Supplementary Material:

Diurnal variations of organic molecular tracers and stable carbon isotopic composition in atmospheric aerosols over Mt. Tai in the North China Plain: an influence of biomass burning

P. Q. Fu[1,2], K. Kawamura[1], J. Chen[3,6], J. Li[2], Y. L. Sun[2], Y. Liu[2], E. Tachibana[1], S. G. Aggarwal[1,*], K. Okuzawa[1], H. Tanimoto[4], Y. Kanaya[5], and Z. F. Wang[2]

[1] Institute of Low Temperature Science, Hokkaido University, Sapporo 060-0819, Japan

[2] State Key Laboratory of Atmospheric Boundary Layer Physics and Atmospheric Chemistry, Institute of Atmospheric Physics, Chinese Academy of Sciences, Beijing 100029, China

[3] SKLEG, Institute of Geochemistry, Chinese Academy of Sciences, Guiyang 550002, China

[4] National Institute for Environmental Studies, Tsukuba, Japan

[5] Frontier Research Center for Global Change, Japan Agency for Marine-Earth Science and Technology, Kanagawa, Japan

[6] Graduate School of the Chinese Academy of Sciences, Beijing 100049, China

*Now at National Physical Laboratory, New Delhi 110012, India

Correspondence to: P. Q. Fu (fupingqing@mail.iap.ac.cn), K. Kawamura (kawamura@lowtem.hokudai.ac.jp)

Table S1. Concentrations of the identified organic compounds in the summertime aerosol samples collected at the summit of Mt. Tai, Central East China (ng m^{-3}).

Compounds	Early June (n=24)			Late June (n=13)		
	range	mean	std[a]	range	mean	std
I. *n*-Alkanes						
C_{20}	0.10-0.83	0.39	0.25	0.04-1.0	0.33	0.30
C_{21}	0.44-6.1	3.2	1.6	0.06-4.3	1.5	1.3
C_{22}	0.97-6.9	3.6	1.3	0.04-3.3	1.4	1.0
C_{23}	1.9-18	8.3	3.5	0.08-5.3	2.6	1.7
C_{24}	1.6-12	5.0	2.7	0.07-4.6	1.8	1.3
C_{25}	3.3-21	11	5.2	0.14-7.5	3.4	2.1
C_{26}	2.6-16	8.1	3.9	0.12-6.1	2.2	1.6
C_{27}	4.7-50	20	11	0.13-8.4	4.4	2.5
C_{28}	3.0-23	11	6.4	0.14-6.6	2.6	1.9
C_{29}	16.2-323	79	68	0.12-14	6.3	4.0
C_{30}	1.3-15	6.7	4.3	0.04-3.3	1.7	1.0
C_{31}	3.6-103	30	22	0.10-6.4	3.6	1.8
C_{32}	0.71-15	3.8	3.4	0.05-2.1	0.95	0.58
C_{33}	0.60-28	7.6	6.6	0.01-1.9	0.98	0.55
C_{34}	0.14-6.3	1.4	1.6	0.03-1.9	0.47	0.64
C_{35}	0.02-0.53	0.23	0.15	nd[b] -0.70	0.20	0.27
C_{36}	nd-0.63	0.20	0.18	nd-1.1	0.24	0.36
subtotal	54.8-599	199	127	1.2-64	35	19
CPI (C_{20}-C_{36})[c]	1.8-7.6	3.9	1.3	1.1-3.2	2.1	0.5
II. Fatty acids						
$C_{10:0}$	nd	nd	nd	0.17-3.2	1.1	0.80
$C_{11:0}$	nd	nd	nd	0.01-0.62	0.19	0.21
$C_{12:0}$	3.4-11	6.8	1.7	0.47-24	5.3	5.9
$C_{13:0}$	1.3-8.0	3.1	1.6	0.02-2.1	0.88	0.76
$C_{14:0}$	7.3-39	18	7.1	0.51-13	6.5	3.6
$C_{15:0}$	1.9-7.7	4.4	1.6	0.14-4.2	2.2	1.2
$C_{16:0}$	17-74	44	14	1.2-84	37	27
$C_{17:0}$	0.54-3.6	2.0	0.81	0.01-1.9	1.0	0.58
$C_{18:0}$	6.6-24	14	4.4	0.30-30	14	9.6
$C_{19:0}$	0.19-2.6	0.95	0.68	0.01-0.86	0.31	0.23
$C_{20:0}$	0.94-10	4.9	2.3	0.03-4.4	2.0	1.6
$C_{21:0}$	0.17-6.3	2.8	1.8	0.01-0.82	0.33	0.24
$C_{22:0}$	3.4-40	17	9.5	0.08-7.0	3.4	2.4
$C_{23:0}$	1.3-32	10	7.5	nd-6.3	1.9	1.9
$C_{24:0}$	4.0-67	24	16	0.01-8.4	4.4	2.6
$C_{25:0}$	0.83-29	8.2	6.6	0.01-1.4	0.69	0.46
$C_{26:0}$	2.9-98	33	23	0.01-6.3	3.5	1.9
$C_{27:0}$	0.73-45	10	10	0.01-1.9	0.50	0.59
$C_{28:0}$	5.9-262	62	60	0.01-11	4.4	3.0
$C_{29:0}$	0.13-31	6.0	7.3	nd-0.84	0.20	0.22
$C_{30:0}$	1.7-137	30	31	nd-7.4	2.8	2.2
$C_{31:0}$	nd-4.7	0.35	0.96	nd-0.19	0.08	0.06
$C_{32:0}$	nd-27	4.9	6.3	nd-1.3	0.30	0.41
$C_{16:1}$	nd-1.02	0.12	0.29	nd	nd	nd
$C_{18:1}$	0.01-3.4	1.6	0.91	0.02-15	4.7	5.0
$C_{18:2}$	nd-1.3	0.24	0.33	nd-3.4	1.0	1.1
subtotal	76-940	309	199	3.0-198	98	65
CPI ($C_{21:0}$-$C_{32:0}$)[c]	3.3-6.0	4.7	0.7	2.3-14	6.2	3.5
III. Fatty alcohols						
C_{18}	0.02-1.8	0.64	0.50	0.06-2.5	0.95	0.75

