Measurement report: High Contributions of Halohydrocarbon and Aromatic Compounds to Emissions and Chemistry of Atmospheric VOCs in Industrial Area

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Table S1: OH reaction rate constant (K^{OH}), maximum incremental reactivity (MIR), and SOA formation potential ($SOAP^p$) of VOCs

Compounds	K^{OH} (Carter, 2010)	MIR (Carter, 2010)	$SOAP^p$ (Derwent et al., 2010)
ethane	2.54E-13	0.28	0.1
propane	1.11E-12	0.49	0
isobutane	2.14E-12	1.23	0
n-butane	2.38E-12	1.15	0.3
isopentane	3.60E-12	1.45	0.2
n-pentane	3.84E-12	1.31	0.3
2,2 dimethylbutane	2.27E-12	1.17	0
2,3 dimethyl butane	5.79E-12	0.97	0.4
2-methyl pentane	5.20E-12	1.5	0
cyclopentane	5.02E-12	2.39	0
3-methylpentane	5.20E-12	1.8	0.2
n-hexane	5.25E-12	1.24	0.1
2,4-dimethylpentane	4.77E-12	1.55	0
methylcyclopentane	5.68E-12	2.19	0
isoheptane	6.81E-12	1.07	0

cyclohexane	7.02E-12	1.25	0
2,3-dimethylpentane	7.15E-12	1.34	0
3-methylhexane	7.17E-12	1.61	0
2,2,4-trimethylpentane	3.38E-12	1.26	0
heptane	6.81E-12	1.07	0.1
methylcyclohexane	9.64E-12	1.7	0
2-methylheptane	8.31E-12	1.07	0
n-octane	8.16E-12	0.9	0.8
n-nonane	9.75E-12	0.78	1.9
decane	1.10E-11	0.68	7
n-hendecane	1.23E-11	0.61	16.2
dodecane	1.32E-11	0.55	34.5
ethylene	8.15E-12	9	1.3
Propylene	2.60E-11	11.66	1.6
trans-2-butene	6.32E-11	15.16	4
cis-2-butene	5.58E-11	14.24	3.6
1-butene	3.11E-11	9.73	1.2
1,3- butadeine	6.59E-11	12.61	1.8
1-pentene	3.14E-11	7.21	0
tran-2-pentene	6.70E-11	10.56	3.1
isoprene	9.96E-11	10.61	1.9
cis-2-pentene	6.50E-11	10.38	3.1
1-hexene	3.70E-11	5.49	0
acetylene	7.56E-13	0.95	0.1
benzene	1.22E-12	0.72	92.9
toulene	5.58E-12	4	100
ethylbenzene	7.00E-12	3.04	111.6
m,p-xylene	2.31E-11	9.75	84.5
o-xylene	1.36E-11	7.64	95.5
styrene	5.80E-11	1.73	212.3
cumene	6.30E-12	2.52	95.5
n-propylbenzene	5.80E-12	2.03	109.7
3-ethyltoulene	1.86E-11	7.39	100.6
4-ethyltoulene	1.18E-11	4.44	69.7
mesitylene	5.67E-11	11.76	13.5
2-ethyltoulene	1.19E-11	5.59	94.8
1,2,4-trimethylbenzene	3.25E-11	8.87	20.6
1,2,3-trimethylbenzene	3.27E-11	11.97	43.9
1,3-diethylbenzene	2.55E-11	7.1	0
1,4-diethylbenzene	1.64E-11	4.43	0
naphthalene	2.30E-11	3.34	0

chloromethane	4.48E-14	0.038	0
vinyl chloride	6.90E-12	2.83	0
methyl bromide	4.12E-14	0.0187	0
chloroethene	0	0	0
trichlorofloromethane	0	0	0
Vinylidene chloride	0	0	0
1,1,2-Trichlor-1,2,2-trifluorethan	0	0	0
dichloromethane	1.45E-13	0.041	0
trans-1,2-dichloroethylene	0	0	0
1,1-dichloroethane	2.60E-13	0.069	0
cis-1,2-dichloroethylene	0	0	0
chloroform	1.06E-13	0.022	0
carbon tetrachloride	0	0	0
1,2-dichloroethane	2.53E-13	0.21	0
trichloroethylene	2.34E-12	0.64	0
1,2-dichloropropane	4.50E-13	0.29	0
bromodichloromethane	0	0	0
trans-1,3-dichloropropene	1.44E-11	5.03	0
cis-1,3-dichloropropene	8.45E-12	3.7	0
1,1,2-trichloroethane	2.00E-13	0.086	0
tetrachloroethylene	0	0	0
1,2-dibromoethane	2.27E-13	0.102	0
chlorobenzene	7.70E-13	0.32	0
bromoform	0	0	0
1,1,2,2-tetrachloroethane	0	0	0
1,3-dichlorobenzene	5.55E-13	0.178	0
1,4 dichlorobebezne	5.55E-13	0.178	0
benzyl chloride	0	0	0
1,2-dichlorobenzene	5.55E-13	0.178	0
1,2,4-trichlorobenzene	0	0	0
hexachloro-1,3-butadiene	0	0	0
carbon disulfide	2.76E-12	0.25	0
Acrolein	1.99E-11	7.45	0
acetone	1.91E-13	0.36	0.1
isopropanol	5.09E-12	0.61	0.4
MTBE	0	0	0
vinyl acetate	3.16E-11	3.2	0
MEK	1.20E-12	1.48	0.6
ethyl acetate	1.60E-12	0.63	0.1
tetrahydrofuran	1.61E-11	4.31	0

methyl methacrylate	5.25E-11	15.61	0
1,4-dioxane	3.83E-11	2.62	0
4-methyl-2-pentanone	1.27E-11	3.88	0.6
2-hexanone	9.10E-12	0	0

Table S2: VOC concentrations measured in the industrial area in Nanjing. VOC concentrations observed in previous studies in Nanjing are also listed.

