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Molecular fingerprints and health risks of smoke from home-use incense burning

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Texts

Text S1. Arctic contamination potential (ACP) assessment.

The partition coefficients of chemical compounds fall in the range of ($-0.5 < \log K_{a\text{-}w} < 4$ & $\log K_{o\text{-}a} < 9$) or ($-3 < \log K_{a\text{-}w}$ & $6.5 < \log K_{o\text{-}a} < 10$) are regarded as of high arctic contamination potential (ACP) concern (Zushi et al., 2019). Chemicals with high ACP are listed in Figure S15. Acetic acid, 1-hydroxy-2-propanone, 3-penten-2-one, 1-methyl-1H-pyrazole, benzenes (toluene, ethylbenzene, and xylenes), 2-furanmethanol, linalool, limonene, benzoic acid 2-ethylhexyl ester, and C15 – C21 *n* and *b*-alkanes are high ACP compounds (Figure S15).

Tables

Table S1. Detailed instrumentation parameters of TD-GC×GC-qMS.

Table S2. Calibration curves of the external standards.

Table S3. Chemicals quantified, with volatility and polarity bins, MIR, *k*OH, and SOA yields.

Table S4. Emission factors (μg g^{-1}) of selected compounds in this study and comparison with other incense burning studies.

Table S1. Detailed instrumentation parameters of TD-GC×GC-qMS.

TDS		**CIS**	
Carrier gas	He, 50 mL/min	Initial temperature	20 ℃
Split/splitless	splitless	Split/splitless	Split, ratio = 15
Temperature program	30℃_60℃/min_280℃ (10 min)	Temperature program	20℃_12℃/s_320℃ (5 min)
GC×GC		**qMS**	
Carrier gas	He, 1.0 mL/min	Ion source	EI (70 eV, 230 ℃)
Columns	**1st** Shimadzu SH-Rxi-1ms (30 m × 0.25 mm × 0.25 μm) **2nd** BPX50 (2.5 m × 0.1 mm × 0.1 μm)	Mode	TIC
Temperature program	50 ℃(5min)_3 ℃/min_250 ℃(5min)_10 ℃/min_300 ℃(20 min)	Mass range	33-500 amu

Table S2. Calibration curves of the external standards.

compound	class_detail	retention1	retention2	response	slope	intercept	r_square	slope_lowest	response lowest
Benzonitrile	nitriles	14.8	1.62	Quantifier(103)	248994.996	-1030650.5	0.997891	6.37507E-06	quantifier
Styrene	aromatics	12.2	0.93	Quantifier(104)	120819.674	-94133.385	0.99244	1.10779E-05	quantifier
Acetic acid, 2-phenylethyl ester	esters	23.4	1.29	Quantifier(104)	321753.949	80735.9534	0.997878	3.17118E-06	quantifier
Benzene, (1-methylethyl)-	aromatics	13.4	0.78	Quantifier(105)	229105.896	-749484.52	0.988508	7.14837E-06	quantifier
Benzyl Benzoate	esters	35.6	1.89	Quantifier(105)	360507.357	-902951.99	0.998724	4.19147E-06	quantifier
Acetophenone	ketones	17.7	1.5	Quantifier(105)	286297.664	-155506.46	0.984967	3.89734E-06	quantifier
Acetic acid, phenylmethyl ester	esters	20.7	1.32	Quantifier(108)	223813.137	-756200.65	0.989638	7.52782E-06	quantifier
Phenol, 3-methyl-	phenols	18.3	1.2	Quantifier(108)	358479.616	896822.628	0.994235	2.15997E-06	quantifier
Phenol, 2-methyl-	phenols	19.8	0.96	Quantifier(108)	228150.221	-3560249	0.978509	1.12132E-05	quantifier
Ethane, hexachloro-	halocarbons	18.4	0.93	Quantifier(117)	34274.7698	205153.834	0.97634	2.00249E-05	quantifier
Indole	indoles	24.4	2.1	Quantifier(117)	362498.345	-1648500.4	0.997581	5.0784E-06	quantifier
p-Chloroaniline	others	21.9	1.8	Quantifier(127)	143633.14	-473328.4	0.998068	9.19422E-06	quantifier
Naphthalene	PAHs	21.6	1.44	Quantifier(128)	299143.85	7078753.5	0.988491	1.57341E-06	quantifier
Phenol, 2-chloro-	phenols	15.6	1.14	Quantifier(128)	95238.115	-486162.9	0.994018	1.61046E-05	quantifier
Phenol, 4-chloro-	phenols	22.2	1.32	Quantifier(128)	238199.115	-818513.4	0.998537	4.80132E-06	quantifier
Hexanedioic acid, bis(2-ethylhexyl) ester	esters	47.2	1.2	Quantifier(129)	193866.316	-1630739.1	0.979979	1.98014E-05	quantifier
Quinoline	others	23	1.8	Quantifier(129)	419799.88	-1522343.3	0.997264	3.72402E-06	quantifier
Benzeneethanol, dimethyl-, acetate	esters	25.3	1.02	Quantifier(132)	124525.261	-323795.24	0.999203	1.23189E-05	quantifier
Benzothiazole	thiazoles	22.4	2.04	Quantifier(135)	451895.164	53866567	0.868748	3.39858E-07	quantifier
Phenol, 2-nitro-	phenols	19.8	1.44	Quantifier(139)	46861.0462	-432734.46	0.99981	3.79603E-05	quantifier
Naphthalene, 2-methyl-	PAHs	24.8	1.35	Quantifier(142)	236865.4	5523543	0.987994	2.15125E-06	quantifier
1-Naphthalenol	phenols	30.1	1.98	Quantifier(144)	161299.719	-1716279.6	0.994577	1.03691E-05	quantifier
2-Naphthalenol	phenols	30.3	2.04	Quantifier(144)	363638.135	-2671808.5	0.992284	3.46363E-06	quantifier

Benzene, 1,3-dichloro-	halocarbons	15.9	1.05	Quantifier(146)	72130.403	497848.447	0.969565	8.0583E-06	quantifier
Benzene, 1,4-dichloro-	halocarbons	16.1	1.08	Quantifier(146)	128297.283	144536.547	0.976931	5.7832E-06	quantifier
Benzene, 1,2-dichloro-	halocarbons	16.9	1.14	Quantifier(146)	112626.282	294316.377	0.988771	6.43652E-06	quantifier
Pyridine, 3,5-dichloro-	Pyridines	15.9	1.08	Quantifier(147)	146161.53	-456122.52	0.997571	9.8031E-06	quantifier
Diethyl Phthalate	esters	31.7	1.65	Quantifier(149)	134313.619	375738.923	0.98491	5.69326E-06	quantifier
1,2-Benzenedicarboxylic acid, bis(2-methylpropyl) ester	esters	37.5	1.38	Quantifier(149)	307433.707	8253485.18	0.991862	1.44136E-06	quantifier
Dibutyl phthalate	esters	39.3	1.47	Quantifier(149)	237452.714	5072697.77	0.999901	2.04197E-06	quantifier
Benzyl butyl phthalate	esters	45.9	2.58	Quantifier(149)	140822.204	-124237.75	0.994786	7.73961E-06	quantifier
Bis(2-ethylhexyl) phthalate	esters	50.2	2.22	Quantifier(149)	219340.444	-131055.27	0.995097	4.66365E-06	quantifier
Di-N-octyl phthalate	esters	53.6	1.56	Quantifier(149)	339861.949	-1224278.1	0.994692	3.50596E-06	quantifier
Acenaphthylene	PAHs	28.6	1.83	Quantifier(152)	303847.136	5053784	0.983424	1.957E-06	quantifier
Acenaphthene	PAHs	29.5	1.74	Quantifier(153)	121532.983	4365923.15	0.994059	2.99039E-06	quantifier
Biphenyl	PAHs	26.9	1.47	Quantifier(154)	296508.489	1457408.82	0.984094	2.39984E-06	quantifier
Naphthalene, 2-chloro-	halocarbons	26.8	1.53	Quantifier(162)	154533.698	3918104.46	0.990002	2.92849E-06	quantifier
Phenol, 2,4-dichloro-	phenols	21.3	1.2	Quantifier(162)	179169.06	-1379638.5	0.988449	6.5718E-06	quantifier
Dimethyl phthalate	esters	28.4	1.86	Quantifier(163)	183210.783	704428.175	0.984511	4.41416E-06	quantifier
Benzene, 2-methyl-1,3-dinitro-	nitro-aromatics	28.1	2.25	Quantifier(165)	40692.07	107516.55	0.991284	2.44959E-05	quantifier
Fluorene	PAHs	31.9	1.74	Quantifier(165)	185048.557	1232454.62	0.977325	3.18421E-06	quantifier
Carbazole	others	37.1	2.64	Quantifier(167)	330671.238	509329.12	0.994968	2.35223E-06	quantifier
Dibenzofuran	ethers	30.3	1.68	Quantifier(168)	279938.104	4594967.5	0.991009	2.08813E-06	quantifier
Diphenyl ether	ethers	27.4	1.5	Quantifier(170)	200982.002	404653.953	0.993451	4.34928E-06	quantifier
Phenanthrene	PAHs	36.1	2.16	Quantifier(178)	186447.071	5917632.92	0.996963	2.09913E-06	quantifier
Anthracene	PAHs	36.3	2.13	Quantifier(178)	307956.618	3390378.24	0.954747	1.89444E-06	quantifier
Benzene, 1-chloro-2-(trifluoromethyl)-	halocarbons	10.9	0.63	Quantifier(180)	52767.7899	-288050.76	0.980687	3.37298E-05	quantifier
Benzene, 1,2,4-trichloro-	halocarbons	21.4	1.14	Quantifier(180)	85996.094	616790.412	0.982474	7.2993E-06	quantifier
Dibutyl adipate	esters	35.6	0.99	Quantifier(185)	59991.765	894675.35	0.981535	1.10492E-05	quantifier

Phenol, 2,4,6-trichloro-	phenols	26.3	1.32	Quantifier(196)	42228.88	137118.2	0.996066	2.26656E-05	quantifier
Phenol, 2,4,5-trichloro-	phenols	26.7	1.29	Quantifier(196)	41491.7831	-28905.413	0.997369	2.55656E-05	quantifier
Fluoranthene	PAHs	41.5	2.46	Quantifier(202)	278226.797	-134067.87	0.999049	2.26623E-06	quantifier
Pyrene	PAHs	42.4	2.7	Quantifier(202)	300945.846	1604594.34	0.984916	2.07521E-06	quantifier
Benzene, 1-chloro-4-phenoxy-	aromatics	32	1.56	Quantifier(204)	79511.208	560171.89	0.976335	7.20455E-06	quantifier
Cyclotrisiloxane, hexamethyl-(D3)	siloxanes	10.3	6.21	Quantifier(207)	21169.1058	-681506.5	0.953529		
1,3-Butadiene, 1,1,2,3,4,4-hexachloro-	halocarbons	22.8	0.84	Quantifier(225)	21615.92	701041.8	0.997131	1.79058E-05	quantifier
Benz[a]anthracene	PAHs	48.4	4.5	Quantifier(228)	213630.011	594086.284	0.987413	3.84991E-06	quantifier
Chrysene	PAHs	48.6	4.77	Quantifier(228)	297532.503	1064500.33	0.991383	2.28984E-06	quantifier
Benzene, 1-bromo-4-phenoxy-	halocarbons	34.1	1.74	Quantifier(248)	33682.9865	722737.231	0.993747	1.46462E-05	quantifier
Benzo[b]fluoranthene	PAHs	54.3	4.08	Quantifier(252)	568086.558	1558460.16	0.971726	1.46715E-06	quantifier
Benzo[k]fluoranthene	PAHs	55.9	5.34	Quantifier(252)	207862.341	79057.7675	0.993479	4.56523E-06	quantifier
Benzo[ghi]perylene	PAHs	62.9	4.53	Quantifier(276)	239833.004	749842.5	0.985134	4.11007E-06	quantifier
Indeno[1,2,3-cd]pyrene	PAHs	64.8	6.6	Quantifier(276)	124920.805	11890.7	0.984077	8.7779E-06	quantifier
Cyclotetrasiloxane, octamethyl-(D4)	siloxanes	16.5	6.21	Quantifier(281)	128593.469	1902775.86	0.967596	4.48484E-06	quantifier
Benzene, hexachloro-	halocarbons	34.8	1.41	Quantifier(284)	28244.7135	734622.769	0.986717	1.58519E-05	quantifier
n-Propyl acetate	esters	6.9	0.6	Quantifier(43)	62835.5046	712890.06	0.958948	8.26336E-06	quantifier
sec-Butyl acetate	esters	7.9	6.57	Quantifier(43)	56155.4618	232064.088	0.995145	1.27468E-05	quantifier
1-Butanol, 3-methyl-, acetate	esters	11.7	0.66	Quantifier(43)	174466.653	-754964.51	0.987068	8.35382E-06	quantifier
Acetic acid, hexyl ester	esters	16.3	0.69	Quantifier(43)	137317.113	390939.782	0.995137	5.3658E-06	quantifier
2-Heptanone	ketones	12	0.78	Quantifier(43)	235077.675	-16249.99	0.999539	3.8733E-06	quantifier
5-Hepten-2-one, 6-methyl-	ketones	15.3	0.87	Quantifier(43)	135602.853	-91064.874	0.994135	7.84336E-06	quantifier
Methyl thiolacetate	others	6.5	0.75	Quantifier(43)	36839.1518	124770.425	0.997808	2.10015E-05	quantifier
Propanoic acid, 2-hydroxy-, ethyl ester	esters	9.6	0.78	Quantifier(45)	229477.995	-2133724.3	0.991894	1.08789E-05	quantifier