Compounds	Early June			Late June		
	range	mean	std	range	mean	std
C_{19}	0.02-0.98	0.28	0.24	0.01-0.35	0.14	0.10
C_{20}	0.05-2.1	0.69	0.51	0.02-1.4	0.49	0.41
C_{21}	0.01-1.8	0.51	0.50	0.01-0.47	0.19	0.14
C_{22}	0.19-7.8	3.2	2.2	0.05-1.8	0.89	0.58
C_{23}	0.06-1.7	0.73	0.49	0.02-0.95	0.29	0.23
C_{24}	1.6-35	11	7.7	0.11-4.1	1.6	1.1
C_{25}	nd-2.8	1.0	0.81	0.01-0.63	0.24	0.20
C_{26}	5.6-96	39	25	0.07-10	4.8	2.9
C_{27}	0.05-10	2.8	3.0	0.02-0.90	0.43	0.28
C_{28}	15-725	149	158	0.16-21	9.9	6.1
C_{29}	0.20-12	1.7	2.4	0.01-2.5	0.57	0.68
C_{30}	0.42-59	18	14	0.05-12	4.5	3.5
C_{31}	nd-1.4	0.60	0.44	0.04-0.85	0.27	0.25
C_{32}	0.19-4.6	1.5	1.3	0.02-4.2	1.2	1.3
subtotal	30-954	231	203	0.8-57	27	17
IV. Sugar compounds						
Anhydrosugars						
galactosan (G)	1.9-23	7.9	5.6	nd-2.3	0.91	0.75
mannosan (M)	2.7-24	9.6	5.8	nd-3.4	1.1	1.2
levoglucosan (L)	88-1210	403	298	0.13-67	25	24
L/M ratio	26-59	40	8.6	2.5-48	25	11
L/(G+M) ratio	15-28	22	3.5	0.4-28	14	6.4
Sugars						
fructose	3.6-37	13	7.3	0.15-10	4.1	3.0
glucose	6.0-76	27	18	0.63-39	19	12
sucrose	4.2-54	16	11	0.72-22	11	6.4
trehalose	1.8-106	23	22	0.66-17	9.0	6.4
Sugar alcohols						
glycerol	7.0-74	25	14	0.32-14	6.5	4.2
arabitol	11-231	90	55	0.93-18	11	6.0
mannitol	8.4-250	90	59	1.1-62	24	20
inositol	1.0-8.5	3.2	2.2	0.11-2.4	1.1	0.68
subtotal	159-2060	706	437	8.2-242	112	76
V. Lignin and resin products						
vanillin	0.10-17	2.6	3.9	0.01-0.80	0.20	0.23
vanillic acid	0.47-9.0	3.2	2.5	0.02-0.59	0.22	0.17
syringic acid	0.31-5.4	1.7	1.3	0.01-0.40	0.13	0.12
dehydroabietic acid	0.17-20	3.4	4.0	0.01-1.0	0.53	0.36
subtotal	1.3-52	11	11	0.05-2.0	1.1	0.64
VI. Sterols						
cholesterol	nd-10	3.2	2.7	0.16-8.7	4.3	2.6
β-cholesterol	nd-18	3.0	4.9	nd-31	7.3	9.6
stigmasterol	nd-2.7	0.83	0.67	nd-1.6	0.47	0.51
β-sitosterol	nd-34.5	5.1	8.1	nd-13	3.2	3.7
subtotal	0.23-40	12	11	0.16-44	15	12
VII. Polyacids						
glyceric	9.1-143	42	32	0.54-18	8.0	5.3
malic	21-260	80	51	1.7-38	22	13
tartaric	0.70-16	5.3	3.6	0.30-3.3	1.5	0.81
citric	0.47-14	4.1	3.3	0.04-2.1	0.81	0.55
tricarballylic	4.1-66	22	15	0.55-14	8.0	4.1
subtotal	38-499	153	103	3.1-69	41	22
VIII. Aromatic acids						
benzoic	2.4-12	5.8	2.6	0.88-57	9.8	15