	Current study										(An et al., 2017), Nanjing		(Wu et al., 2020), Nanjing
Compounds	Summer		Autumn		Winter		Spring		Yearly		Summer	Winter	Yearly
	Mean	Std	Mean	Std	Mean	Std	Mean	Std	Mean	Std	Mean	Mean	Mean
ethane	2.81	0.58	8.06	1.77	7.66	1.39	4.76	1.25	5.82	2.49	2.76	7.66	2.89
propane	3.12	0.63	6.09	1.21	4.92	0.91	2.73	0.92	4.22	1.57	1.70	4.51	3.29
isobutane	0.75	0.16	1.25	0.26	1.16	0.15	0.48	0.14	0.91	0.36	1.04	2.25	0.9
n-butane	1.75	0.39	2.61	0.63	2.32	0.26	0.87	0.29	1.89	0.76	1.09	2.35	1.53
isopentane	1.59	0.29	1.56	0.47	1.63	0.31	0.42	0.19	1.30	0.59	0.86	1.13	1.26
n-pentane	0.66	0.17	1.06	0.29	1.36	0.25	0.31	0.10	0.85	0.46	0.50	0.86	0.78
2,2 dimethylbutane	0.08	0.01	0.06	0.01	0.06	0.01	0.06	0.01	0.06	0.01	0.28	0.03	0.04
2,3 dimethyl butane	0.13	0.03	0.18	0.03	0.11	0.00	0.20	0.02	0.16	0.04	0.12	0.35	0.04
2-methyl pentane	0.26	0.08	0.32	0.10	0.44	0.11	0.29	0.06	0.33	0.08	0.25	0.41	0.16
cyclopentane	0.15	0.03	0.10	0.02	0.08	0.01	0.22	0.03	0.14	0.06	0.08	0.12	0.08
3-methylpentane	0.25	0.06	0.38	0.09	0.37	0.12	0.25	0.08	0.31	0.07	0.22	0.31	0.26
n-hexane	0.17	0.04	0.33	0.09	0.41	0.17	0.21	0.06	0.28	0.11	0.41	0.48	0.47
2,4-dimethylpentane	0.06	0.00	0.06	0.01	0.06	0.00	0.13	0.01	0.08	0.03	0.05	0.08	0.01

methylcyclopentane	0.12	0.03	0.16	0.04	0.14	0.04	0.13	0.03	0.14	0.02	0.08	0.13	0.26
isoheptane	0.13	0.04	0.12	0.04	0.11	0.04	0.16	0.03	0.13	0.02			
cyclohexane	0.44	0.29	0.37	0.15	0.43	0.31	0.21	0.13	0.36	0.10	0.41	0.60	0.15
2,3-dimethylpentane	0.86	0.59	0.73	0.30	0.85	0.63	0.42	0.25	0.72	0.21	0.11	0.20	0.02
3-methylhexane	0.10	0.02	0.12	0.03	0.09	0.02	0.14	0.02	0.11	0.02	0.04	0.05	0.08
2,2,4-trimethylpentane	1.59	0.37	2.81	0.82	3.26	0.78	1.16	0.74	2.21	0.99	0.03	0.02	0.03
heptane	0.10	0.01	0.12	0.02	0.12	0.01	0.10	0.01	0.11	0.01	1.92	0.2	0.11
methylcyclohexane	0.18	0.02	0.18	0.04	0.19	0.03	0.16	0.03	0.18	0.01	0.08	0.12	0.08
2-methylheptane	0.08	0.00	0.08	0.01	0.08	0.00	0.17	0.01	0.10	0.04	0.01	0.05	0.02
n-octane	0.09	0.01	0.08	0.01	0.09	0.01	0.20	0.01	0.11	0.06	0.19	0.21	0.05
n-noane	0.06	0.00	0.08	0.02	0.08	0.02	0.07	0.00	0.07	0.01	0.03	0.05	0.03
decane	0.05	0.00	0.06	0.01	0.06	0.01	0.05	0.00	0.06	0.01	0.05	0.06	0.04
n-hendecane	0.04	0.01	0.16	0.01	0.22	0.01	0.17	0.01	0.15	0.07	0.06	0.09	0.02
dodecane	0.08	0.00	0.36	0.02	0.50	0.01	0.22	0.02	0.29	0.18	0.07	0.13	0.03
ethylene	2.02	0.58	3.80	0.89	4.71	1.09	1.25	0.71	2.95	1.59	3.08	6.62	1.21
Propylene	0.41	0.34	0.91	0.46	0.97	0.31	0.44	0.58	0.68	0.30	0.98	2.09	0.70
trans-2-butene	0.02	0.00	0.06	0.02	0.23	0.01	0.03	0.01	0.09	0.10	0.07	0.14	0.07
cis-2-butene	0.07	0.00	0.16	0.03	0.33	0.03	0.09	0.01	0.16	0.12	0.06	0.10	0.05
1-butene	0.07	0.00	0.10	0.02	0.43	0.02	0.31	0.13	0.22	0.17	0.18	0.23	0.15