Bis(2-chloro-1-methylethyl) ether	ethers	17.4	0.93	Quantifier(45)	249499.551	2091527.72	0.972361	2.43046E-06	quantifier
S-Methyl methanethiosulphonate	others	17	2.73	Quantifier(47)	55663.3	-1299977	1		
2-Propenenitrile, 2-chloro-	nitriles	5.2	0.57	Quantifier(52)	39085.6513	62634.1402	0.998079	2.22115E-05	quantifier
1-Butanol, 3-methyl-	alcohols	7.4	6.57	Quantifier(55)	110459.135	-466671.3	0.996545	1.73678E-05	quantifier
1-Dodecanol	alcohols	29.5	0.69	Quantifier(55)	123824.649	-924855.59	0.985058	3.75208E-05	quantifier
Cyclohexanone	ketones	11.8	1.35	Quantifier(55)	191984.33	-604929.55	0.994404	8.8754E-06	quantifier
Caprolactam	others	22.9	2.52	Quantifier(55)	115640.482	-1212316.5	0.999999		
1-Butanol	alcohols	6	0.51	Quantifier(56)	96642.0912	-31504.808	0.996538	1.12188E-05	quantifier
1-Hexanol	alcohols	11.5	0.69	Quantifier(56)	126154.929	-1123407	0.98363		
Decanal	aldehydes	22.2	0.72	Quantifier(57)	10032.0096	2353536.5	0.999969	1.00115E-05	quantifier
Dodecanal	aldehydes	27.7	0.72	Quantifier(57)	53663.0143	293039.342	0.975566	1.3212E-05	quantifier
n-Butyl ether	ethers	12.2	0.48	Quantifier(57)	274589.281	-1295799.9	0.994309	9.45026E-06	quantifier
3-Heptanone	ketones	11.9	0.75	Quantifier(57)	175663.864	156580.395	0.987488	5.04713E-06	quantifier
C7	n-alkanes	6.8	0.3	Quantifier(57)	7320.28	432670.95	0.95042	3.86884E-05	quantifier
C8	n-alkanes	9.5	6.36	Quantifier(57)	8475.435	333423.15	0.978284	4.0298E-05	quantifier
C9	n-alkanes	12.9	6.36	Quantifier(57)	120235.624	-99427.234	0.9647	1.61956E-05	quantifier
C10	n-alkanes	16.3	6.39	Quantifier(57)	83877.9904	4201287.31	0.997749	3.42886E-06	quantifier
C11	n-alkanes	19.6	0.39	Quantifier(57)	58379.5981	4919162.77	0.991546	3.38982E-06	quantifier
C12	n-alkanes	22.6	0.39	Quantifier(57)	81584.735	4801650.65	0.991965	3.13495E-06	quantifier
C13	n-alkanes	25.3	0.42	Quantifier(57)	97441.9846	5681795.69	0.996596	2.59862E-06	quantifier
C14	n-alkanes	27.9	0.42	Quantifier(57)	61722.64	7616313.35	0.98976	2.29698E-06	quantifier
C15	n-alkanes	30.4	0.45	Quantifier(57)	59203.39	6216782.1	0.966441	2.84017E-06	quantifier
C16	n-alkanes	32.6	6.45	Quantifier(57)	46754.24	5451474.35	0.978873	3.1732E-06	quantifier
C17	n-alkanes	34.8	6.45	Quantifier(57)	83770.76	7352452.9	0.96089	2.35652E-06	quantifier
C18	n-alkanes	36.9	0.48	Quantifier(57)	48317	5389776	0.994807	3.12675E-06	quantifier
C19	n-alkanes	38.8	6.51	Quantifier(57)	64620.305	5266453.45	0.988654	3.1737E-06	quantifier

C20	n-alkanes	40.8	0.51	Quantifier(57)	119998.177	5134521.54	0.99989	2.6596E-06	quantifier
C21	n-alkanes	42.5	0.54	Quantifier(57)	130128.327	4467730.54	0.997373	2.85993E-06	quantifier
C22	n-alkanes	44.2	0.54	Quantifier(57)	139113.687	4675122.23	0.989379	2.74312E-06	quantifier
C23	n-alkanes	45.9	0.63	Quantifier(57)	87427.67	6186200.05	0.97346	2.66406E-06	quantifier
C24	n-alkanes	47.8	0.78	Quantifier(57)	159896.493	6077824	0.99682	2.10874E-06	quantifier
C25	n-alkanes	50	0.99	Quantifier(57)	180486.007	5367065	0.993152	2.14525E-06	quantifier
C26	n-alkanes	52.1	0.69	Quantifier(57)	102498.456	8012553.69	0.995087	2.03811E-06	quantifier
C27	n-alkanes	53.7	0.69	Quantifier(57)	129061.414	4907054	0.997719	2.62096E-06	quantifier
C28	n-alkanes	55.4	0.81	Quantifier(57)	207877.739	3395350.5	0.999502	2.68609E-06	quantifier
C29	n-alkanes	57.2	0.99	Quantifier(57)	184951.404	2317084.5	0.999612	3.37157E-06	quantifier
C30	n-alkanes	59.4	1.23	Quantifier(57)	179109.234	209777.88	0.982392	4.12872E-06	quantifier
C31	n-alkanes	62	1.5	Quantifier(57)	153485.431	23965.0565	0.988572	5.23866E-06	quantifier
C32	n-alkanes	65.1	1.83	Quantifier(57)	104885.436	1953288	0.973182	5.48111E-06	quantifier
Terpineol	alcohols	21.9	0.93	Quantifier(59)	110318.538	343731.031	0.977379	8.07002E-06	quantifier
Propanoic acid, 2-chloro-, methyl ester	esters	8.7	0.9	Quantifier(63)	61333.2811	-168558.26	0.994755	1.98275E-05	quantifier
o-Nitroaniline	others	27.2	2.37	Quantifier(65)	57086.215	-15018.15	0.991773	2.06838E-05	quantifier
m-Nitroaniline	others	29.2	2.55	Quantifier(65)	54811.12	-3796.95	0.991837	2.12108E-05	quantifier
p-Nitroaniline	others	32	3	Quantifier(65)	38502.19	240522.1	0.985155	2.38923E-05	quantifier
Citronellol	alcohols	22.9	0.78	Quantifier(69)	78849.9241	-233192.06	0.991207	2.0028E-05	quantifier
Citral	aldehydes	23.9	0.99	Quantifier(69)	93061.2394	-430026.17	0.996819	1.96637E-05	quantifier
Linalool	alcohols	19.2	0.69	Quantifier(71)	13409.5976	-29238.05	0.997827		
Butanoic acid, ethyl ester	esters	9.2	0.66	Quantifier(71)	32356.781	225214.346	0.995375	1.74158E-05	quantifier
2,2,4-Trimethyl-1,3-pentanediol diisobutyrate	esters	26.9	0.81	Quantifier(71)	114293.663	-75685.576	0.992158	1.16457E-05	quantifier
Formamide, N,N-dimethyl-	amides	8.3	1.62	Quantifier(73)	136372.576	-1639405.1	0.991024	6.46743E-05	quantifier
Cyclopentasiloxane, decamethyl-(D5)	siloxanes	21.5	6.24	Quantifier(73)	45705.4052	3844226.02	0.971154	4.45964E-06	quantifier

Cyclohexasiloxane, dodecamethyl-(D6)	siloxanes	26.4	6.21	Quantifier(73)	27461.9983	2314406.33	0.92923	8.05801E-06	quantifier
N-Nitrosodimethylamine	amines	7.2	1.44	Quantifier(74)	79301.675	45695	0.999632	1.18737E-05	quantifier
Benzaldehyde	aldehydes	14.2	1.47	Quantifier(77)	67111.0585	2527729.95	0.954625	6.08124E-06	quantifier
Acetic acid, chloro-, ethyl ester	esters	10.1	1.08	Quantifier(77)	58363.8652	-273677.7	0.995285	2.99013E-05	quantifier
Benzene, nitro-	nitro-aromatics	18.2	1.65	Quantifier(77)	110574.044	88468.8707	0.988179	8.49194E-06	quantifier
Azobenzene	others	32.7	1.68	Quantifier(77)	190853.681	1215199.02	0.981028	3.14077E-06	quantifier
Benzyl alcohol	alcohols	17	1.38	Quantifier(79)	77124.835	943492.15	0.999689	8.13814E-06	quantifier
Isophorone	ketones	19.4	1.2	Quantifier(82)	144711.039	5467039.79	0.998747		
Cyclohexane-C6	cycloalkanes	23.7	0.51	Quantifier(83)	93485.9397	4432996.97	0.998368	3.20437E-06	quantifier
Cyclohexane-C7	cycloalkanes	26.5	0.51	Quantifier(83)	77441.18	4282127.45	0.964403	3.53225E-06	quantifier
Cyclohexane-C8	cycloalkanes	29	6.54	Quantifier(83)	72784.8441	4100978.14	0.974758	3.84769E-06	quantifier
Phenylethyl Alcohol	alcohols	19.4	1.41	Quantifier(91)	290662.176	-2968011.1	0.99427	1.33354E-05	quantifier
Toluene	aromatics	8.3	0.72	Quantifier(91)	40729.9019	1363235.23	0.990375	9.80998E-06	quantifier
Ethylbenzene	aromatics	11.3	0.75	Quantifier(91)	77930.6472	570790.215	0.993751	8.01141E-06	quantifier
Benzene, 1,3-dimethyl-	aromatics	11.6	0.72	Quantifier(91)	272561.801	-610546.59	0.990536	6.13796E-06	quantifier
o-Xylene	aromatics	12.3	0.84	Quantifier(91)	155669.358	-1368693.1	0.973105	1.68025E-05	quantifier
Benzene, propyl-	aromatics	14.4	0.78	Quantifier(91)	277925.567	1056466.94	0.985482	3.43647E-06	quantifier
Benzeneacetic acid, ethyl ester	esters	23	1.29	Quantifier(91)	422328.049	-462584.64	0.99985	2.6904E-06	quantifier
Alpha-Pinene	alkenes	14	0.54	Quantifier(93)	7737.3504	60278.6087	0.97996	8.24436E-05	quantifier
3-Carene	alkenes	16.6	0.6	Quantifier(93)	127653.279	-328175.98	0.986408	1.49216E-05	quantifier
Linalyl acetate	esters	23.6	6.69	Quantifier(93)	55618.15	-1844572	1		
Bis(2-chloroethyl) ether	ethers	14.9	1.26	Quantifier(93)	124070.962	177735.477	0.987959	6.91045E-06	quantifier
Methane, bis(2-chloroethoxy)-	ethers	20.5	1.29	Quantifier(93)	112202.2	2775329.25	0.958071	4.62496E-06	quantifier
Phenol	phenols	15.4	1.17	Quantifier(94)	75004.6846	-828090.85	0.997412	3.70606E-05	quantifier
Camphor	ketones	20.3	1.14	Quantifier(95)	103524.07	-83537.949	0.995205	1.06481E-05	quantifier
1-Butanol	alcohols	6	0.51	Volume(-)	371770.169	17028801	0.964114	4.4218E-07	volume
1-Butanol, 3-methyl-	alcohols	7.4	6.57	Volume(-)	768703.535	4686315.7	0.988049	8.6499E-07	volume