Compounds	Early June			Late June		
	range	mean	std	range	mean	std
o-toluic	0.09-1.1	0.43	0.26	0.02-1.3	0.27	0.33
m-toluic	0.19-1.5	0.66	0.33	0.08-3.3	0.72	0.81
p-toluic	0.22-1.5	0.70	0.33	0.03-2.3	0.50	0.58
phthalic	9.7-82	32	17	0.57-39	16	12
iso-phthalic (i-ph)	0.70-11	3.7	2.7	0.07-3.5	1.2	0.94
tere-phthalic (t-ph)	4.0-67	19	14	0.11-11	4.4	3.3
2-hydroxybenzoic (salicylic)	1.1-14	6.2	3.7	0.18-3.5	1.9	1.1
3-hydroxybenzoic	0.30-2.5	1.3	0.70	0.01-0.97	0.39	0.29
4-hydroxybenzoic	2.1-30	11	8.4	0.13-2.4	1.1	0.71
3,4-dihydroxybenzoic	1.3-21	7.4	6.4	0.02-1.4	0.66	0.40
subtotal	26-179	88	48	2.1-115	37	30
IX. Biogenic SOA tracers						
Isoprene SOA tracers						
2-methylglyceric acid	9.0-80	42	19	0.86-94	28	28
∑C_5-alkene triols	12-67	33	15	1.0-36	18	11
2-methylthreitol	7.2-78	30	19	0.18-52	21	19
2-methylerythritol	15-143	58	35	0.51-119	43	37
Σisoprene SOA tracers	48-340	164	83	2.6-301	110	92
α-/β-pinene SOA tracers						
cis-pinonic acid	3.0-38	13	8.7	0.09-7.6	4.0	2.4
pinic acid	0.14-1.8	0.67	0.41	nd-0.93	0.32	0.22
3-hydroxyglutaric acid	15-120	43	25	1.2-31	18	10
HDCCA [d]	0.3-1.4	0.7	0.3	0.04-1.4	0.7	0.4
3-acetylglutaric acid	0.4-1.6	0.9	0.4	0.07-1.5	0.8	0.4
3-acetyladipic acid	0.2-2.4	0.7	0.5	0.01-0.3	0.2	0.1
3-isopropylglutaric acid	0.8-5.4	3.2	1.4	0.06-3.4	1.7	1.2
MBTCA [e]	1.6-21	8.3	5.2	0.42-11	5.8	3.2
Σmonoterpene SOA tracers	26-167	71	36	1.9-56	31	16
β-Caryophyllene SOA tracer						
β-caryophyllinic acid	3.2-48	18	13	0.05-8.7	4.0	3.2
subtotal	86-481	253	108	4.5-347	146	106
X. Phthalate esters						
dimethyl (DMP)	0.01-9.7	2.2	2.4	0.08-3.9	0.90	0.99
diethyl (DEP)	0.10-5.8	1.7	1.6	0.02-2.2	1.1	0.75
diisobutyl (DiBP)	16-143	58	36	8.0-665	248	206
di-n-butyl (DnBP)	18-94	47	23	5.1-406	149	123
subtotal	39-240	109	58	13-1070	400	330
XI. Hopanes						
$C_{27}\alpha$	nd-0.15	0.05	0.05	0.01-0.25	0.09	0.07
$C_{27}\beta$	nd-0.20	0.06	0.05	nd-0.19	0.06	0.05
$C_{29}\alpha\beta$	0.05-0.50	0.21	0.11	0.01-0.72	0.24	0.20
$C_{29}\beta\alpha$	nd-0.19	0.06	0.06	nd-0.29	0.08	0.07
$C_{30}\alpha\beta$	0.06-0.84	0.35	0.20	0.02-0.76	0.41	0.29
$C_{30}\beta\alpha$	nd-0.12	0.05	0.03	0.01-0.18	0.06	0.06
$C_{31}\alpha\beta S$	nd-0.24	0.08	0.06	0.01-0.45	0.16	0.15
$C_{31}\alpha\beta R$	nd-0.27	0.05	0.06	nd-0.25	0.12	0.09
$C_{31}\beta\alpha$	nd-0.61	0.12	0.14	0.03-0.36	0.16	0.11
$C_{32}\alpha\beta S$	nd-0.30	0.10	0.10	0.02-0.43	0.15	0.13
$C_{32}\alpha\beta R$	nd-0.21	0.09	0.06	0.01-0.32	0.11	0.09
subtotal	0.50-2.0	1.2	0.41	0.16-2.9	1.6	1.0
XII. PAHs						
phenanthrene (Phen)	0.01-1.2	0.30	0.33	nd-1.1	0.39	0.34
anthracene (Anthr)	nd-0.07	0.02	0.02	nd-0.10	0.04	0.04
fluoranthene (Flu)	0.25-3.8	1.9	1.2	nd-6.9	1.6	1.8