1,3- butadeine	0.31	0.07	0.34	0.05	0.30	0.03	0.28	0.00	0.31	0.02			
1-pentene	0.16	0.03	0.14	0.03	0.08	0.03	0.10	0.03	0.12	0.04	0.04	0.05	0.04
tran-2-pentene	0.09	0.03	0.06	0.02	0.05	0.01	0.09	0.02	0.07	0.02	0.03	0.04	0.03
isoprene	0.51	0.37	0.15	0.06	0.09	0.02	0.19	0.02	0.23	0.19	0.58	0.07	0.18
cis-pentene	0.07	0.02	0.06	0.01	0.07	0.01	0.17	0.02	0.09	0.05	0.03	0.02	0.02
1-hexene	0.05	0.03	0.06	0.02	0.06	0.03	0.24	0.01	0.10	0.09	0.03	0.02	0.01
acetylene	1.02	0.15	1.77	0.24	1.59	0.15	1.20	0.13	1.40	0.35	2.63	6.46	
benzene	0.80	0.19	1.41	0.41	1.63	0.39	0.58	0.37	1.10	0.50	1.86	3.21	0.82
toulene	0.84	0.40	1.88	0.51	1.67	0.31	0.49	0.12	1.22	0.66	1.47	3.20	1.07
ethylbenzene	0.22	0.05	0.83	0.21	0.65	0.15	0.20	0.10	0.48	0.32	1.27	1.79	0.43
m,p-xylene	0.24	0.07	0.86	0.24	0.80	0.17	0.19	0.07	0.52	0.36	0.46	0.59	0.67
o-xylene	0.43	0.09	1.67	0.42	1.30	0.29	0.40	0.21	0.95	0.63	0.28	0.39	0.21
styrene	0.47	0.15	1.71	0.49	1.58	0.35	0.36	0.15	1.03	0.71	0.17	0.30	0.12
cumene	0.87	0.19	3.34	0.84	2.60	0.59	0.80	0.41	1.90	1.27			
n-propylbenzene	0.04	0.01	0.13	0.02	0.14	0.01	0.08	0.11	0.10	0.05	0.09	0.08	0.03
3-ethyltoulene	0.10	0.02	0.29	0.06	0.26	0.05	0.18	0.21	0.21	0.09	0.05	0.05	0.03
4-ethyltoulene	0.07	0.00	0.08	0.01	0.08	0.01	0.10	0.06	0.08	0.01	0.19	0.29	0.03
mesitylene	0.03	0.00	0.06	0.02	0.08	0.03	0.04	0.00	0.05	0.02			
2-ethyltoulene	0.04	0.01	0.07	0.02	0.07	0.02	0.06	0.07	0.06	0.02	0.51	0.08	
1,2,4-trimethylbenzene	0.06	0.01	0.06	0.02	0.08	0.03	0.13	0.11	0.08	0.03	0.33	0.42	0.09

1,2,3-trimethylbenzene	0.08	0.01	0.20	0.03	0.22	0.01	0.10	0.01	0.15	0.07	0.05	0.05	0.05
1,3-diethylbenzene	0.09	0.00	0.18	0.02	0.17	0.01	0.16	0.01	0.15	0.04	0.03	0.05	0.01
1,4-diethylbenzene	0.09	0.00	0.17	0.02	0.20	0.01	0.17	0.01	0.16	0.05	0.04	0.10	0.04
naphthalene	0.13	0.02	3.09	0.98	2.14	0.22	1.35	0.29	1.68	1.25			
chloromethane	0.16	0.02	0.56	0.08	1.21	0.33	0.15	0.01	0.52	0.50			
vinyl chloride	0.05	0.00	0.07	0.02	0.09	0.02	0.16	0.01	0.09	0.05			
methyl briomide	0.04	0.00	0.05	0.01	0.04	0.01	0.03	0.00	0.04	0.01			
chloroethene	0.08	0.01	0.08	0.02	0.10	0.03	0.05	0.01	0.08	0.02			
trichloroflorome thane	0.23	0.01	0.18	0.01	0.30	0.02	0.21	0.04	0.23	0.05			
Vinylidene chloride	0.05	0.01	0.05	0.01	0.04	0.00	0.05	0.01	0.05	0.00			
1,1,2-Trichlor-1,2,2-trifluorethan	0.08	0.00	0.08	0.01	0.10	0.00	0.08	0.01	0.08	0.01			
dichloromethane	1.26	0.09	3.09	0.54	2.62	0.47	1.97	0.53	2.23	0.80			
trans-1,2-dichloroethylene	0.05	0.00	0.05	0.01	0.05	0.01	0.14	0.01	0.07	0.05			
1,1-dichloroethane	0.33	0.08	0.65	0.18	0.82	0.34	0.41	0.13	0.55	0.22			
cis-1,2-dichloroethylene	0.07	0.00	0.07	0.01	0.03	0.00	0.20	0.01	0.09	0.07			

chloroform	0.17	0.02	0.57	0.16	0.53	0.18	0.18	0.04	0.36	0.22
carbon tetrachloride	0.12	0.01	0.18	0.02	0.17	0.03	0.18	0.02	0.16	0.03
1,2-dichloroethane	0.95	0.14	3.19	0.40	2.95	0.43	1.15	0.31	2.06	1.17
trichloroethylene	0.13	0.02	0.14	0.02	0.10	0.02	0.06	0.00	0.11	0.04
1,2-dichloropropane	0.57	0.21	1.48	0.53	0.96	0.23	0.14	0.05	0.79	0.57
bromodichloromethane	0.06	0.00	0.03	0.01	0.03	0.00	0.06	0.00	0.04	0.01
trans-1,3-dichloropropene	0.10	0.00	0.08	0.01	0.13	0.00	0.17	0.01	0.12	0.04
cis-1,3-dichloropropene	1.68	0.79	3.76	1.02	3.35	0.62	0.98	0.23	2.44	1.33
1,1,2-trichloroethane	0.06	0.01	0.12	0.04	0.11	0.07	0.05	0.05	0.09	0.03
tetrachloroethylene	0.06	0.00	0.09	0.02	0.08	0.02	0.06	0.01	0.07	0.01
1,2-dibromoethane	0.03	0.00	0.02	0.01	0.02	0.00	0.02	0.00	0.02	0.01
chlorobenzene	0.31	0.18	1.89	0.91	1.73	1.14	0.20	0.16	1.03	0.90
bromoform	0.02	0.00	0.02	0.01	0.02	0.00	0.02	0.00	0.02	0.00
1,1,2,2-tetrachloroethane	0.94	0.30	3.43	0.97	3.16	0.70	0.73	0.30	2.06	1.43
1,3-	0.02	0.00	0.09	0.03	0.14	0.05	0.04	0.01	0.07	0.05