1-Hexanol	alcohols	11.5	0.69	Volume(-)	461868.264	-1777981	0.984581		
Benzyl alcohol	alcohols	17	1.38	Volume(-)	313467.05	24115041.3	0.996083	6.43458E-07	volume
Linalool	alcohols	19.2	0.69	Volume(-)	106489.439	5653581.44	0.977716		
Phenylethyl Alcohol	alcohols	19.4	1.41	Volume(-)	951424.093	3536114.26	0.997184	8.08847E-07	volume
Terpineol	alcohols	21.9	0.93	Volume(-)	874457.355	8776301.27	0.987818	5.95631E-07	volume
Citronellol	alcohols	22.9	0.78	Volume(-)	736130.411	3235752.75	0.99251	7.37487E-07	volume
1-Dodecanol	alcohols	29.5	0.69	Volume(-)	1675362.33	-11839246	0.993296	1.27205E-06	volume
Benzaldehyde	aldehydes	14.2	1.47	Volume(-)	295989.292	32923561.1	0.928861	5.62022E-07	volume
Decanal	aldehydes	22.2	0.72	Volume(-)	90832.1943	30410602.5	0.91838	7.68249E-07	volume
Citral	aldehydes	23.9	0.99	Volume(-)	476599.703	5532991.75	0.997937	1.03847E-06	volume
Dodecanal	aldehydes	27.7	0.72	Volume(-)	613460.835	8672551.69	0.973318	7.06712E-07	volume
3-Carene	alkenes	16.6	0.6	Volume(-)	555477.598	2352661.96	0.996717	1.31338E-06	volume
Formamide, N,N-dimethyl-	amides	8.3	1.62	Volume(-)	639538.124	-1756059.9	0.999197	1.89851E-06	volume
N-Nitrosodimethylamine	amines	7.2	1.44	Volume(-)	125347.589	17277719.5	0.915964	9.67984E-07	volume
Toluene	aromatics	8.3	0.72	Volume(-)	111437.345	15552626.6	0.908394	1.13912E-06	volume
Ethylbenzene	aromatics	11.3	0.75	Volume(-)	164716.114	7648261.32	0.993769	1.74172E-06	volume
Benzene, 1,3-dimethyl-	aromatics	11.6	0.72	Volume(-)	732906.039	7395867.46	0.999845	1.95158E-06	volume
Styrene	aromatics	12.2	0.93	Volume(-)	382946.99	2598518.1	0.967069	2.51416E-06	volume
o-Xylene	aromatics	12.3	0.84	Volume(-)	422382.202	-1314510.3	0.963411	2.7499E-06	volume
Benzene, (1-methylethyl)-	aromatics	13.4	0.78	Volume(-)	548984.5	8129641.52	0.996125	1.13721E-06	volume
Benzene, propyl-	aromatics	14.4	0.78	Volume(-)	609446.518	12668627.1	0.999525	7.84626E-07	volume
Biphenyl	aromatics	26.9	1.47	Volume(-)	833827.577	12937676.3	0.981003	5.22721E-07	volume
Benzene, 1-chloro-4-phenoxy-	aromatics	32	1.56	Volume(-)	340005.725	15045138	0.99267	9.29891E-07	volume
Cyclohexane-C6	cycloalkanes	23.7	0.51	Volume(-)	516190.948	24464884.6	0.995987	5.60808E-07	volume
Cyclohexane-C7	cycloalkanes	26.5	0.51	Volume(-)	197535.205	27873753.2	0.952813	6.72421E-07	volume
Cyclohexane-C8	cycloalkanes	29	6.54	Volume(-)	358018.607	25520410.2	0.9402	6.82893E-07	volume
n-Propyl acetate	esters	6.9	0.6	Volume(-)	172406.138	6510745.63	0.978575	1.13561E-06	volume
sec-Butyl acetate	esters	7.9	6.57	Volume(-)	365821.06	4516487.8	0.998136	1.15229E-06	volume

Propanoic acid, 2-chloro-, methyl ester	esters	8.7	0.9	Volume(-)	206144.927	8670199.74	0.97375	9.95367E-07	volume
Butanoic acid, ethyl ester	esters	9.2	0.66	Volume(-)	138521.093	10530426.9	0.97704	8.0804E-07	volume
Propanoic acid, 2-hydroxy-, ethyl ester	esters	9.6	0.78	Volume(-)	237641.369	9228945.01	0.977146	8.03557E-07	volume
Acetic acid, chloro-, ethyl ester	esters	10.1	1.08	Volume(-)	636784.626	3482306.52	0.99672	9.18225E-07	volume
Acetic acid, hexyl ester	esters	16.3	0.69	Volume(-)	584635.045	3691577.98	0.999881	1.01926E-06	volume
Acetic acid, phenylmethyl ester	esters	20.7	1.32	Volume(-)	1047153.31	-2856342.3	0.998769	1.12506E-06	volume
Benzeneacetic acid, ethyl ester	esters	23	1.29	Volume(-)	776055.212	4430225.49	0.984715	8.93401E-07	volume
Acetic acid, 2-phenylethyl ester	esters	23.4	1.29	Volume(-)	660762.445	9186511.08	0.995017	6.24023E-07	volume
Linalyl acetate	esters	23.6	6.69	Volume(-)	575136.95	-6733826	1		
Benzeneethanol, dimethyl-, acetate	esters	25.3	1.02	Volume(-)	918069.484	3341459.89	0.97681	1.1607E-06	volume
2,2,4-Trimethyl-1,3-pentanediol diisobutyrate	esters	26.9	0.81	Volume(-)	414581.406	13288013.6	0.93362	1.20476E-06	volume
Dimethyl phthalate	esters	28.4	1.86	Volume(-)	382161.965	4090570.92	0.970216	1.5413E-06	volume
Diethyl Phthalate	esters	31.7	1.65	Volume(-)	347421.027	2214076.87	0.994984	1.87418E-06	volume
Dibutyl adipate	esters	35.6	0.99	Volume(-)	654608.34	28310250.9	0.970301	5.38476E-07	volume
Benzyl Benzoate	esters	35.6	1.89	Volume(-)	1198995.63	13776826.8	0.994584	4.19534E-07	volume
1,2-Benzenedicarboxylic acid, bis(2-methylpropyl) ester	esters	37.5	1.38	Volume(-)	720445.973	26780920.3	0.99221	4.84178E-07	volume
Dibutyl phthalate	esters	39.3	1.47	Volume(-)	490263.071	26288201	0.915778	6.12372E-07	volume
Benzyl butyl phthalate	esters	45.9	2.58	Volume(-)	599420.415	29148243.9	0.952222	5.53382E-07	volume
Hexanedioic acid, bis(2-ethylhexyl) ester	esters	47.2	1.2	Volume(-)	1403558.03	-1591044	0.989732	5.29825E-07	volume
Bis(2-ethylhexyl) phthalate	esters	50.2	2.22	Volume(-)	990602.44	35974273.4	0.98858	3.66661E-07	volume
Di-N-octyl phthalate	esters	53.6	1.56	Volume(-)	970681.25	49149986.3	0.994088	2.8276E-07	volume
n-Butyl ether	ethers	12.2	0.48	Volume(-)	543706.17	522042.965	0.989505	1.70108E-06	volume

Bis(2-chloroethyl) ether	ethers	14.9	1.26	Volume(-)	293251.721	10112408.2	0.981181	1.18076E-06	volume
Bis(2-chloro-1-methylethyl) ether	ethers	17.4	0.93	Volume(-)	502820.195	20511710.8	0.982945	6.41801E-07	volume
Methane, bis(2-chloroethoxy)-	ethers	20.5	1.29	Volume(-)	789231.604	29903803.5	0.996062	4.49011E-07	volume
Diphenyl ether	ethers	27.4	1.5	Volume(-)	1502301.27	1056835.95	0.994182	5.60487E-07	volume
Dibenzofuran	ethers	30.3	1.68	Volume(-)	456697.98	27947696.2	0.946373	5.86123E-07	volume
Benzene, 1-chloro-2-(trifluoromethyl)-	halocarbons	10.9	0.63	Volume(-)	408718.749	5998995.16	0.986613	9.48426E-07	volume
Benzene, 1,3-dichloro-	halocarbons	15.9	1.05	Volume(-)	253717.267	5558043.85	0.999359	1.89426E-06	volume
Benzene, 1,4-dichloro-	halocarbons	16.1	1.08	Volume(-)	477669.97	2813017.91	0.994554	8.93244E-07	volume
Benzene, 1,2-dichloro-	halocarbons	16.9	1.14	Volume(-)	417706.139	10280963.4	0.981112	8.99799E-07	volume
Ethane, hexachloro-	halocarbons	18.4	0.93	Volume(-)	178919.348	10358046.7	0.983889	1.59793E-06	volume
Benzene, 1,2,4-trichloro-	halocarbons	21.4	1.14	Volume(-)	986872.498	2585774.85	0.997446	1.0402E-06	volume
1,3-Butadiene, 1,1,2,3,4,4-hexachloro-	halocarbons	22.8	0.84	Volume(-)	159192.86	16639933.2	0.994979	1.0209E-06	volume
Naphthalene, 2-chloro-	halocarbons	26.8	1.53	Volume(-)	427755.267	32539597.8	0.993208	4.91567E-07	volume
Benzene, 1-bromo-4-phenoxy-	halocarbons	34.1	1.74	Volume(-)	509885.978	10320899.6	0.977821	9.76793E-07	volume
Benzene, hexachloro-	halocarbons	34.8	1.41	Volume(-)	145535.96	16932293.4	0.973847	1.05536E-06	volume
Indole	indoles	24.4	2.1	Volume(-)	1160645.73	13181754.1	0.993281	3.65726E-07	volume
Cyclohexanone	ketones	11.8	1.35	Volume(-)	768571.842	13246450.7	0.977102	5.0048E-07	volume
3-Heptanone	ketones	11.9	0.75	Volume(-)	337670.212	10556939.7	0.997361	1.12921E-06	volume
5-Hepten-2-one, 6-methyl-	ketones	15.3	0.87	Volume(-)	715277.453	6622011.06	0.996124	7.36244E-07	volume
Acetophenone	ketones	17.7	1.5	Volume(-)	803630.829	15811130.1	0.987278	3.73598E-07	volume
Isophorone	ketones	19.4	1.2	Volume(-)	232077.139	19913900.5	0.99291		
Camphor	ketones	20.3	1.14	Volume(-)	754493.313	4795306.75	0.984681	7.43488E-07	volume
C7	n-alkanes	6.8	0.3	Volume(-)	127233.285	17592558.7	0.936707	9.04836E-07	volume
C8	n-alkanes	9.5	6.36	Volume(-)	211176.589	24792624.8	0.936172	7.04735E-07	volume
C9	n-alkanes	12.9	6.36	Volume(-)	494690.974	6730391.63	0.999576	1.98022E-06	volume