Compounds	Early June			Late June		
	range	mean	std	range	mean	std
pyrene (Pyr)	0.31-3.4	1.7	1.0	nd-5.5	1.3	1.4
benzo(b)fluorine (BbFlr)	nd-0.27	0.05	0.07	nd-1.1	0.20	0.28
benz(a)anthracene (BaA)	0.01-1.5	0.21	0.36	nd-1.5	0.32	0.39
chrysene/triphenylene(Chry/Trp)	nd-1.8	0.26	0.46	nd-3.5	0.96	0.98
benzo(b)fluoranthene (BbF)	0.53-4.6	2.0	1.3	nd-5.1	1.9	1.5
benzo(k)fluoranthene (BkF)	0.22-3.4	1.5	0.95	nd-1.9	0.74	0.55
benzo(e)pyrene (BeP)	0.17-2.1	1.0	0.59	nd-2.4	0.89	0.68
benzo(a)pyrene (BaP)	0.03-2.0	0.67	0.54	nd-2.1	0.66	0.58
perylene (Per)	0.01-0.22	0.06	0.05	nd-0.61	0.17	0.17
indeno(1,2,3-cd)pyrene (IP)	0.30-2.4	1.3	0.72	nd-2.4	0.87	0.70
dibenz(a,h)anthracene (DbahA)	nd-0.13	0.03	0.03	nd-0.44	0.13	0.12
benzo(ghi)perylene (BghiP)	0.38-3.0	1.5	0.80	nd-2.6	1.0	0.80
anthanthrene (AA)	nd-0.51	0.07	0.10	nd-0.28	0.13	0.09
coronene (Cor)	0.03-1.9	0.44	0.51	nd-1.7	0.66	0.53
subtotal	2.7-25	13	7.3	nd-39	12	11
Total measured organics (ng m^{-3})	610-5840	2086	1174	36-1990	926	574
Total organics/OC (%)[f]	3.4-8.1	5.8	1.3	1.1-11	6.8	2.2
Water-soluble organics/WSOC (%)[g]	2.7-6.1	3.8	0.9	0.5-4.3	3.2	1.0

[a] std = standard deviation. [b] nd = not detected. [c] CPI = carbon preference index: $(C_{21}+C_{23}+C_{25}+C_{27}+C_{29}+C_{31}+C_{33}+C_{35})/(C_{22}+C_{24}+C_{26}+C_{28}+C_{30}+C_{32}+C_{34}+C_{36})$ for *n*-alkanes; $(C_{20}+C_{22}+C_{24}+C_{26}+C_{28}+C_{30}+C_{32})/(C_{21}+C_{23}+C_{25}+C_{27}+C_{29}+C_{31})$ for fatty acids. [d] HDCCA: 3-(2-hydroxyethyl)-2,2-dimethylcyclobutane carboxylic acid. [e] MBTCA: 3-methyl-1,2,3-butane tricarboxylic acid. [f] All the quantified organic compounds were converted to their carbon contents to calculate the OC and WSOC ratios. [g] Water-soluble organics: sugars, aliphatic hydroxy-/polyacids, biogenic SOA tracers, benzoic acid, *o*-phthalic acid and vanillic acid. The last two acids are slightly soluble in water.

