Supporting Information

Process-based VOCs source profiles and contributions to ozone formation in typical organic solvent-used industries in Hangzhou

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Table S1 The basic information of companies, sampling sites and the amount of samples.

Company code	Source	VOCs treatment technology	Sampling site[a]	Serial number	No. of samples
A	Color steel spraying	Low-temperature plasma	Import of treatment measures in paint spraying workshop	A-1	1
			Export of treatment measures in paint spraying workshop	A-2	1
			Import of treatment measures in drying workshop	A-3	1
			Export of treatment measures in drying workshop	A-4	1
B	Car spraying	High-temperature incineration	Import of treatment measures for electrophoresis drying	B-1	1
			Export of treatment measures for electrophoresis drying	B-2	1
			Import of treatment measures for spray drying	B-3	1
			Export of treatment measures for spray drying	B-4	1
C[b]	Metal material spraying	Adsorption-desorption combined with catalytic combustion	Exhaust gas of drying	C-1	1
			Exhaust gas of paint spraying	C-2	1
			Export of treatment measures	C-3	1
D	Printing	High-temperature incineration	Import of treatment measures in coating workshop	D-1	1
			Export of treatment measures in coating workshop	D-2	1
E	Printing	Activated carbon adsorption	Import of treatment measures in printing workshop	E-1	1
			Export of treatment measures in printing workshop	E-2	1
F	Post-printing coating	Activated carbon adsorption combined with condensation	Import of treatment measures in coating workshop	F-1	1
			Export of treatment measures in coating workshop	F-2	1
G	Stereotype of synthetic fiber	Water spray combined with electrostatic	Import of treatment measures in stereotype workshop	G-1	1
			Export of treatment measures in stereotype workshop	G-2	1

Notes: *a.* The inlet of the treatment facility was connected with waste gas collector of the workshop, so the imported gas was the waste gas produced by workshop.

b. After the drying and paint-spraying waste gas was collected in this company, they were treated together by high-temperature incineration.

Table S2 The information of used VOCs-containing raw and auxiliary material and its total removal efficiencies in each process.

Company code	Source	Emission process	Non-solvent		Solvent	Efficiency (%)	
			Amount ($t\ a^{-1}$)	VOCs[a] (%)	Amount ($t\ a^{-1}$)	Collection	Removal
A	Color steel spraying	Paint spraying	274.6	20	68.7	75	5.8
		Drying	400.5	20	114.4	75	11.9
B	Car spraying	Electrophoresis drying	700	10	72.6	75	90.2
		Spray drying	620	20	208	75	95.9
C	Metal material spraying	Paint spraying and drying	1122	15	152.4	0.8	36.8
D	Printing	Coating	972.8	50	1276	0.8	93.0
E	Printing	Printing	2817.8	44	4829	0.8	0[b]
F	Post-printing coating	Coating	779	30	503	0.8	41.3
G	Stereotype of synthetic fiber	Stereotype	328.9	40	184	0.8	24.1

[a], The weighted average of the VOCs content in each ingredient.

[b], Since the measured removal efficiency of activated carbon adsorption was negative, the removal efficiency was taken as zero.

Table S3 The mass concentration ratios of the top 20 VOCs species in spraying companies (%).