C10	n-alkanes	16.3	6.39	Volume(-)	310360.825	28307147	0.995473	5.83555E-07	volume
C11	n-alkanes	19.6	0.39	Volume(-)	217524.065	30446956.6	0.997817	5.72834E-07	volume
C12	n-alkanes	22.6	0.39	Volume(-)	371224.26	24216171.2	0.996241	6.49594E-07	volume
C13	n-alkanes	25.3	0.42	Volume(-)	380560.135	38157001.7	0.986857	4.32196E-07	volume
C14	n-alkanes	27.9	0.42	Volume(-)	126513.725	52109622.5	0.831378	3.75098E-07	volume
C15	n-alkanes	30.4	0.45	Volume(-)	314167.78	45032615.7	0.95676	3.96835E-07	volume
C16	n-alkanes	32.6	6.45	Volume(-)	499091.898	16637226.6	0.998321	5.15652E-07	volume
C17	n-alkanes	34.8	6.45	Volume(-)	429261.04	47836313.6	0.964208	3.71499E-07	volume
C18	n-alkanes	36.9	0.48	Volume(-)	1071200.05	25711698.7	0.905911	3.6825E-07	volume
C19	n-alkanes	38.8	6.51	Volume(-)	542664.277	25649099.4	0.939338	4.44948E-07	volume
C20	n-alkanes	40.8	0.51	Volume(-)	798637.067	42583916.1	0.98845	3.59932E-07	volume
C21	n-alkanes	42.5	0.54	Volume(-)	625403.925	52123220	0.996117	3.13097E-07	volume
C22	n-alkanes	44.2	0.54	Volume(-)	738515.729	49371822.1	0.986974	3.16644E-07	volume
C23	n-alkanes	45.9	0.63	Volume(-)	468679.568	68021690.5	0.822762	2.76351E-07	volume
C24	n-alkanes	47.8	0.78	Volume(-)	1642492.32	34264579.6	0.987253	2.08419E-07	volume
C25	n-alkanes	50	0.99	Volume(-)	1006802.22	52180805.5	0.979821	2.64363E-07	volume
C26	n-alkanes	52.1	0.69	Volume(-)	1071560.9	73193410	0.98666	2.05124E-07	volume
C27	n-alkanes	53.7	0.69	Volume(-)	297997.175	79536129	0.924074	2.40992E-07	volume
C28	n-alkanes	55.4	0.81	Volume(-)	1248237.68	71716056	0.984305	2.1496E-07	volume
C29	n-alkanes	57.2	0.99	Volume(-)	1511457.41	45597776.5	0.995881	2.71805E-07	volume
C30	n-alkanes	59.4	1.23	Volume(-)	985551.162	47138362.2	0.927356	3.14148E-07	volume
C31	n-alkanes	62	1.5	Volume(-)	1153965.03	39361148.5	0.89353	3.75649E-07	volume
C32	n-alkanes	65.1	1.83	Volume(-)	2862892.86	889904.262	0.933398	2.70115E-07	volume
Benzonitrile	nitriles	14.8	1.62	Volume(-)	669404.017	5322867.01	0.982467	6.72332E-07	volume
Benzene, nitro-	nitro-aromatics	18.2	1.65	Volume(-)	410963.785	11364083.8	0.968992	2.14487E-06	volume
Benzene, 2-methyl-1,3-dinitro-	nitro-aromatics	28.1	2.25	Volume(-)	302991.52	15797394.3	0.983646	9.25809E-07	volume
Methyl thiolacetate	others	6.5	0.75	Volume(-)	119179.768	3575346.35	0.992657	2.06874E-06	volume

S-Methyl methanethiosulphonate	others	17	2.73	Volume(-)	572472.9	4641170	1		
p-Chloroaniline	others	21.9	1.8	Volume(-)	617262.11	15491041.7	0.96358	8.55657E-07	volume
Caprolactam	others	22.9	2.52	Volume(-)	1053287.34	11054585	0.998908		
Quinoline	others	23	1.8	Volume(-)	978932.614	13926338.9	0.99825	3.95047E-07	volume
o-Nitroaniline	others	27.2	2.37	Volume(-)	323997.815	12291086.1	0.97491	1.18862E-06	volume
m-Nitroaniline	others	29.2	2.55	Volume(-)	396400.993	12145274	0.947652	1.11597E-06	volume
p-Nitroaniline	others	32	3	Volume(-)	402928.829	16312345	0.987711	8.57156E-07	volume
Azobenzene	others	32.7	1.68	Volume(-)	457013.25	27266753.5	0.964036	5.99565E-07	volume
Carbazole	others	37.1	2.64	Volume(-)	736675.895	38880331.3	0.979556	3.88567E-07	volume
Naphthalene	PAHs	21.6	1.44	Volume(-)	578826.2	26016002.5	0.980146	5.57522E-07	volume
Naphthalene, 2-methyl-	PAHs	24.8	1.35	Volume(-)	876151.23	56066828.7	0.975523	2.9039E-07	volume
Acenaphthylene	PAHs	28.6	1.83	Volume(-)	560799.725	25808574	0.955881	6.11109E-07	volume
Acenaphthene	PAHs	29.5	1.74	Volume(-)	369008.255	31445652.2	0.926645	5.70039E-07	volume
Fluorene	PAHs	31.9	1.74	Volume(-)	770538.355	25457595.5	0.986952	5.24415E-07	volume
Phenanthrene	PAHs	36.1	2.16	Volume(-)	509837.45	23180085.3	0.98984	6.27002E-07	volume
Anthracene	PAHs	36.3	2.13	Volume(-)	541299.735	41284837.2	0.982082	4.04086E-07	volume
Fluoranthene	PAHs	41.5	2.46	Volume(-)	608302.25	40499272.8	0.952228	4.20267E-07	volume
Pyrene	PAHs	42.4	2.7	Volume(-)	709976.78	46290854.7	0.973638	3.55256E-07	volume
Benz[a]anthracene	PAHs	48.4	4.5	Volume(-)	563148.46	21107461.4	0.987229	6.6125E-07	volume
Chrysene	PAHs	48.6	4.77	Volume(-)	843500.82	49198941.6	0.977413	3.23077E-07	volume
Benzo[b]fluoranthene	PAHs	54.3	4.08	Volume(-)	1939792.71	36919246.5	0.958022	2.5317E-07	volume
Benzo[k]fluoranthene	PAHs	55.9	5.34	Volume(-)	664575.175	26418826.3	0.98293	5.4029E-07	volume
Benzo[ghi]perylene	PAHs	62.9	4.53	Volume(-)	1489621.91	58637845.5	0.948007	2.48837E-07	volume
Indeno[1,2,3-cd]pyrene	PAHs	64.8	6.6	Volume(-)	412808.996	33364647.9	0.964393	7.83547E-07	volume
Phenol	phenols	15.3	1.17	Volume(-)	699127.973	19878129.3	0.993664	5.62012E-07	volume
Phenol, 2-chloro-	phenols	15.6	1.14	Volume(-)	426779.07	2677929.55	0.984874	1.85234E-06	volume
Phenol, 3-methyl-	phenols	18.3	1.2	Volume(-)	1482562.79	22941359.6	0.996644	3.73146E-07	volume

Phenol, 2,6-dimethyl-	phenols	19.1	1.26	Volume(-)	559906.312	42982305.7	0.965926	3.87076E-07	volume
Phenol, 2-nitro-	phenols	19.8	1.44	Volume(-)	284768.398	4284557.77	0.99974	2.03651E-06	volume
Phenol, 2-methyl-	phenols	19.8	0.96	Volume(-)	1588271.67	-20574066	0.999699	1.69098E-06	volume
Phenol, 2,4-dichloro-	phenols	21.3	1.2	Volume(-)	924474.084	2798422.37	0.993005	8.22116E-07	volume
Phenol, 4-chloro-	phenols	22.2	1.32	Volume(-)	870925.718	17430419.3	0.985047	6.02054E-07	volume
Phenol, 2,4,6-trichloro-	phenols	26.3	1.32	Volume(-)	315307.115	10058400.4	0.978778	1.36416E-06	volume
Phenol, 2,4,5-trichloro-	phenols	26.7	1.29	Volume(-)	329541.557	8884883.42	0.953355	1.21679E-06	volume
1-Naphthalenol	phenols	30.1	1.98	Volume(-)	516104.751	10297562.6	0.996501	1.01218E-06	volume
2-Naphthalenol	phenols	30.3	2.04	Volume(-)	1126467.21	17204599	0.997854	5.08909E-07	volume
Pyridine, 3,5-dichloro-	Pyridines	15.9	1.08	Volume(-)	656722.314	12940893.5	0.976672	5.87393E-07	volume
Cyclotetrasiloxane, octamethyl-(D4)	siloxanes	16.5	6.21	Volume(-)	302876.828	19176043.3	0.952888	8.72126E-07	volume
Cyclopentasiloxane, decamethyl-(D5)	siloxanes	21.5	6.24	Volume(-)	167993.887	15440281.7	0.992134	1.09289E-06	volume
Cyclohexasiloxane, dodecamethyl-(D6)	siloxanes	26.4	6.21	Volume(-)	128048.569	9832029.38	0.997709	1.62309E-06	volume

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Table S3. Chemicals quantifed, with volatility and polarity bins, MIR, *k*OH, and SOA yields. The SOA yields of precursors were from literature (Loza et al., 2014; Harvey and Petrucci, 2015; Tkacik et al., 2012; Shah et al., 2020; McDonald et al., 2018; Chan et al., 2010, 2009; Wu et al., 2017; Li et al., 2016; Matsunaga et al., 2009; Algrim and Ziemann, 2019, 2016; Liu et al., 2018; Charan et al., 2020) or surrogates from *n*-alkanes in the same volatility bins (Zhao et al., 2014, 2017).

compound	class_detail	bins	VBS	VOCs	bins_2D	MIR	*k*OH (10^{12})	*k*OH_reference	yield	yield_surrogate	yield_reference
Acetic acid	acids	B8_before	more_than_6	VOCs	P2	0.68	0.622	AopWin			
Propanoic acid	acids	B8_before	more_than_6	VOCs	P2	1.22	1.3878	AopWin			
Propanoic acid, 2-methyl-	acids	B8_before	more_than_6	VOCs	P3	1.2	2.3096	AopWin			
Butanoic acid	acids	B8	more_than_6	VOCs	P2	1.82	2.6977	AopWin			
Maleic anhydride	acids	B8	more_than_6	VOCs	P6	1.82					
Isocrotonic acid	acids	B8	more_than_6	VOCs	P2	1.82					
2,5-Furandione, dihydro-3-methyl-	acids	B10	more_than_6	VOCs	P6						
Benzoic acid	acids	B12	6	IVOCs	P3		1.242	AopWin v1.92	0.02	C12	Chan et al., 2009
Nonanoic acid	acids	B13	6	IVOCs	P2		9.763	AopWin v1.92	0.03	C13	Chan et al., 2009
1,2-Benzenedicarboxylic acid	acids	B13	6	IVOCs	P5	2.58	0.7492				
2-Propanone, 1-hydroxy-	alcohols	B8_before	more_than_6	VOCs	P3	3.23	2.6938	AopWin			
1-Butanol	alcohols	B8_before	more_than_6	VOCs	P2	2.88	8.5	(Atkinson and Arey,2003)	0		Wu et al., 2017
1-Hydroxy-2-butanone	alcohols	B8_before	more_than_6	VOCs	P3						
2-Furanol, tetrahydro-	alcohols	B8	more_than_6	VOCs	P2						
1-Hexen-3-ol	alcohols	B8	more_than_6	VOCs	P2	2.88	8.5				
2-Furanmethanol, tetrahydro-	alcohols	B8	more_than_6	VOCs	P3	3.31	23.5819	AopWin			
3-Penten-1-ol, 3-methyl-	alcohols	B8	more_than_6	VOCs	P3	2.88	8.5				
2-Hexen-1-ol, (E)-	alcohols	B9	more_than_6	VOCs	P3	2.88	8.5				
4-Hepten-1-ol	alcohols	B9	more_than_6	VOCs	P3	2.88	8.5				

