0.5	1.0	1.3	0.3	0.5	0.5	0.1	[3]
Seoul	Residential	TSP	1991-1992	9	4.2	6.1	10.6	0.8	4.7	5.3	2.4	[4]
Daegu #1	Residential	TSP	1992-1993	30	2.0	6.5	9.1	1.5	2.7	1.9	0.7	[1]
Daegu #2	Residential	PM _{2.5}	1992-1993	47	1.3	2.8	2.8	0.9	1.6	2.0	0.3	[5]
Seoul	Residential	PM _{2.5}	1998-1999	47	1.8	2.8		4.9	2.6	3.6	0.6	[6]
Chongju	Residential	PM _{2.5}	2001-2002	15	0.6	1.0	1.0	N.A. ^{d)}	0.6	0.3	0.1	[7]
Siheung	Residential	TSP	2005-2007	22	3.3	5.8 ^{a)}		10.5 ^{b)}	3.9	2.7	0.3 ^{c)}	This study
Ansan #1	Residential	TSP	2005-2007	22	2.8	5.1 ^{a)}		8.5 ^{b)}	3.2	2.4	0.2 ^{c)}	This study
Ansan #2	Residential	TSP	2006-2007	10	3.1	6.0 ^{a)}		10.5 ^{b)}	3.6	2.6	0.1 ^{c)}	This study
Seoul	Residential	PM ₁₀	2006-2007	20	2.5	2.5 ^{a)}	4.1	3.0	2.5	2.7	0.7	[8]
Pohang	Residential	TSP	2010-2011	10	0.5	0.9	1.4	0.4	0.6	0.5	0.1	[2]
Daesan	Residential	TSP	2011-2012	7	0.7	1.4	1.6	0.4	0.7	0.6	0.1	[3]
Seoul	Residential	TSP	2013-2014	35	0.9	1.4	1.2	0.6	0.8	0.8	N.D. ^{e)}	[8]
Gyeongsan	Suburban	TSP	1992-1993	31	1.3	4.4	6.0	0.8	1.5	1.1	0.4	[1]
Gyeongsan	Suburban	TSP	1995-1996	19	2.4	5.1	2.3	1.0	1.7	2.0	0.5	[9]
Gosan	Background	TSP	2001-2003	27	0.2	0.5	0.6	0.4	0.1	0.3	N.A.	[10]
Gosan	Background	TSP	2001-2004	49	0.2	0.6	0.6	0.3	0.3	0.5	0.1	[11]
Pocheon	Suburban	TSP	2005-2006	12	1.3	2.6 ^{a)}		2.9 ^{b)}	1.0	0.7	N.D.	This study
Ulsan	Suburban	TSP	2013-2014	N.A	0.1	0.3	0.5	0.2	0.2	0.2	0.1	[12]

a) Concentration of TRPL+CHRY; b) Concentration of B[b+j+k]F; c) Concentration of D[ah+ac]A.

N.A.: not available; N.D.: not detected.

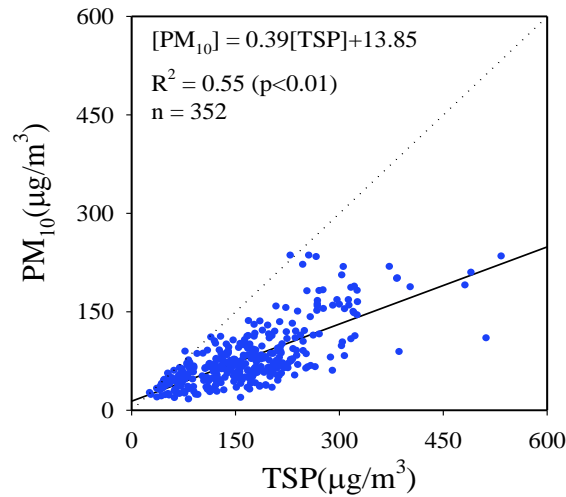


Fig. S1. Linear regression analysis between TSP and PM₁₀ data.

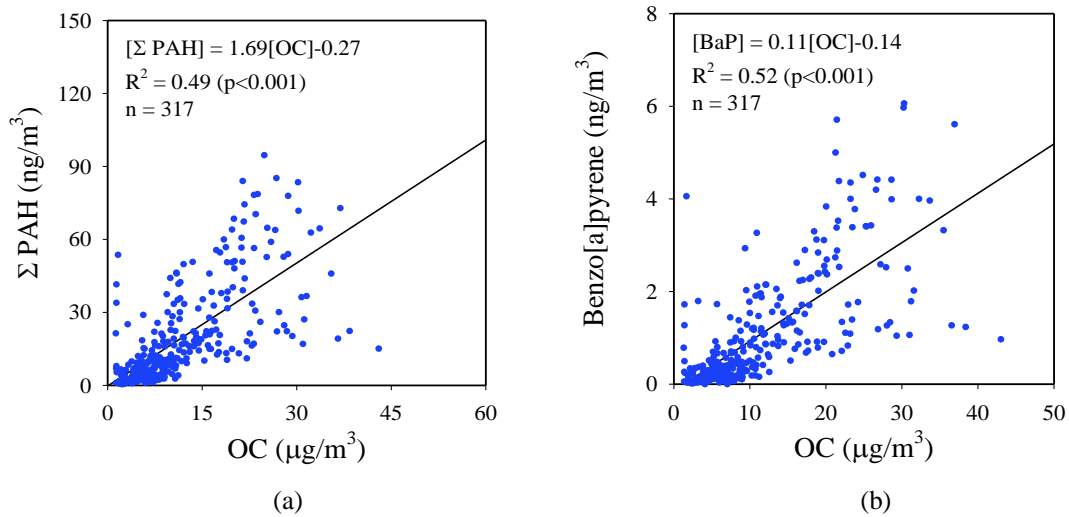


Fig. S2. (a) Linear regression analysis between OC and Σ PAH, and (b) OC and benzo[a]pyrene.

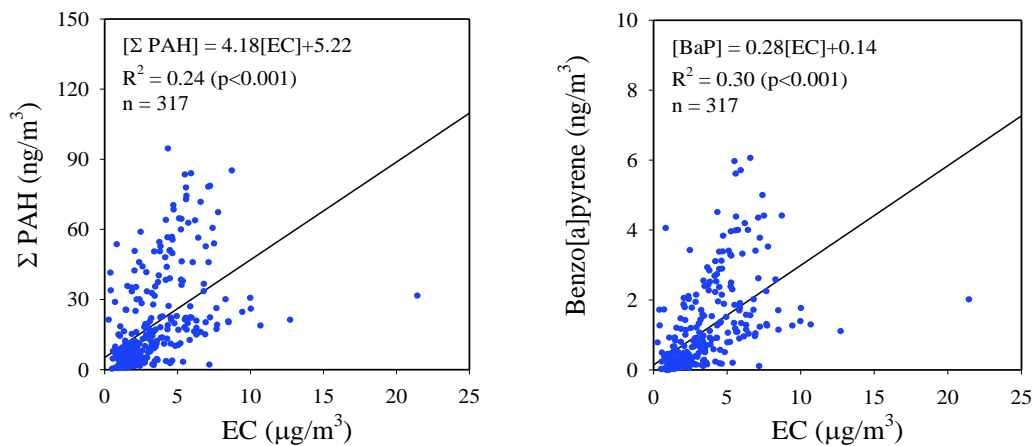


Fig. S3. (a) Linear regression analysis between EC and Σ PAH, and (b) EC and benzo[a]pyrene.

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