Constituents	Company A				Company B				Company C		
	A-1	A-2	A-3	A-4	B-1	B-2	B-3	B-4	C-1	C-2	C-3
Alkane											
n-Decane	4.4	6.2	4.6	6.1	5.7	5.4	29.6	19.3	16.4	16.0	14.5
n-Undecane	3.5	4.8	3.8	4.4	3.5	5.0	42.6	28.0	22.3	21.6	23.1
n-Octane	0.7	0.8	0.7	0.7	2.0	1.2	1.1	0.0	0.8	1.6	1.4
2-Methylheptane	0.8	0.9	0.7	0.8	2.2	1.2	3.0	0.0	1.0	2.2	0.1
3-Methylpentane	0.2	0.5	0.2	0.2	1.0	0.7	0.9	0.0	0.6	1.1	0.5
Methylcyclohexane	0.2	0.5	0.2	0.2	0.9	0.7	0.9	0.6	0.6	0.9	0.5
3-Methylheptane	0.2	0.4	0.2	0.2	0.7	0.7	0.7	0.5	0.5	0.7	0.4
n-Nonane	0.3	0.9	0.5	0.5	1.3	0.9	2.6	0.7	0.7	1.4	0.5
n-Dodecane	0.3	0.5	0.4	0.5	1.3	0.9	2.4	6.8	7.1	2.7	7.1
Methylcyclopentane	0.3	0.7	0.4	0.4	—	—	—	—	—	—	—
n-Hexane	0.3	0.6	0.3	0.3	1.2	0.8	1.3	0.0	0.6	1.2	0.6
Propane	0.6	6.3	0.6	6	1.6	1.1	0.0	0.1	0.8	1.4	1.3
Alkene											
1-Butene	—	—	—	—	1.2	27.5	1.1	8.0	19.8	2.2	13.0
Aromatic											
Toluene	70.9	54.5	40.2	29.9	52.0	2.5	2.6	1.9	1.4	2.8	1.3
m-Xylene	5.1	8.8	20.8	22.2	3.0	16.7	1.1	1.2	1.0	1.4	1.1
Ethylbenzene	3.1	4.5	11.4	11.9	2.9	2.5	0.7	0.9	0.6	2.8	0.8
Propylene	2.5	1.6	1	0.8	3.5	2.2	0.0	0.0	0.0	2.7	0.1
p-Xylene	2.3	2.8	6.1	6	0.7	1.6	0.0	0.0	0.4	0.9	0.2
o-Xylene	1.7	2.4	5.7	6.3	1.2	1.2	0.0	1.3	1.1	2.6	0.6
p-Diethylbenzene	0.2	0.4	0.1	0.2	0.7	0.7	0.6	0.5	1.0	0.6	0.4
Styrene	—	—	—	—	1.2	16.7	1.5	25.2	19.7	29.9	23.8
Carbon disulfide	0.2	0.6	0.2	0.3	—	—	—	—	—	—	—
Others	2.1	1.4	2	2.2	12.4	9.7	7.2	5.2	3.7	3.3	8.6
TVOCs（mg m^{-}	34.7	32.7	28.6	25.2	11.2	1.1	53.8	2.2	1.2	2.6	1.2

Table S4 The mass concentration ratios of the top 20 VOCs species in printing companies (%).

Constituents	Company D		Company E	
	D-1	D-2	E-1	E-2
Alkane				
n-Undecane	11.8	8.9	27.7	33.2
n-Decane	4.2	5.6	8.6	7.7
n-Dodecane	3.0	3.1	16.2	14.8
Ethane	1.2	2.1	—	—
Alkene				
Ethylene	1.6	2.5	—	—
1-Butene	2.9	3.1	—	—
Propylene	—	—	1.6	1.2
Aromatic				
Propylbenzene	24.5	6.6	1.2	1.0
m-Ethyltoluene	9.4	14.0	1.6	2.9
1,2,4-Trimethylbenzene	7.0	8.6	2.5	3.4
1,2,3-Trimethylbenzene	6.3	7.1	3.1	3.9
p-Diethylbenzene	5.4	11.6	2.1	1.4
m-Diethylbenzene	3.5	4.5	1.8	1.3
o-Ethyltoluene	3.3	3.3	2.5	1.4
Styrene	3.2	3.2	8.9	11.6
1,3,5-Trimethylbenzene	2.8	2.8	1.2	0.8
p-Ethyltoluene	1.8	2.5	0.9	0.4
Toluene	1.1	1.7	1.1	0.8
m-Xylene	1.0	1.2	2.9	2.4
p-Dichlorobenzene	0.7	0.9	—	—
Ethylbenzene	0.6	0.8	1.4	1.1
o-Xylene	—	—	0.9	0.8
p-Xylene	—	—	0.8	0.1
Carbon disulfide	—	—	0.8	0.0
Others	4.5	5.6	12.2	9.6
TVOCs（mg m^{-3}）	45.9	3.2	18.6	26.7

Table S5 The mass concentration ratios of the top 20 VOCs species in printing & dyeing companies (%).