2-Cyclohexen-1-ol	alcohols	B9	more_than_6	VOCs	P4	2.88					
2-Cyclopenten-1-one, 2-hydroxy-	alcohols	B9	more_than_6	VOCs	P4	2.88					
Ethanol, 2-butoxy-	alcohols	B9	more_than_6	VOCs	P2	2.9	23.5134	AopWin			
Cyclopropanemethanol, α-methyl-α-propyl-	alcohols	B10	more_than_6	VOCs	P4						
4-Hepten-3-ol, 4-methyl-	alcohols	B10	more_than_6	VOCs	P3	2.88					
2-Propanol, 1-(2-methoxypropoxy)-	alcohols	B10	more_than_6	VOCs	P2	1.83					
2-Propanol, 1,1'-oxybis-	alcohols	B10	more_than_6	VOCs	P3	2.31	31.3336	AopWin			
Benzyl alcohol	alcohols	B10	more_than_6	VOCs	P3	5.11	8.2541	AopWin	0.6		Charan et al., 2020
1,2-Cyclohexanediol	alcohols	B10	more_than_6	VOCs	P4						
1-Hexanol, 2-ethyl-	alcohols	B10	more_than_6	VOCs	P2	2	13.2292	AopWin v1.92			
1-Propanol, 2,2'-oxybis-	alcohols	B10	more_than_6	VOCs	P3						
2-Propyl-1-pentanol	alcohols	B11	more_than_6	VOCs	P2	2					
Benzenemethanol, α,α-dimethyl-	alcohols	B11	more_than_6	VOCs	P3				0.6	Benzyl alcohol	Charan et al., 2020
7-Octen-2-ol, 2,6-dimethyl-	alcohols	B11	more_than_6	VOCs	P2	2.88					
1-Nonanol	alcohols	B11	more_than_6	VOCs	P2		13.9553	AopWin v1.92			
Cyclohexanol, 1-methyl-4-(1-methylethenyl)-	alcohols	B11	more_than_6	VOCs	P2						
3,7-Octadiene-2,6-diol, 2,6-dimethyl-	alcohols	B12	6	IVOCs	P2						
α-Terpineol	alcohols	B12	6	IVOCs	P2	4.63	103.0734	AopWin			
1,4:3,6-Dianhydro-α-D-glucopyranose	alcohols	B12	6	IVOCs	P5						

Cyclohexanol, 4-(1,1-dimethylethyl)-	alcohols	B12	6	IVOCs	P2						
1-Octanol, 2-butyl-	alcohols	B12	6	IVOCs	P2		13.9553	AopWin v1.92			
2-Decen-1-ol, (E)-	alcohols	B12	6	IVOCs	P2	2.88	13.9553	AopWin v1.92			
Eugenol	alcohols	B13	6	IVOCs	P3						
Cedrol	alcohols	B16	5	IVOCs	P3		20.1453	AopWin v1.92	0.08	C15	Chan et al., 2009
Patchouli alcohol	alcohols	B17	4	IVOCs	P3						
Methyl glyoxal	aldehydes	B8_before	more_than_6	VOCs	P1	16.56	15	(Atkinson and Arey,2003)			
2-Butenal, (E)-	aldehydes	B8_before	more_than_6	VOCs	P8		35	(A. W. H. Chan et al,2010)	0.02		Chan et al., 2010; Fang et al., 2017
2-Butenal, 2-methyl-	aldehydes	B8_before	more_than_6	VOCs	P4		35		0.02	2-Butenal, (E)-	Chan et al., 2010; Fang et al., 2017
Succindialdehyde	aldehydes	B8_before	more_than_6	VOCs	P5						
Furfural	aldehydes	B8	more_than_6	VOCs	P4	4.35	37.4206	AopWin			
2-Hexenal, (E)-	aldehydes	B8	more_than_6	VOCs	P3	4.35	35		0.02	2-Butenal, (E)-	Chan et al., 2010; Fang et al., 2017
Glutaraldehyde	aldehydes	B9	more_than_6	VOCs	P4	4.31	46.8857	AopWin			
2-Butenal, 2-ethenyl-	aldehydes	B9	more_than_6	VOCs	P3		35				
2-Pentenal, 2-methyl-	aldehydes	B9	more_than_6	VOCs	P5		35		0.02	2-Butenal, (E)-	Chan et al., 2010; Fang et al., 2017
Hexanal, 2-ethyl-	aldehydes	B9	more_than_6	VOCs	P2	4.35	30		0.02	2-Butenal, (E)-	Chan et al., 2010; Fang et al., 2017
Benzaldehyde	aldehydes	B9	more_than_6	VOCs	P3		12	(Atkinson and Arey,2003)	0.38		Fang et al., 2017
Octanal	aldehydes	B10	more_than_6	VOCs	P4	3.16	31.657	AopWin v1.92	0.026		Chan et al., 2010
Nonanal	aldehydes	B11	more_than_6	VOCs	P2	3.16	33.07	AopWin v1.92	0.026		Chan et al., 2010
(Z)-3-Phenylacrylaldehyde	aldehydes	B12	6	IVOCs	P4						
Decanal	aldehydes	B12	6	IVOCs	P2	3.16	34.48	AopWin v1.92	0.026		Chan et al., 2010
Undecanal	aldehydes	B13	6	IVOCs	P2	3.16			0.026		Chan et al., 2010

2-Propenal, 2-methyl-3-phenyl-	aldehydes	B13	6	IVOCs	P4						
Vanillin	aldehydes	B14	6	IVOCs	P4		12		0.026		Chan et al., 2010
Octanal, 2-(phenylmethylene)-	aldehydes	B17	4	IVOCs	P3	2.96	54.9612	AopWin			
C7-ene	n-alkenes	B8_before	more_than_6	VOCs	P4	4.43	40	(Atkinson and Arey,2003)	0.015		Wu et al., 2017
C8-ene	n-alkenes	B8	more_than_6	VOCs	P4	3.25	33.0041	AopWin	0.015	C7-ene	Wu et al., 2017
C9-ene	n-alkenes	B9	more_than_6	VOCs	P1	2.6	34.4171	AopWin	0.154		Matsunaga, Aiko,2009
C10-ene	n-alkenes	B10	more_than_6	VOCs	P1	2.17	35.8302	AopWin	0.317		Matsunaga, Aiko,2009
C11-ene	n-alkenes	B11	more_than_6	VOCs	P1	1.87	37.2432	AopWin	0.344		Matsunaga, Aiko,2009
C12-ene	n-alkenes	B12	6	IVOCs	P1	1.64	38.6563	AopWin	0.468		Matsunaga, Aiko,2009
C13-ene	n-alkenes	B13	6	IVOCs	P2	1.48	40.0693	AopWin	0.459		Matsunaga, Aiko,2009
C14-ene	n-alkenes	B14	6	IVOCs	P2	1.34	41.4824	AopWin	0.501		Matsunaga, Aiko,2009
1,3-Nonadiene, (E)-	alkenes	B9	more_than_6	VOCs	P2		37.2432				
β-Pinene	alkenes	B10	more_than_6	VOCs	P2	3.52	74.3	(Atkinson and Arey,2003)	0.17		Lee et al., 2006
Cyclohexene, 4-(1,1-dimethylethyl)-	alkenes	B10	more_than_6	VOCs	P2						
Limonene	alkenes	B10	more_than_6	VOCs	P2	4.55	164	(Atkinson and Arey,2003)	0.13		McDonald et al., 2018
β-Ocimene	alkenes	B10	more_than_6	VOCs	P2	4.55	252	(Atkinson and Arey,2003)	0.13	Limonene	McDonald et al., 2018
Longifolene	alkenes	B14	6	IVOCs	P2	4.55	47	(Atkinson and Arey,2003)	0.13	Limonene	McDonald et al., 2018
α-Cedrene	alkenes	B14	6	IVOCs	P2	4.55	67	(Atkinson and Arey,2003)	0.55		Jaoui et al., 2013

8,9-Dimethylbicyclo[4.4.1]undeca-2,4,8-triene	alkenes	B15	5	IVOCs	P4				0.55	α-Cedrene	Jaoui et al., 2013
Aromandendrene	alkenes	B15	5	IVOCs	P2	4.55	67		0.55	α-Cedrene	Jaoui et al., 2013
4,9:5,8-Dimethano-1H-benz[f]indene, 3a,4,4a,5,8,8a,9,9a-octahydro-	alkenes	B16	5	IVOCs	P3						
Kaur-16-ene, (8β,13β)-	alkenes	B21	3	IVOCs	P3	4.55	67		0.55	α-Cedrene	Jaoui et al., 2013
Benzene	aromatics	B8_before	more_than_6	VOCs	P2	0.72	1.22	(Atkinson and Arey,2003)	0.19		Chan et al., 2009
Toluene	aromatics	B8	more_than_6	VOCs	P2	4	5.63	(Atkinson and Arey,2003)	0.1		Chan et al., 2009
Ethylbenzene	aromatics	B9	more_than_6	VOCs	P2	3.04	7	(Atkinson and Arey,2003)	0.1		Chan et al., 2009
p-Xylene	aromatics	B9	more_than_6	VOCs	P2	5.84	14.3	(Atkinson and Arey,2003)	0.06		Chan et al., 2009
Phenylethyne	aromatics	B9	more_than_6	VOCs	P2		58		0.22	Styrene	Fang et al., 2017
Styrene	aromatics	B9	more_than_6	VOCs	P2	1.73	58	(Atkinson and Arey,2003)	0.22		Fang et al., 2017
o-Xylene	aromatics	B9	more_than_6	VOCs	P2	7.64	13.6	(Atkinson and Arey,2003)	0.06		Chan et al., 2009
Bicyclo[4.2.0]octa-1,3,5-triene	aromatics	B9	more_than_6	VOCs	P2						
Benzene-C3-ene	aromatics	B9	more_than_6	VOCs	P2	2.03			0.1	Benzene-C3	Chan et al., 2009
Benzene, 2-propenyl-	aromatics	B10	more_than_6	VOCs	P2	1.53	32.0791	AopWin	0.1	Benzene-C3	Chan et al., 2009
Benzene-C3	aromatics	B9	more_than_6	VOCs	P2	2.03	5.8	(Atkinson and Arey,2003)	0.1		Chan et al., 2009
Indane	aromatics	B10	more_than_6	VOCs	P3	3.32	19	(Atkinson and Arey,2003)	0.077		Gentner, 2012
Indene	aromatics	B10	more_than_6	VOCs	P3	1.55	78	(Atkinson and Arey,2003)	0.05		Fang et al., 2017
Indan, 1-methyl-	aromatics	B11	more_than_6	VOCs	P2	3.32	19		0.077	Indane	Gentner, 2012
Benzene-C4-ene	aromatics	B11	more_than_6	VOCs	P2	2.36	8.723		0.1	Benzene-C3	Chan et al., 2009
Benzene-C4	aromatics	B10	more_than_6	VOCs	P2	2.36	8.723	AopWin	0.1	Benzene-C3	Chan et al., 2009
1H-Indene, 2,3-dihydro-4-methyl-	aromatics	B11	more_than_6	VOCs	P3		78		0.05	Indene	Fang et al., 2017
1H-Indene, 3-methyl-	aromatics	B11	more_than_6	VOCs	P3	1.55	78		0.05	Indene	Fang et al., 2017
Benzene-C6	aromatics	B11	more_than_6	VOCs	P2	2.12	10.1361		0.1	Benzene-C3	Chan et al., 2009