dichlorobenzene										
1,4 dichlorobebezne	0.11	0.01	0.65	0.20	0.40	0.05	0.09	0.01	0.31	0.27
benzyl chloride	0.12	0.02	0.10	0.05	0.13	0.07	0.24	0.23	0.15	0.06
1,2-dichlorobenzene	0.03	0.01	0.25	0.11	0.15	0.04	0.08	0.01	0.13	0.10
1,2,4-trichlorobenzene	0.04	0.00	0.17	0.04	0.25	0.01	0.14	0.02	0.15	0.09
hexachloro-1,3-butadiene	0.02	0.00	0.17	0.04	0.15	0.04	0.02	0.00	0.09	0.08
carbon disulfide	0.42	0.11	0.59	0.13	0.66	0.15	0.21	0.07	0.47	0.20
Acrolein	0.09	0.02	0.07	0.02	0.05	0.01	0.07	0.02	0.07	0.01
acetone	1.60	0.29	2.98	0.25	1.94	0.22	2.61	0.61	2.28	0.63
isopropanol	0.46	0.07	2.34	0.60	1.28	0.34	0.44	0.10	1.13	0.90
MTBE	0.37	0.11	0.66	0.23	0.35	0.11	0.35	0.13	0.43	0.15
vinyl acetate	0.17	0.04	0.33	0.09	0.42	0.18	0.26	0.08	0.30	0.11
MEK	0.69	0.06	1.14	0.10	0.73	0.09	0.77	0.43	0.84	0.21
ethyl acetate	1.06	0.17	1.56	0.25	1.43	0.18	1.34	0.95	1.35	0.21
tetrahydrofuran	0.41	0.56	0.08	0.11	0.43	0.45	0.24	0.03	0.29	0.16
methyl methacrylate	0.11	0.01	0.21	0.01	0.20	0.01	0.32	0.00	0.21	0.09
1,4-dioxane	0.05	0.00	0.07	0.01	0.09	0.00	0.26	0.01	0.12	0.10
4-methyl-2-pentanone	0.23	0.08	0.31	0.07	0.28	0.06	0.30	0.03	0.28	0.03

2-hexanone	0.15	0.00	0.23	0.01	0.28	0.01	0.29	0.02	0.23	0.07
TVOC	**38.81**	**10.21**	**83.05**	**20.07**	**77.51**	**16.77**	**39.62**	**13.12**	**59.75**	**28.57**