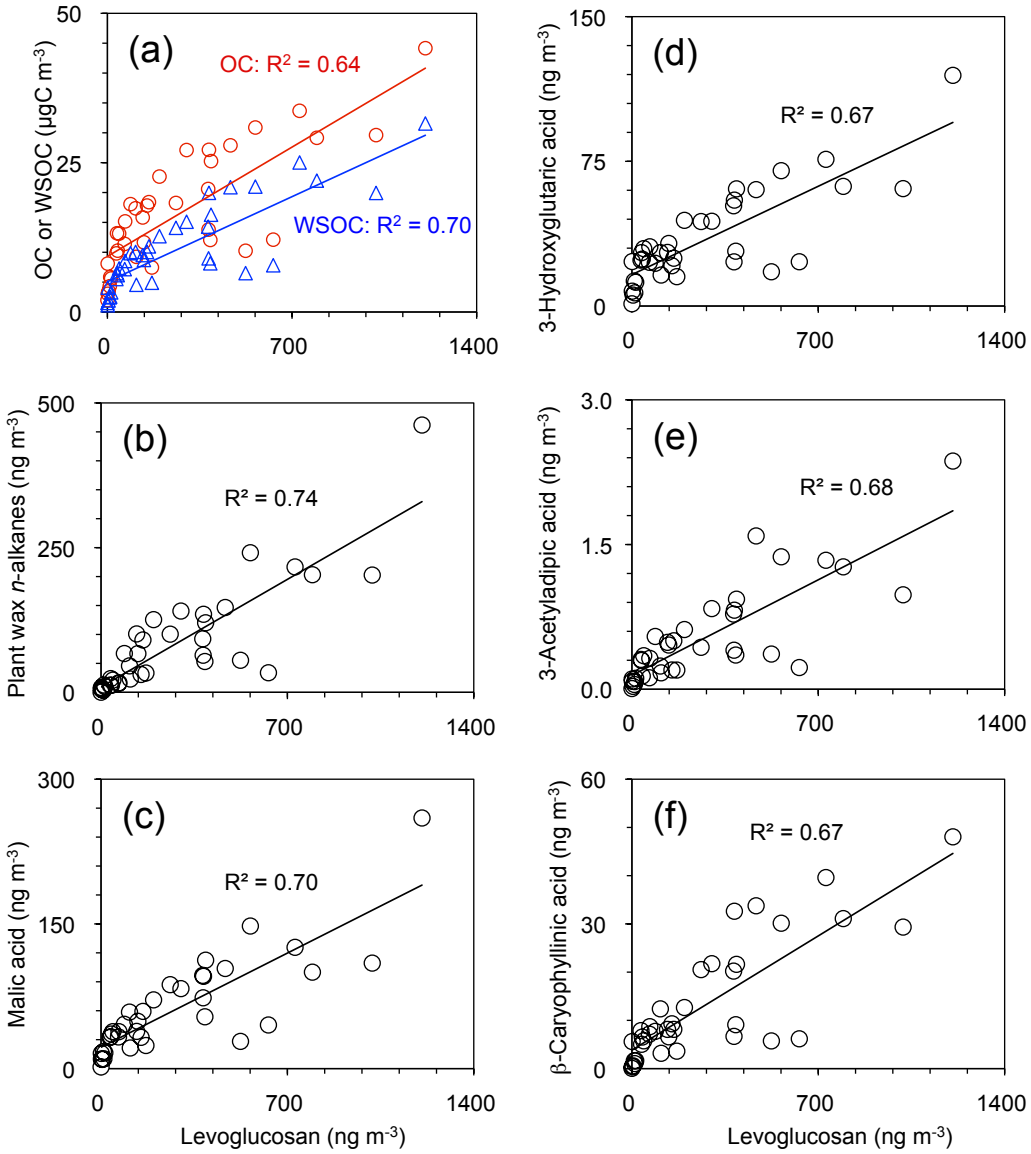

Fig. S1. Linear correlations between levoglucosan and other parameters measured in the Mt. Tai aerosols.