Naphthalene, 1,2,3,4-tetrahydro,C1	aromatics	B13	6	IVOCs	P3	2.97	34		0.12	Benzene, 1,2,3,4-tetramethyl-	Gentner, 2012
1H-Indene, 2,3-dihydro-4,7-dimethyl-	aromatics	B13	6	IVOCs	P3				0.05	Indene	Fang et al., 2017
Biphenyl	aromatics	B14	6	IVOCs	P3	3.34	7.1	(Atkinson and Arey,2003)	0.26	Naphthalene	Chan et al., 2009
Biphenyl-C1	aromatics	B15	5	IVOCs	P3	3.34	7.1		0.33	Naphthalene, 1-methyl-	Chan et al., 2009
3,4,4a,9a-Tetrahydrofluorene	aromatics	B15	5	IVOCs	P3						
Benzene, 1,1'-(1,2-cyclobutanediyl)bis-, trans-	aromatics	B17	4	IVOCs	P4		10.1361				
Hexane, 2,4-dimethyl-	b-alkanes	B8	more_than_6	VOCs	P4	1.73	8.5522	AopWin			
B10_b_alkanes_UCM	b-alkanes	B9	more_than_6	VOCs	P1	0.68	11	(Atkinson and Arey,2003)	0.22	C10	Wu et al., 2017
B10_b_alkanes	b-alkanes	B10	more_than_6	VOCs	P1	0.68	11		0.22	C10	Wu et al., 2017
B12_b_alkanes_UCM	b-alkanes	B12	6	IVOCs	P1	0.55	13.2	(Atkinson and Arey,2003)	0.02	C12	Chan et al., 2009
B13_b_alkanes_UCM	b-alkanes	B13	6	IVOCs	P1	0.53	15.1	(Atkinson and Arey,2003)	0.03	C13	Chan et al., 2009
B14_b_alkanes_UCM	b-alkanes	B14	6	IVOCs	P1	0.51	17.9	(Atkinson and Arey,2003)	0.05	C14	Chan et al., 2009
B15_b_alkanes_UCM	b-alkanes	B15	5	IVOCs	P1	0.5	20.7	(Atkinson and Arey,2003)	0.08	C15	Chan et al., 2009
B16_b_alkanes_UCM	b-alkanes	B15	5	IVOCs	P1	0.45	23.2	(Atkinson and Arey,2003)	0.12	C16	Chan et al., 2009
B17_b_alkanes_UCM	b-alkanes	B17	4	IVOCs	P1	0.42	28.5	(A. W. H. Chan et al,2009)	0.2	C17	Chan et al., 2009
B18_b_alkanes_UCM	b-alkanes	B18	4	IVOCs	P1	0.4	35.1	(A. W. H. Chan et al,2009)	0.3	C18	Chan et al., 2009
B19_b_alkanes_UCM	b-alkanes	B18	4	IVOCs	P1	0.38	43.2	(A. W. H. Chan et al,2009)	0.42	C19	Chan et al., 2009
B20_b_alkanes_UCM	b-alkanes	B20	3	IVOCs	P1	0.36	53.1	(A. W. H. Chan et al,2009)	0.56	C20	Chan et al., 2009
B21_b_alkanes_UCM	b-alkanes	B21	3	IVOCs	P2	0.34	26.654	AopWin v1.92	0.77	C21	Gentner, 2012
Benzene, 1,3-dichloro-	chlorides	B10	more_than_6	VOCs	P3	0.178	0.9649	AopWin v1.92			
Cyclohexane-C7	cyclohexanes	B14	6	IVOCs	P1	0.55	19.0567	AopWin	0.55	Cyclohexane-C4	Wu et al., 2017

Cyclohexane-C8	cyclohexanes	B14	6	IVOCs	P2	0.51	20.4697	AopWin	0.55	Cyclohexane-C4	Wu et al., 2017
Cyclohexane-C9	cyclohexanes	B16	5	IVOCs	P2	0.47	21.8828	AopWin	0.613		Lim and Ziemannn, 2009
Cyclohexane-C10	cyclohexanes	B17	4	IVOCs	P2	0.43	23.2958	AopWin	0.613	Cyclohexane-C9	Lim and Ziemannn, 2009
Propanoic acid, ethenyl ester	esters	B8_before	more_than_6	VOCs	P2						
Methyl methacrylate	esters	B8_before	more_than_6	VOCs	P6	15.61	18.3436	AopWin v1.92			
Acetic acid, hydroxy-, methyl ester	esters	B8_before	more_than_6	VOCs	P2						
Acetic acid, butyl ester	esters	B8	more_than_6	VOCs	P2	0.83	4.6094	AopWin			
Butyrolactone	esters	B9	more_than_6	VOCs	P6	0.96	2.3087	AopWin			
2(5H)-Furanone	esters	B9	more_than_6	VOCs	P6	0.96	12.2364				
2(5H)-Furanone, 5-methyl-	esters	B9	more_than_6	VOCs	P5	0.96	12.2364				
2(3H)-Furanone, dihydro-3-methyl-	esters	B9	more_than_6	VOCs	P5	0.96	2.7214	AopWin v1.92			
2(3H)-Furanone, dihydro-5-methyl-	esters	B9	more_than_6	VOCs	P5	0.96	2.7214				
2(5H)-Furanone, 5,5-dimethyl-	esters	B9	more_than_6	VOCs	P4	0.96	2.7214				
2(5H)-Furanone, 3-methyl-	esters	B9	more_than_6	VOCs	P5	0.96	12.2364				
Methyl 2-furoate	esters	B10	more_than_6	VOCs	P3						
4-Methyl-5H-furan-2-one	esters	B10	more_than_6	VOCs	P5						
2-Furanone, 2,5-dihydro-3,5-dimethyl	esters	B10	more_than_6	VOCs	P4						
2-Hydroxy-gamma-butyrolactone	esters	B10	more_than_6	VOCs	P5						
Benzofuran	esters	B10	more_than_6	VOCs	P3						
2H-Pyran-2-one, tetrahydro-	esters	B10	more_than_6	VOCs	P6						

2-Oxepanone	esters	B10	more_than_6	VOCs	P6			
2,3-Dimethyl-4-hydroxy-2-butenoic lactone	esters	B10	more_than_6	VOCs	P4			
Formic acid, phenylmethyl ester	esters	B11	more_than_6	VOCs	P3			
Benzoic acid, methyl ester	esters	B11	more_than_6	VOCs	P3		0.844	AopWin v1.92
Pentanedioic acid, dimethyl ester	esters	B11	more_than_6	VOCs	P3	0.42	2.5605	AopWin
Acetic acid, phenylmethyl ester	esters	B11	more_than_6	VOCs	P3			
Benzoic acid, ethyl ester	esters	B11	more_than_6	VOCs	P3		0.844	
Hexanedioic acid, dimethyl ester	esters	B12	6	IVOCs	P3	1.8	3.9736	AopWin
Acetic acid, 2-phenylethyl ester	esters	B12	6	IVOCs	P3			
Linalyl acetate	esters	B12	6	IVOCs	P2			
n-Butyric acid 2-ethylhexyl ester	esters	B13	6	IVOCs	P2			
Cyclohexanol, 4-(1,1-dimethylethyl)-, acetate, trans-	esters	B13	6	IVOCs	P2			
α-Terpinyl acetate	esters	B13	6	IVOCs	P2			
Cyclohexanol, 4-(1,1-dimethylethyl)-, acetate, cis-	esters	B14	6	IVOCs	P2			
Pentanoic acid, 2-ethylhexyl ester	esters	B14	6	IVOCs	P2			
Verdyl acetate	esters	B14	6	IVOCs	P3			
1,6-Dioxacyclododecane-7,12-dione	esters	B15	5	IVOCs	P4			
Benzoic acid, hept-3-yl ester	esters	B15	5	IVOCs	P3			

2,2,4-Trimethyl-1,3-pentanediol diisobutyrate	esters	B16	5	IVOCs	P2	0.38	11.4614	AopWin			
n-Hexyl salicylate	esters	B17	4	IVOCs	P2						
Benzoic acid, 2-ethylhexyl ester	esters	B17	4	IVOCs	P2	0.98	11.5368	AopWin			
1,4-Dioxin, 2,3-dihydro-	ethers	B8_before	more_than_6	VOCs	P2						
Anisole	ethers	B9	more_than_6	VOCs	P3	6.66	22.3336	AopWin			
Oxepine, 2,7-dimethyl-	ethers	B9	more_than_6	VOCs	P2						
Furan, 2-butyltetrahydro-	ethers	B10	more_than_6	VOCs	P3	2.13	23.5632	AopWin			
(2R,5R)-2-Methyl-5-(prop-1-en-2-yl)-2-vinyltetrahydrofuran	ethers	B10	more_than_6	VOCs	P2						
Benzene, 1-methoxy-4-methyl-	ethers	B10	more_than_6	VOCs	P3						
Benzofuran, 2-methyl-	ethers	B11	more_than_6	VOCs	P3						
Benzofuran, 4,7-dimethyl-	ethers	B12	6	IVOCs	P3						
Ether, α,α-dimethylbenzyl isopropyl	ethers	B13	6	IVOCs	P3						
Benzofuran, 2,3-dihydro-	ethers	B13	6	IVOCs	P5						
Naphthalene, 2-methoxy-	ethers	B14	6	IVOCs	P4						
Dibenzofuran	ethers	B15	5	IVOCs	P4		7.0302	AopWin v1.92			
Oxacyclotetradeca-4,11-diyne	ethers	B17	4	IVOCs	P3						
Furan, 2,5-dimethyl-	furans	B8_before	more_than_6	VOCs	P5	7.88	129.881	AopWin v1.92	0.38		Fang et al., 2017
2-Vinylfuran	furans	B8_before	more_than_6	VOCs	P6	7.88	129.881		0.38	Furan, 2,5-dimethyl-	Fang et al., 2017
3,4-Dimethylfuran	furans	B8	more_than_6	VOCs	P3	9.15	129.881		0.38	Furan, 2,5-dimethyl-	Fang et al., 2017
Furan, 2-ethyl-5-methyl-	furans	B8	more_than_6	VOCs	P6	9.15	129.881		0.38	Furan, 2,5-dimethyl-	Fang et al., 2017
Furan, 2,3,5-trimethyl-	furans	B8	more_than_6	VOCs	P6	9.15	129.881		0.38	Furan, 2,5-dimethyl-	Fang et al., 2017

2-Furanmethanol	furans	B8	more_than_6	VOCs	P3	9.15	104.0454	AopWin	0.38	Furan, 2,5-dimethyl-	Fang et al., 2017
Ethanone, 1-(2-furanyl)-	furans	B9	more_than_6	VOCs	P3						
2-Butanone, 3-methyl-	ketones	B8_before	more_than_6	VOCs	P4	1.48	2.9	(Atkinson and Arey,2003)	0		Shah et al., 2020
2-Pentanone	ketones	B8_before	more_than_6	VOCs	P6	2.81	4.4	(Atkinson and Arey,2003)	0		Shah et al., 2020
3-Pentanone	ketones	B8_before	more_than_6	VOCs	P6	1.24	2	(Atkinson and Arey,2003)	0		Shah et al., 2020
Acetoin	ketones	B8_before	more_than_6	VOCs	P2						
3-Penten-2-one, (E)-	ketones	B8_before	more_than_6	VOCs	P2	1.24	2				
Propanoic acid, 2-oxo-, methyl ester	ketones	B8	more_than_6	VOCs	P4						
Cyclopentanone	ketones	B8	more_than_6	VOCs	P3	1.15	2.9	(Atkinson and Arey,2003)			
2-Hexanone	ketones	B8	more_than_6	VOCs	P2	3.14	9.1	(Atkinson and Arey,2003)			
2-Hydroxy-3-pentanone	ketones	B8	more_than_6	VOCs	P3	1.24	2				
1-Hydroxy-3-methyl-2-butanone	ketones	B8	more_than_6	VOCs	P3	1.48					
2-Cyclopenten-1-one	ketones	B8	more_than_6	VOCs	P4						
2-Pentanone, 3-ethyl-	ketones	B8	more_than_6	VOCs	P4	1.24	2				
3-Hexen-2-one	ketones	B8	more_than_6	VOCs	P2	3.14	9.1				
4-Hexen-3-one	ketones	B8	more_than_6	VOCs	P3	3.14	9.1				
2-Propanone, 1-(acetyloxy)-	ketones	B8	more_than_6	VOCs	P4						
4-Cyclopentene-1,3-dione	ketones	B8	more_than_6	VOCs	P5						
Cyclopentanone, 2-methyl-	ketones	B9	more_than_6	VOCs	P4	1.24					
Cyclopentanone, 3-methyl-	ketones	B9	more_than_6	VOCs	P4	1.35					
2-Cyclopenten-1-one, 2-methyl-	ketones	B9	more_than_6	VOCs	P3						
3-Penten-2-one, 3,4-dimethyl-	ketones	B9	more_than_6	VOCs	P3	1.24					
2-Acetyl-2-methyltetrahydrofuran	ketones	B9	more_than_6	VOCs	P3						