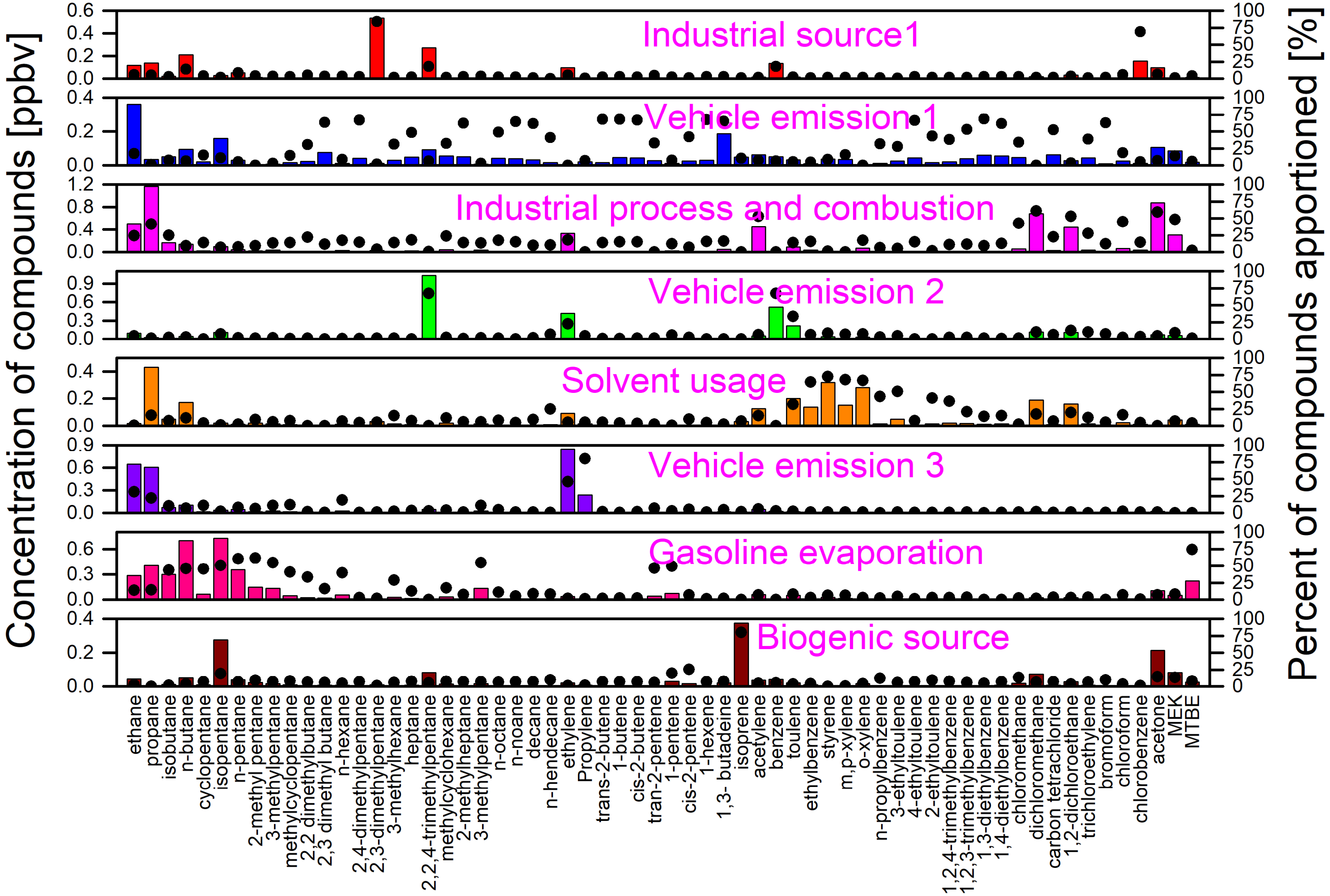
S1. Source apportionment of VOCs

Figure S1 shows the source profile of summertime VOCs obtained from the PMF model. The resolved factors were identified as industrial source-1, vehicle emission-1, industrial process and combustion, vehicle emission-2, solvent usage, vehicle emission-3, gasoline evaporation, and biogenic source. Factor 1 was characterized by high concentrations of 2,3-dimethylpentane, chlorobenzene, and benzene. These compounds are emitted from industries (Liu et al., 2008; Wu et al., 2016) and chlorobenzene is used as a solvent in industries (Dörter et al., 2020). Therefore, factor 1 was identified as industrial source-1. Factor 2 was distinguished by a significant presence of vehicle emission VOCs 1-butene, trans-2-butene, cis-2-butene, 1,3-butadiene, and n-nonane (Liu et al., 2008; Zhang et al., 2017). So, factor 2 was identified as vehicle emission-1. Factor 3 was dominated by high concentrations of industrial solvent dichloromethane, acetone, 1,2-dichloroethane, MEK (Yu et al., 2014; Pallavi et al., 2019; Saeaw & Thepanondh, 2015) and also combustion markers like acetylene and chloromethane (An et al., 2014; McCulloch et al., 1999). Therefore, factor 3 was identified as an industrial process and combustion. Factor 4 possessed high concentrations of vehicle exhaust VOCs benzene, toluene, and acetylene (Song et al., 2018). Although these VOCs are also emitted by industrial processes, the contribution of benzene was twice of toluene in this factor. Therefore, factor 4 was assigned to vehicle emission-2. Factor 5 was attributed to solvent usage as it was characterized by high concentrations of m,p-xylene, o-xylene, styrene, ethylbenzene, 3-ethyltoluene (Li et al., 2018). Factor 6 was dominated by vehicle exhaust markers propylene, ethylene, ethane, propane, and n-hexane (An et al., 2014). SO, we identified this factor as vehicle emission-3. Factor 7 was distinguished by high concentrations of MTBE, isopentane, n-pentane, 2-methylpentane, and 3-methylpentane. These compounds are typical traces of gasoline evaporation and combustion (Song et al., 2018; Wang et al., 2016). However, the contributions of combustion markers (e.g. acetylene, ethylene) were low in this factor. Therefore, factor 7 was assigned to gasoline evaporation. Factor 8 was attributed to the biogenic source, which was mainly distinguished by a high concentration of isoprene (Song et al., 2018).

During autumn, the possible VOC sources were solvent usage, vehicle emission-1, industrial process and combustion, vehicle emission-2, gasoline evaporation, biomass burning, industrial source-1, and industrial source-2 (Fig.S2). Factor 1 was represented by a high concentration of m,p-xylene, o-xylene, styrene, ethylbenzene, 3-ethyltoluene, which are typical markers of solvent usage (Li et al., 2018). Factor 2 was dominated by vehicle exhaust markers propylene, ethylene, ethane, propane, and n-hexane (An et al., 2014). Factor 3 was identified as an industrial process and combustion source as it was characterized by high concentrations of industry-emitted halohydrocarbons (e.g. chloroform, 1,2-dichloroethane) and combustion-related VOCs (e.g. acetylene and propane) (Zhang et al., 2018; Song et al., 2020). The 4th factor was identified as vehicle emission-2, it was mainly composed of 2-methylheptane, n-nonane, and 1-butene (Song et al., 2018). Factor 5 was assigned to gasoline evaporation as isopentane, MTBE, and 2-methylpentane were the main contributor to it (Song et al., 2018; Wang et al., 2016). Factor 6 was characterized by a high concentration of chloromethane, which is a typical tracer of biomass burning (Song et al., 2018; Hui et al., 2018, 2019). Factor 7 was identified as industrial source-1, it was dominated by high concentrations of 2-ethyltoluene and cyclopentane (Song et al., 2018). Factor 8 was assigned to industrial source-2, which was characterized by high concentrations of chlorobenzene, 2,3-dimethylpentane, and benzene (Liu et al., 2008; Wu et al., 2016; Dörter et al., 2020).

During winter, the source factors were identified as vehicle emission-1, solvent usage, industrial source-1, multiple sources, LPG/NG usage, vehicle emission-2, industrial source-2, and industrial process and combustion (Fig. S3). Factor 1 was assigned to vehicle emission-1, it was dominated by trans-2-butene, acetylene, cis-2-butene, 1-butene, and isobutane (Liu et al., 2008; Zhang et al., 2017). Factor 2 was represented by a high concentration of styrene, m,p-xylene, o-xylene, and ethylbenzene, which are typical tracers of solvent usage (Li et al., 2018). Factor 3 was identified as industrial source-1 and it was characterized by high concentrations of 2,3-dimethylpentane, chlorobenzene, and benzene (Liu et al., 2008; Wu et al., 2016; Dörter et al., 2020). Factor 4 was characterized by both the vehicle (e.g. n-hendecane, 1,3-butadiene, n-nonane) and industrial (e.g. C9-C10 aromatics) VOCs, therefore, it was identified as multiple sources (Hui et al., 2019; Song et al., 2018). Factor 5 was assigned to LPG/NG usage as it was characterized by high concentrations of propylene, ethylene, and propane (Lyu et al., 2016; Hui et al., 2019; Shao et al., 2016). Factor 6 was dominated by high concentrations of n-hexane, 3-methylpentane, 2-methylpentane, and n-pentane. Therefore, it was identified as vehicle emission-2 (An et al., 2014; Song et al., 2018; Wang et al., 2016). Factor 7 was identified as industrial source-2 due to the high contribution of chloroform, carbontetrachloride, 2,2,4-trimethylpentane, and benzene (Zhang et al., 2018; Song et al., 2020). Factor 8 was identified as an industrial process and combustion source due to the high contribution of industrial solvent acetone, dichloromethane, MEK, 1,2-dichloroethane (Yu et al., 2014; Pallavi et al., 2019; Saeaw & Thepanondh, 2015) and also combustion tracer acetylene (An et al., 2014; McCulloch et al., 1999).