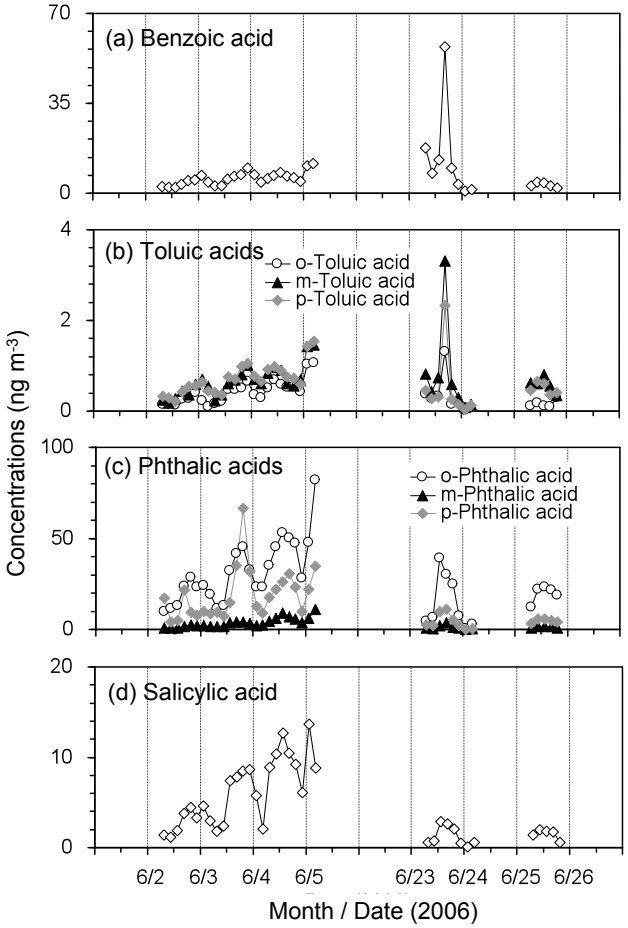

Fig. S2. Diurnal variations of aromatic acids in the Mt. Tai aerosols.

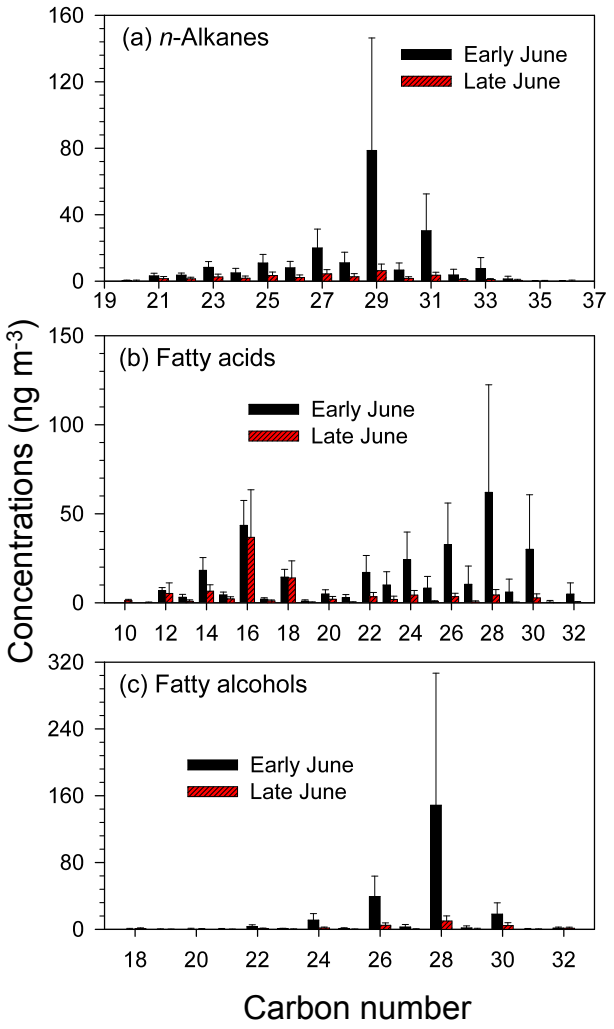

Fig. S3. Molecular distributions of **(a)** *n*-alkanes, **(b)** fatty acids, and **(c)** fatty alcohols in the Mt. Tai aerosols.