2-Cyclopenten-1-one, 2,3-dimethyl-	ketones	B9	more_than_6	VOCs	P3	1.24		
3-Hepten-2-one	ketones	B9	more_than_6	VOCs	P3	3.14	9.1	
3-Methyl-3-cyclohexen-1-one	ketones	B9	more_than_6	VOCs	P4			
2-Butanone, 1-(acetyloxy)-	ketones	B9	more_than_6	VOCs	P3	1.48		
2-Cyclopenten-1-one, 3-methyl-	ketones	B9	more_than_6	VOCs	P4			
5-Hepten-2-one, 6-methyl-	ketones	B10	more_than_6	VOCs	P2			
2-Cyclopenten-1-one, 3,4-dimethyl-	ketones	B9	more_than_6	VOCs	P3			
1,4-Cyclohex-2-enedione	ketones	B10	more_than_6	VOCs	P4		6.4	
1,2-Cyclopentanedione, 3-methyl-	ketones	B10	more_than_6	VOCs	P3			
1,3-Cyclohexanedione, 2-methyl-	ketones	B10	more_than_6	VOCs	P4	1.35	6.4	
1-(1,2-Dimethyl-cyclopent-2-enyl)-ethanone	ketones	B10	more_than_6	VOCs	P4			
2-Cyclopenten-1-one, 2,3,4-trimethyl-	ketones	B10	more_than_6	VOCs	P3			
Cyclohexanone, 3-ethenyl-	ketones	B10	more_than_6	VOCs	P4	1.35		
Acetophenone	ketones	B10	more_than_6	VOCs	P3		1.8795	AopWin v1.92
Levoglucosenone	ketones	B11	more_than_6	VOCs	P5			
Isophorone	ketones	B11	more_than_6	VOCs	P3	4.63	80.691	AopWin v1.92
Camphor	ketones	B11	more_than_6	VOCs	P3	0.49	4.3	(Atkinson and Arey,2003)
Cyclohexanone, 4-acetyl-	ketones	B12	6	IVOCs	P5		6.4	
1,2-Naphthalenedione	ketones	B12	6	IVOCs	P4			
1H-Inden-1-one, 2,3-dihydro-	ketones	B13	6	IVOCs	P4			
1H-Inden-1-one, 2,3-dihydro-2-methyl-	ketones	B13	6	IVOCs	P4			

1-Methylindan-2-one	ketones	B13	6	IVOCs	P4					
2,3,6-Trimethylacetophenone	ketones	B13	6	IVOCs	P3					
Ethanone, 1-(2,4,6-trimethylphenyl)-	ketones	B13	6	IVOCs	P3					
5,9-Undecadien-2-one, 6,10-dimethyl-	ketones	B14	6	IVOCs	P2					
2,5-Cyclohexadiene-1,4-dione, 2,6-bis(1,1-dimethylethyl)-	ketones	B15	5	IVOCs	P2					
Benzophenone	ketones	B16	5	IVOCs	P4		3.5549	AopWin v1.92		
Ethanone, 1,2-diphenyl-	ketones	B17	4	IVOCs	P5		7.323	AopWin v1.92		
C8	n-alkanes	B8	more_than_6	VOCs	P1	0.9	8.11	(Atkinson and Arey,2003)	0.058	Wu et al., 2017
C9	n-alkanes	B9	more_than_6	VOCs	P1	0.78	9.7	(Atkinson and Arey,2003)	0.14	Wu et al., 2017
C10	n-alkanes	B10	more_than_6	VOCs	P1	0.68	11	(Atkinson and Arey,2003)	0.22	Wu et al., 2017
C11	n-alkanes	B11	more_than_6	VOCs	P1	0.61	12.3	(Atkinson and Arey,2003)	0.33	Wu et al., 2017
C12	n-alkanes	B12	6	IVOCs	P1	0.55	13.2	(Atkinson and Arey,2003)	0.02	Chan et al., 2009
C13	n-alkanes	B13	6	IVOCs	P1	0.53	15.1	(Atkinson and Arey,2003)	0.03	Chan et al., 2009
C14	n-alkanes	B14	6	IVOCs	P1	0.51	17.9	(Atkinson and Arey,2003)	0.05	Chan et al., 2009
C15	n-alkanes	B15	5	IVOCs	P1	0.5	20.7	(Atkinson and Arey,2003)	0.08	Chan et al., 2009
C16	n-alkanes	B16	5	IVOCs	P1	0.45	23.2	(Atkinson and Arey,2003)	0.12	Chan et al., 2009
C17	n-alkanes	B17	4	IVOCs	P1	0.42	28.5	(A. W. H. Chan et al,2009)	0.2	Chan et al., 2009
C18	n-alkanes	B18	4	IVOCs	P1	0.4	35.1	(A. W. H. Chan et al,2009)	0.3	Chan et al., 2009
C19	n-alkanes	B19	4	IVOCs	P1	0.38	43.2	(A. W. H. Chan et al,2009)	0.42	Chan et al., 2009
C20	n-alkanes	B20	3	IVOCs	P2	0.36	53.1	(A. W. H. Chan et al,2009)	0.56	Chan et al., 2009
C21	n-alkanes	B21	3	IVOCs	P2	0.34	26.654	AopWin v1.92	0.77	Gentner, 2012
C22	n-alkanes	B22	3	IVOCs	P2	0.33	28.0671	AopWin v1.92	0.96	Gentner, 2012
C23	n-alkanes	B23	2	SVOCs	P2		29.4801	AopWin v1.92	1.08	Gentner, 2012
C24	n-alkanes	B24	2	SVOCs	P2		30.8932	AopWin v1.92	1.14	Gentner, 2012
C25	n-alkanes	B25	2	SVOCs	P2		32.3062	AopWin v1.92	1.16	Gentner, 2012

2-Furancarbonitrile	nitriles	B8	more_than_6	VOCs	P3		
Isoamyl cyanide	nitriles	B8	more_than_6	VOCs	P3		
Benzonitrile	nitriles	B10	more_than_6	VOCs	P4	0.3443	AopWin
4-Methyl-2-oxopentanenitrile	nitriles	B11	more_than_6	VOCs	P6		
Pyrazine	nitrogen-containing compounds	B8_before	more_than_6	VOCs	P3		
1H-Pyrazole, 1-methyl-	nitrogen-containing compounds	B8_before	more_than_6	VOCs	P2		
Pyrrole	nitrogen-containing compounds	B8_before	more_than_6	VOCs	P3		
Pyridine	nitrogen-containing compounds	B8_before	more_than_6	VOCs	P3		
Pyrazine, methyl-	nitrogen-containing compounds	B8	more_than_6	VOCs	P3		
N,N-Dimethylacetamide	nitrogen-containing compounds	B8	more_than_6	VOCs	P4		
Pyrimidine, 4-methyl-	nitrogen-containing compounds	B9	more_than_6	VOCs	P3		
Imidazole, 1,4,5-trimethyl-	nitrogen-containing compounds	B9	more_than_6	VOCs	P3		

Pyrazine, methoxy-	nitrogen-containing compounds	B9	more_than_6	VOCs	P3
Propanamide, N-ethyl-	nitrogen-containing compounds	B9	more_than_6	VOCs	P3
4(1H)-Pyrimidinone, 6-methyl-	nitrogen-containing compounds	B9	more_than_6	VOCs	P5
1H-Pyrazole, 3-methyl-	nitrogen-containing compounds	B10	more_than_6	VOCs	P4
4-Cyanocyclohexene	nitrogen-containing compounds	B10	more_than_6	VOCs	P4
α-Amino-γ-butyrolactone	nitrogen-containing compounds	B11	more_than_6	VOCs	P5
Piperidine, 1-nitroso-	nitrogen-containing compounds	B11	more_than_6	VOCs	P7
Pyrrolidine, 1-acetyl-	nitrogen-containing compounds	B11	more_than_6	VOCs	P4
Benzenamine, 2-ethyl-6-methyl-	nitrogen-containing compounds	B11	more_than_6	VOCs	P3

Formamide, N-cyclohexyl-	nitrogen-containing compounds	B12	6	IVOCs	P4			
Caprolactam	nitrogen-containing compounds	B12	6	IVOCs	P5			
2-Butyn-1-one, 1-(5-methyl-1H-1,2,3-triazol-4-yl)-	nitrogen-containing compounds	B12	6	IVOCs	P3			
1H-Pyrrole, 1-phenyl-	nitrogen-containing compounds	B13	6	IVOCs	P3			
Acetamide, N-methyl-N-phenyl-	nitrogen-containing compounds	B13	6	IVOCs	P4			
Hept-2-enoylamide, N-methyl-	nitrogen-containing compounds	B13	6	IVOCs	P5			
Quinoline, 1,2-dihydro-2,2,4-trimethyl-	nitrogen-containing compounds	B14	6	IVOCs	P3			
Quinoline, 2,4-dimethyl-	nitrogen-containing compounds	B14	6	IVOCs	P4			
2-Benzothiazolamine, N-ethyl-	nitrogen-containing compounds	B17	4	IVOCs	P5			
Diethyl Phthalate	PAEs	B16	5	IVOCs	P4	1.62	3.4658	AopWin

1,2-Benzenedicarboxylic acid, bis(2-methylpropyl) ester	PAEs	B18	4	IVOCs	P3		9.2602	AopWin v1.92			
Dibutyl phthalate	PAEs	B19	4	IVOCs	P3	1.25	9.277	AopWin v1.92			
Naphthalene	PAHs	B12	6	IVOCs	P3	3.34	23	(Atkinson and Arey,2003)	0.26		Chan et al., 2009
Naphthalene, 2-methyl-	PAHs	B13	6	IVOCs	P3	3.06	48.6	(Phousongphouang and Arey，2002)	0.38		Chan et al., 2009
Naphthalene, 1-methyl-	PAHs	B13	6	IVOCs	P3	3.06	40.9	(Phousongphouang and Arey，2002)	0.33		Chan et al., 2009
Naphthalene-C2	PAHs	B14	6	IVOCs	P3	3.06	40.2	(Phousongphouang and Arey，2002)	0.28		Gentner, 2012
Acenaphthylene	PAHs	B14	6	IVOCs	P4	3.06	75.4921	AopWin v1.92	0.03		Fang et al., 2017
Phenol	phenols	B10	more_than_6	VOCs	P3	2.76	33.4673	AopWin v1.92	0.38		Fang et al., 2017
Phenol, 2-methyl-	phenols	B11	more_than_6	VOCs	P3	2.4	41.13	AopWin v1.92	0.38		Fang et al., 2017
Phenol, 2-methoxy-	phenols	B11	more_than_6	VOCs	P3	2.4	29.798	AopWin v1.92	0.4		Fang et al., 2017
Creosol	phenols	B12	6	IVOCs	P3	2.4	23.2235		0.38	Phenol, 3-methyl-	Fang et al., 2017
Phenol, 4-ethyl-2-methoxy-	phenols	B13	6	IVOCs	P3	2.4	23.2235		0.38	Phenol, 3-methyl-	Fang et al., 2017
Hydroquinone	phenols	B13	6	IVOCs	P4	2.4	23.2235	AopWin	0.38	Phenol, 3-methyl-	Fang et al., 2017
Propofol	phenols	B13	6	IVOCs	P3	2.4	23.2235		0.38	Phenol, 3-methyl-	Fang et al., 2017
Phenol, 2,6-dimethoxy-	phenols	B13	6	IVOCs	P4	2.4	23.2235		0.38	Phenol, 3-methyl-	Fang et al., 2017
Phenol, 2,6-bis(1,1-dimethylethyl)-4-(1-methylpropyl)-	phenols	B16	5	IVOCs	P2	1.18	18.2887		0.38	Phenol, 3-methyl-	Fang et al., 2017