During spring, the possible VOC sources were gasoline evaporation, solvent usage, vehicle emission-1, multiple sources, industrial source-1, LPG/NG usage, industrial source-2, and vehicle emission-2 (Fig. S4). Factor 1 was identified as a gasoline evaporation source for the high loading of isopentane (Song et al., 2018; Wang et al., 2016). Due to the high contribution of o-xylene, styrene, m,p-xylene, and ethylbenzene, factor 2 was assigned to solvent usage sources (Li et al., 2018). Factor 3 had a high contribution of vehicle exhaust compounds 1,2,4-trimethylbenzene, cis-2-butene, ethane, 1,3-butadiene (Borbon et al., 2002; Liu et al., 2008). Therefore, factor 3 was identified as vehicle emission-1. Factor 4 was represented by a high concentration of 1,2,4-trimethylbenzene, isoprene, chloromethane, and n-hendecane. 1,2,4-trimethylbenzene is used in furniture and coating industries (Liu et al., 2008), isoprene is emitted from trees and also from vehicles (Reimann et al., 2000), chloromethane is a tracer of biomass burning (Song et al., 2018; Hui et al., 2018, 2019), and n-hendecane is emitted from vehicles (Song et al., 2018). Therefore, factor 4 was identified as multiple sources. Factor 5 was represented by high concentrations of industrial solvent acetone, dichloromethane, MEK (Yu et al., 2014; Pallavi et al., 2019; Saeaw & Thepanondh, 2015), therefore, identified as industrial source-1. Factor 6 was assigned to LPG/NG usage due to the high contribution of propane and isobutane (Shao et al., 2016). Factor 7 was identified as industrial source-2 due to the high contribution of chlorobenzene, 2,2,4-trimethylpentane, and benzene (Zhang et al., 2018; Song et al., 2020). Due to the high contribution of ethylene, propylene, and n-hexane, factor 8 was identified as vehicle emission-2 (An et al., 2014).



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108 **Figure S1: Source profile of VOCs during summer in Nanjing industrial area**