Constituents	Company F		Company G	
	F-1	F-2	G-1	G-2
Alkane				
n-Undecane	17.8	25.6	2.6	2.5
n-Decane	11.7	8.5	2.5	0.8
2-Methylheptane	2.4	1.9	0.4	0.1
n-Dodecane	2.4	2.6	0.3	0.3
Isopentane	2.0	3.0	0.2	0.3
n-Pentane	1.3	1.9	0.1	0.2
Methylcyclohexane	1.1	0.4	0.1	0.1
n-Octane	0.9	0.7	—	—
n-Nonane	0.9	0.7	0.2	0.1
Propane	0.9	1.5	0.1	0.1
Isobutane	0.7	1.1	0.0	0.1
n-Butane	0.4	0.4	0.0	0.1
3-Methylheptane	0.4	0.4	—	—
Aromatic				
Toluene	46.1	39.6	91.7	94.3
Benzene	3.0	3.7	0.1	0.1
m-Xylene	1.1	0.4	0.1	0.1
Ethylbenzene	0.9	0.7	0.2	0.2
o-Xylene	0.7	0.4	—	—
p-Xylene	0.7	0.4	—	—
m-Diethylbenzene	—	—	0.0	0.1
OVOC				
Acetone	0.4	0.4	0.0	0.1
Others	5.7	7.8	0.7	0.5
TVOCs（mg m^{-3}）	4.6	2.7	46.5	35.3

Table S6 The MIR, method detection limitation and correlation coefficients of main VOCs in this study.

Species	MIR ($g\ g^{-1}$)	MDL[a] ($\mu g\ m^{-3}$)	Correlation Coefficients
Alkane			
Ethane	0.28	0.13	1.000
Propane	0.49	0.20	1.000
Isobutane	1.23	0.26	0.998
n-Butane	1.15	0.26	0.998
Isopentane	1.45	0.32	0.998
n-Pentane	1.31	0.32	0.998
3-Methylpentane	1.8	0.38	0.997
n-Hexane	1.24	0.38	0.991
Methylcyclopentane	2.19	0.38	0.990
Methylcyclohexane	1.7	0.44	0.991
2-Methylheptane	1.07	0.51	0.994
3-Methylheptane	1.24	0.51	0.994
n-Octane	0.9	0.51	0.994
n-Nonane	0.78	0.57	0.990
n-Decane	0.68	0.63	0.991
n-Undecane	0.61	0.70	0.992
n-Dodecane	0.55	0.76	0.992
Alkene			
ethene	9	0.13	1.000
propene	11.66	0.19	0.999
1-Butene	9.73	0.25	0.999
Carbon disulfide	-	0.36	0.999
OVOC			
Acetone	0.36	0.56	0.999
Halo hydrocarbon			
1,4-Dichlorobenzene	0.178	1.04	0.999
Aromatic			
Benzene	0.72	0.35	0.992
Toluene	4	0.41	0.991
Ethylbenzene	3.04	0.47	0.991
p-Xylene	5.84	0.47	0.993
m-Xylene	9.75	0.47	0.993
o-Xylene	7.64	0.47	0.994
Styrene	1.73	0.46	0.993
Propylbenzene	2.03	0.54	0.992

m-Ethyltoluene	7.39	0.54	0.991
p-Ethyltoluene	4.44	0.54	0.991
1,3,5-Trimethylbenzene	11.76	0.54	0.992
o-Ethyltoluene	5.59	0.54	0.991
1,2,4-Trimethylbenzene	8.87	0.54	0.992
1,2,3-Trimethylbenzene	11.97	0.54	0.992
p-Diethylbenzene	4.43	0.60	0.992
m-Diethylbenzene	7.39	0.60	0.992

[a], MDL, method detection limitation.