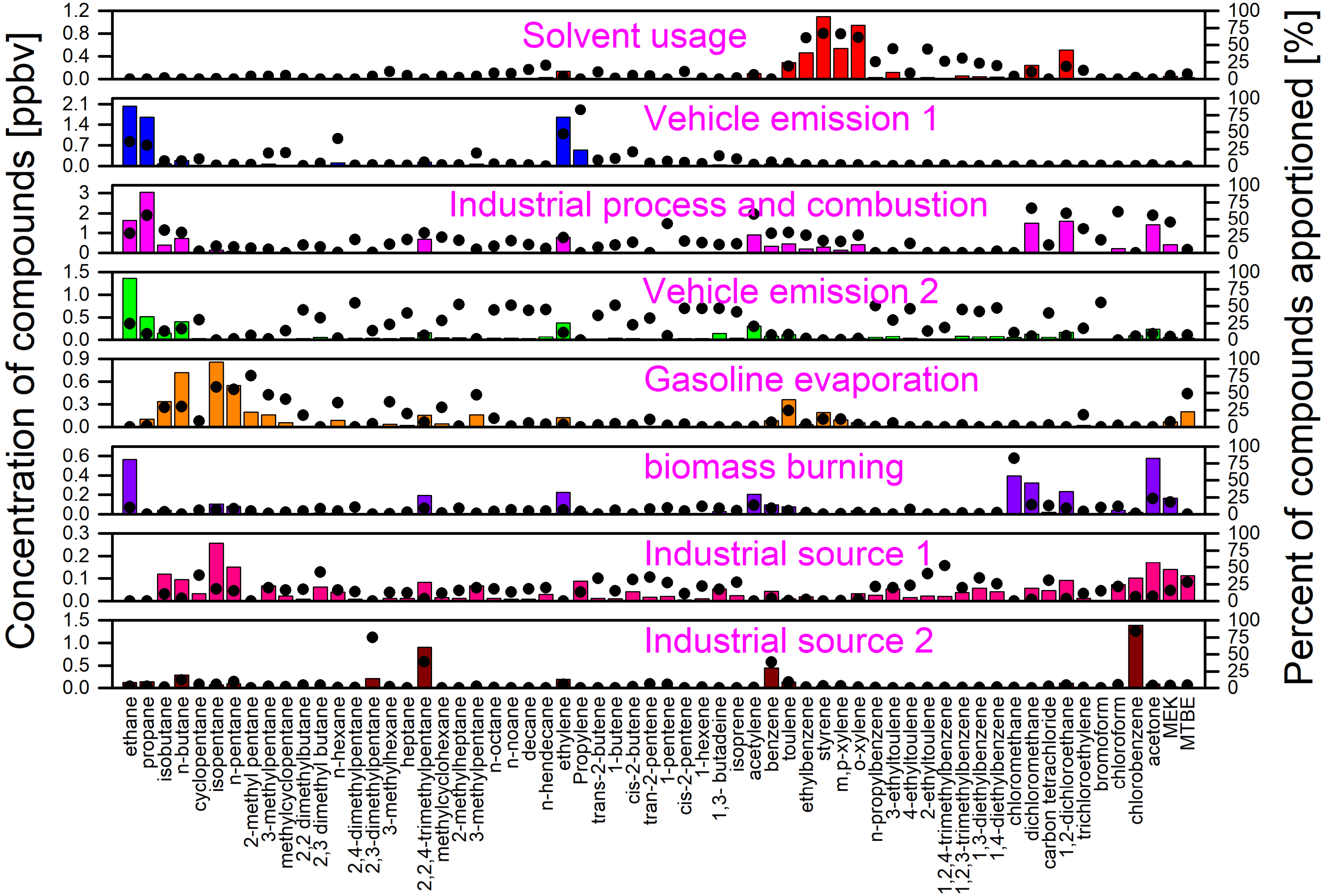

Figure S2: Source profile of VOCs during autumn in Nanjing industrial area

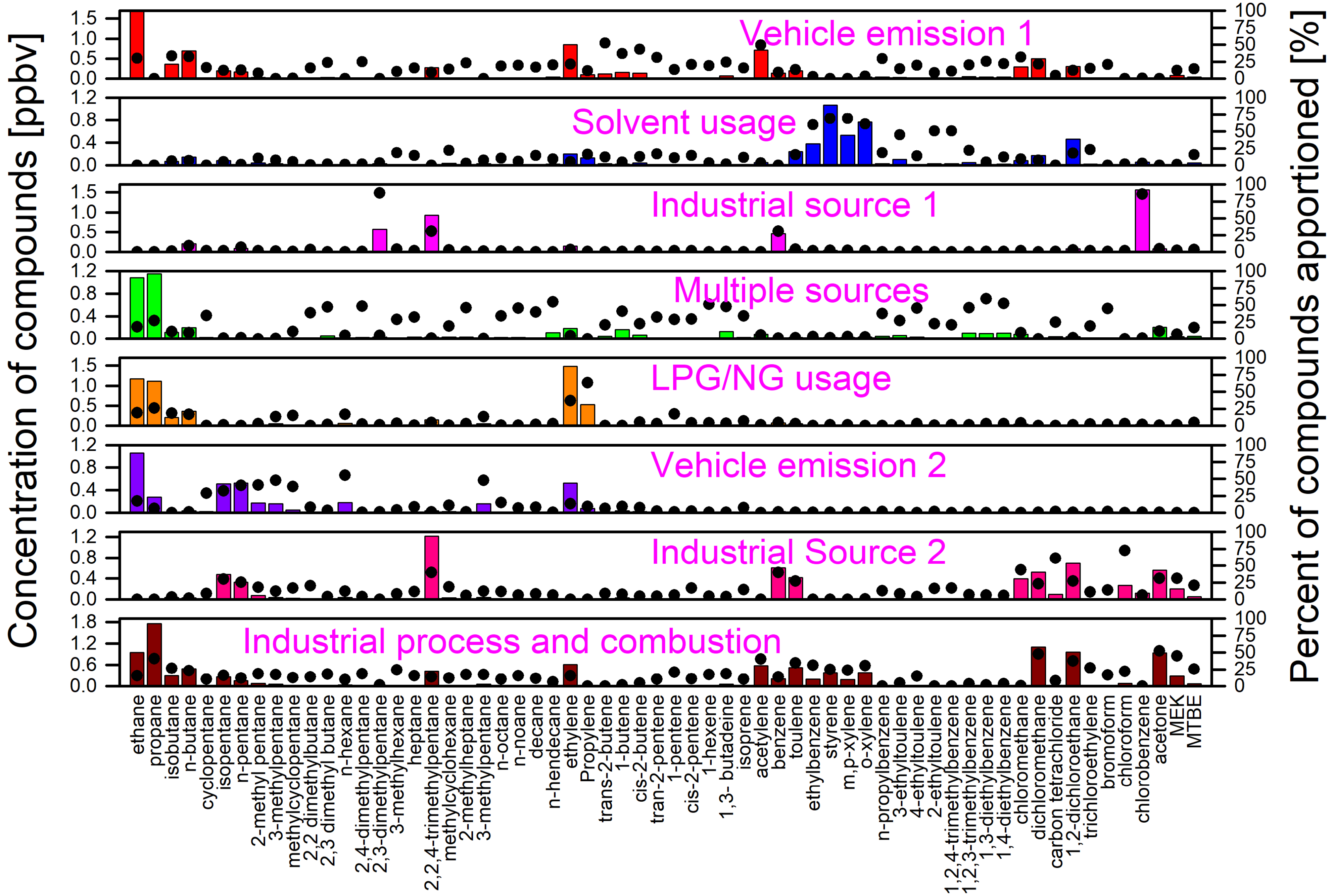

Figure S3: Source profile of VOCs during winter in Nanjing industrial area

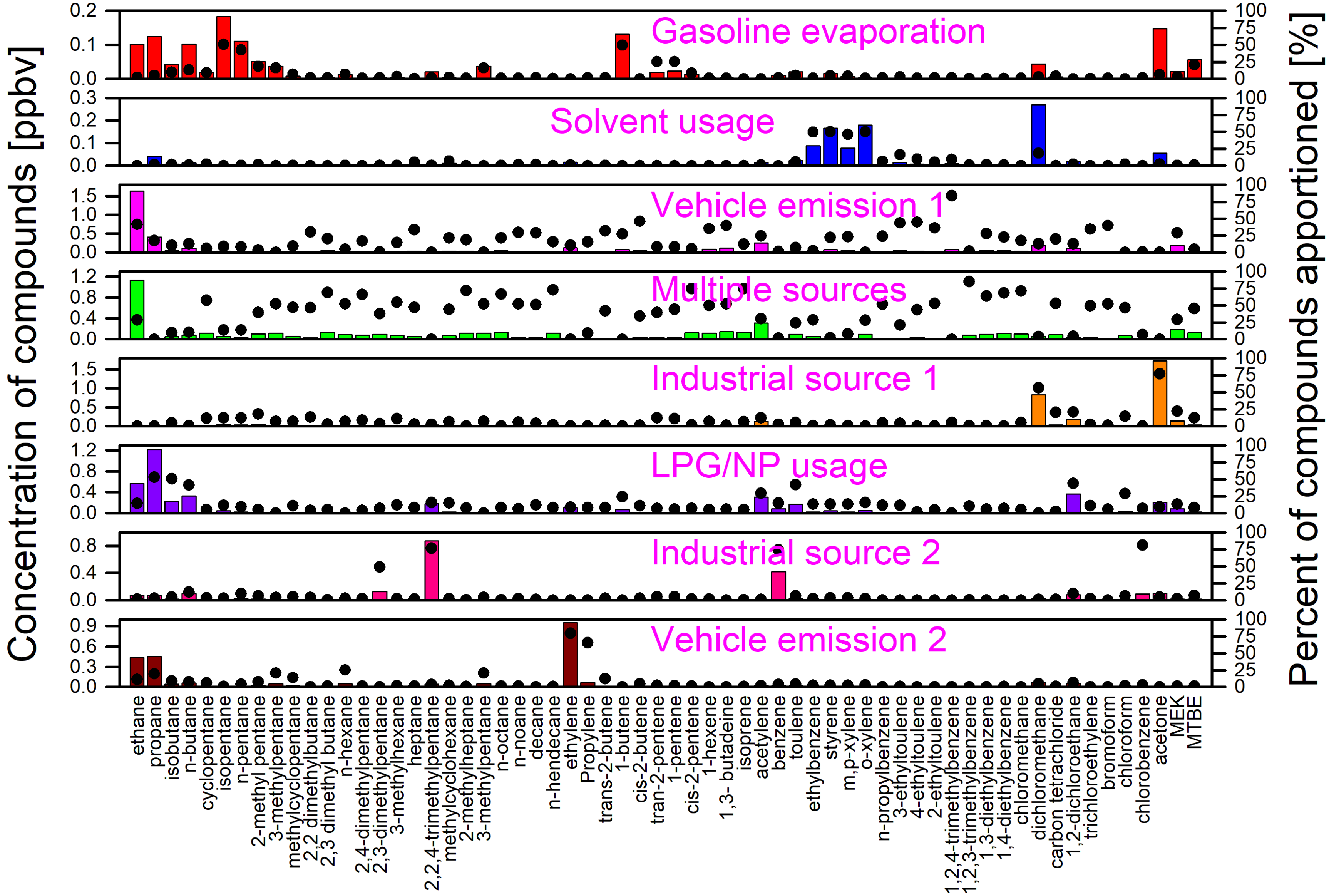

Figure S4: Source profile of VOCs during spring in Nanjing industrial area

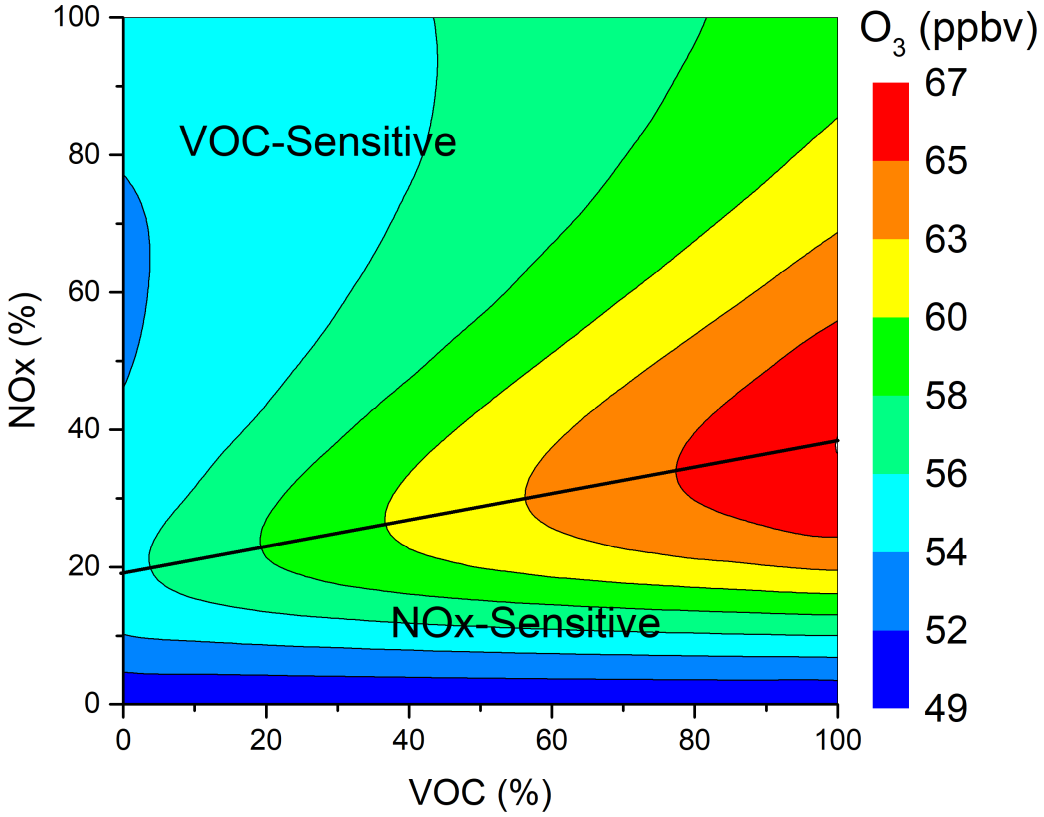

Figure S5: O_3 isopleth diagram on a high O_3 episode day (July 29 2018) in Nanjing industrial area.

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