Ethanone, 1-(7-hydroxy-5-methoxy-2,2-dimethyl-2H-1-benzopyran-8-yl)-	phenols	B19	4	IVOCs	P3	1.18	18.2887		0.38	Phenol, 3-methyl-	Fang et al., 2017
D3	siloxanes	B8	more_than_6	VOCs	P3		0.86	(Alton et al., 2020)	0.095		McDonald et al., 2018
D4	siloxanes	B10	more_than_6	VOCs	P1		1.3	(Alton et al., 2020)	0.095		McDonald et al., 2018
L4	siloxanes	B11	more_than_6	VOCs	P1		1.496	AopWin v1.92	0.095		McDonald et al., 2018
D5	siloxanes	B12	6	IVOCs	P1		2.1	(Alton et al., 2020)	0.095		McDonald et al., 2018
L5	siloxanes	B13	6	IVOCs	P1		1.7952	AopWin v1.92	0.095		
D6	siloxanes	B13	6	IVOCs	P1		1.7952	AopWin v1.92	0.095		McDonald et al., 2018
D7	siloxanes	B15	5	IVOCs	P1		1.7952				
D8	siloxanes	B17	4	IVOCs	P1		1.7952				
Benzothiazole	sulfur compounds	B12	6	IVOCs	P4						
Cyclohexane, isothiocyanato-	sulfur compounds	B12	6	IVOCs	P3						
B15_cyclic_UCM	UCMs	B15	5	IVOCs	P2	0.47	21.8828		0.613		Lim and Ziemannn, 2009
B15_aliphatic_UCM	UCMs	B15	5	IVOCs	P2	0.5	20.7		0.08	C15	Chan et al., 2009
B16_cyclic_UCM	UCMs	B16	5	IVOCs	P3	0.47	21.8828		0.613		Lim and Ziemannn, 2009
B17_cyclic_UCM	UCMs	B17	4	IVOCs	P2	0.43	23.2958		0.613		Lim and Ziemannn, 2009

B18_cyclic_UCM	UCMs	B18	4	IVOCs	P2	0.43	23.2958	0.613		Lim and Ziemannn, 2009
B20_aliphatic_UCM	UCMs	B20	3	IVOCs	P1	0.36	53.1	0.56	C20	Chan et al., 2009
B20_oxygenated_UCM	UCMs	B20	3	IVOCs	P2					
B20_cyclic_UCM	UCMs	B20	3	IVOCs	P3	0.43	23.2958	0.613		Lim and Ziemannn, 2009
B21_cyclic_UCM	UCMs	B21	3	IVOCs	P3	0.43	23.2958	0.613		Lim and Ziemannn, 2009

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Table S4. Emission factors (μg g^{-1}) of selected compounds in this study and comparison with other incense burning studies.

Rank of EF	Compound	This study	Lee et al., 2004 (Lee and Wang, 2004)	Yang et al., 2007 (Yang et al., 2007)	Manoukian et al., 2016 (Manoukian et al., 2016)
1	Toluene	70.8 ± 35.7	150.7 ± 34.3	108 ~ 661	366 ~ 1194
2	Benzene	59.6 ± 43.1	491.1 ± 50.6	188 ~ 1796	654 ~ 1826
3	Furfural	28.8 ± 10.4			
4	Phenol	24.0 ± 13.3			
5	Styrene	21.9 ± 11.1	53.3 ± 22.0	13 ~ 73	
6	Propanoic acid, 2-oxo-, methyl ester	21.0 ± 9.5			
7	2-Butanone, 3-methyl-	18.7 ± 14.0			
8	Ethylbenzene	15.5 ± 8.9	9.9 ± 2.0	2 ~ 165	
9	2-Propanone, 1-hydroxy-	13.9 ± 7.3			
10	Benzyl alcohol	13.4 ± 19.2			
11	*p*-Xylene	12.1 ± 5.6	27.5 ± 6.7	3 ~ 115	
18	Limonene	9.4 ± 8.5			
23	Phenylethyne	6.8 ± 3.8			
24	*o*-Xylene	6.7 ± 4.0	6.1 ± 1.4	1 ~ 133	
27	2-Furanmethanol	5.9 ± 2.1			
36	2-Butenal, 2-methyl-	4.9 ± 3.6			
37	Diethyl Phthalate	4.7 ± 4.0			
39	Benzaldehyde	4.4 ± 2.8			
40	Aromandendrene	4.3			
62	Naphthalene	3.0 ± 1.5			
65	Furan, 2,5-dimethyl-	2.9 ± 0.9			
311	Acenaphthylene	0.1 ± 0.1			

315	Dibenzofuran	0.1 ± 0.04

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Figures

Figure S1. Incenses used in this study including 4 common incense sticks, 2 Thailand incense sticks, 1 mosquito coil, and 2 incense coils.

Figure S2. Typical chromatogram of incense burning emissions. Blobs identified are colored by chemical classes.

Figure S3. Constitutes of emission factor (EF), ozone formation potential (OFP), and secondary organic aerosol (SOA) estimation.

Figure S4. Top 10 chemicals of the incense burning emission factor (EF), ozone formation potential (OFP), and secondary organic aerosol (SOA) estimation. The unit of EF, OFP, and SOA is μg g-1. Compounds are colored by chemical class.

Figure S5. Volatility-polarity distribution of emission factor (EF), ozone formation potential (OFP), and secondary organic aerosol (SOA) estimation. VOCs (blue color on the *x*-axis), IVOCs (orange color on the *x*-axis), and SVOCs (red color on the *x*-axis) are displayed in volatility bins (a decrease of volatility from B8 to B31) along with their polarity (an increase from P1 to P8 in the *y*-axis). The EF unit is μg g^{-1}.

Figure S6. Emission factor (EF), ozone formation potential (OFP), and secondary organic aerosol (SOA) in both VOC and IVOC ranges. SVOCs are only *n*-alkane compounds.

Figure S7. Pixel-based partial least squares-discriminant analysis (PLS-DA) of incense burning using different forms of incense. The pre-grouping variable is the incense shape.

Figure S8. Pixel-based partial least squares-discriminant analysis (PLS-DA) of incense burning made in different materials. The pre-grouping variable is the incense material.

Figure S9. Compositions of EFs, OFP, and SOA estimation of different types of incense: incense coil, incense stick, mosquito coil, and Thailand incense stick.

Figure S10. Compositions of EFs, OFP, and SOA estimation of different types of incense: aromatic coil, aromatic stick, mosquito coil, sandalwood stick, and smokeless sandalwood stick.

Figure S11. Compositions of EFs of different types of incense: incense coil, incense stick, mosquito coil, and Thailand incense stick.

Figure S12. Compositions of EFs of different types of incense: aromatic coil, aromatic stick, mosquito

coil, sandalwood stick, and smokeless sandalwood stick.

Figure S13. Relationships of 2-hydroxy-2-cyclopenten-1-one (a), 2-furanmethanol (b), 3-ethyl-2-pentanone (c), furfural (d) emission factors (EFs) among different incense types.

Figure S14. The formation mechanism of furfural from xylose and D-xylopyranose.

Figure S15. Chemicals with high arctic contamination potential (ACP) assesses by pixel-based approaches.

Figure S1. Incenses used in this study including 4 common incense sticks, 2 Thailand incense sticks, 1 mosquito coil, and 2 incense coils.

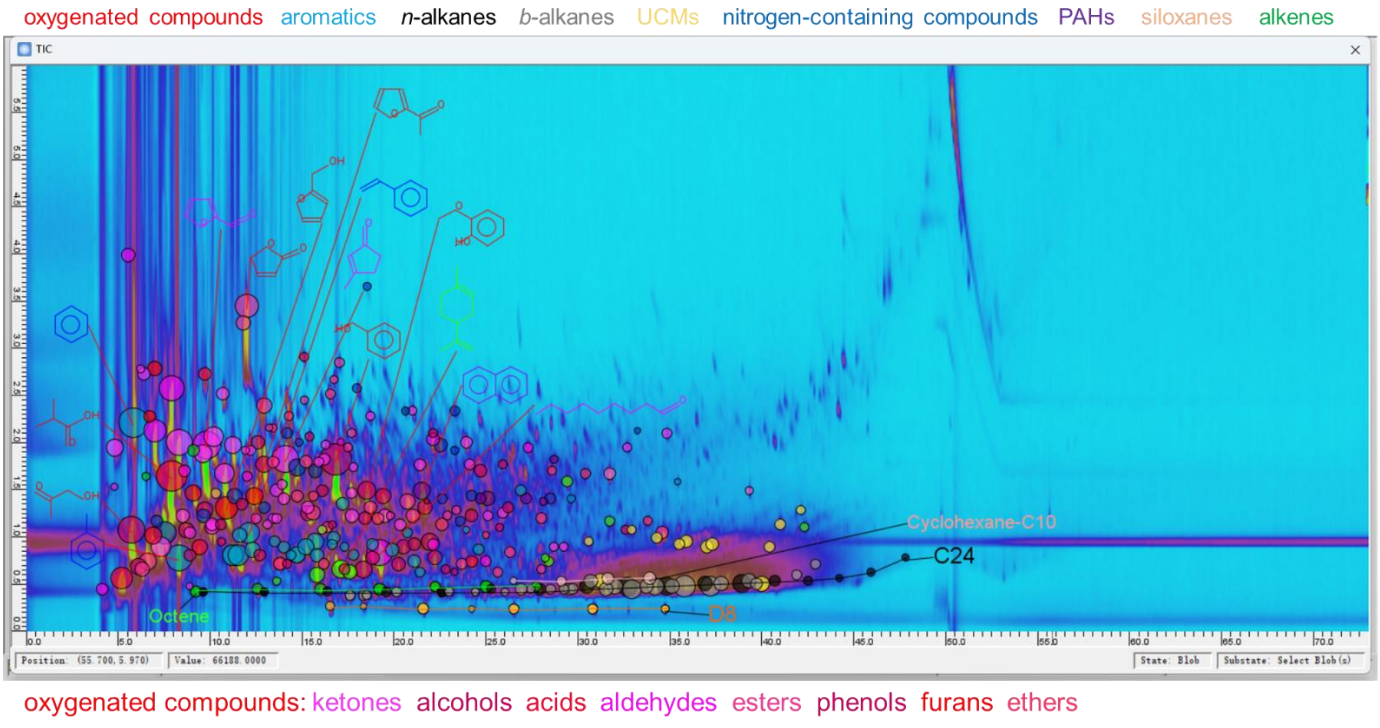
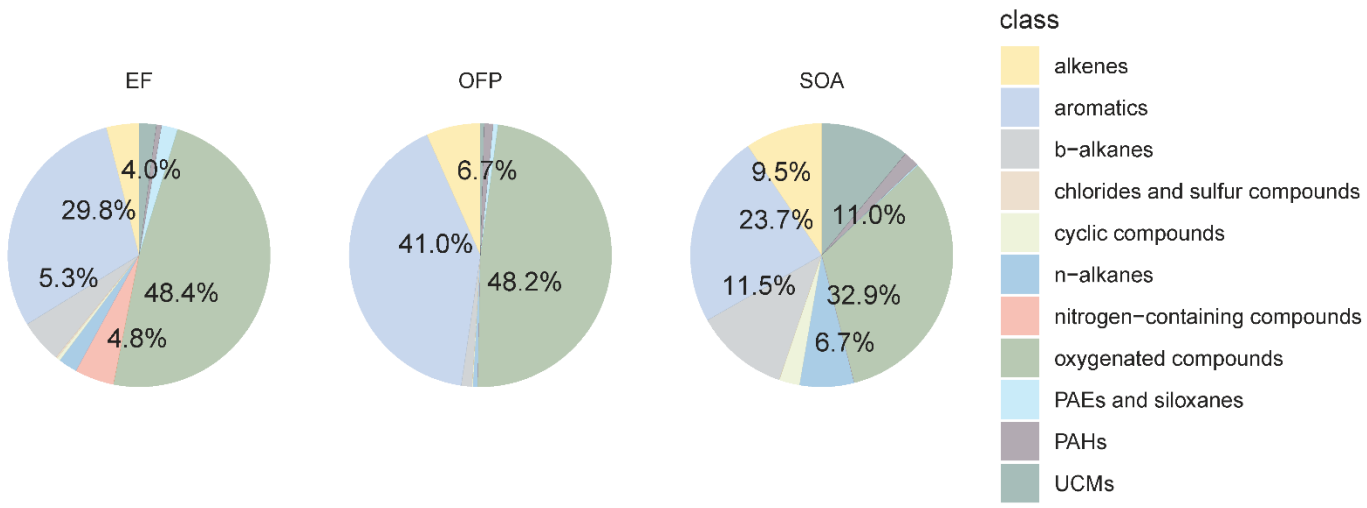


Figure S2. Typical chromatogram of incense burning emissions. Blobs identified are colored by chemical classes.



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75 **Figure S3.** Constitutes of emission factor (EF), ozone formation potential (OFP), and secondary

76 organic aerosol (SOA) estimation.

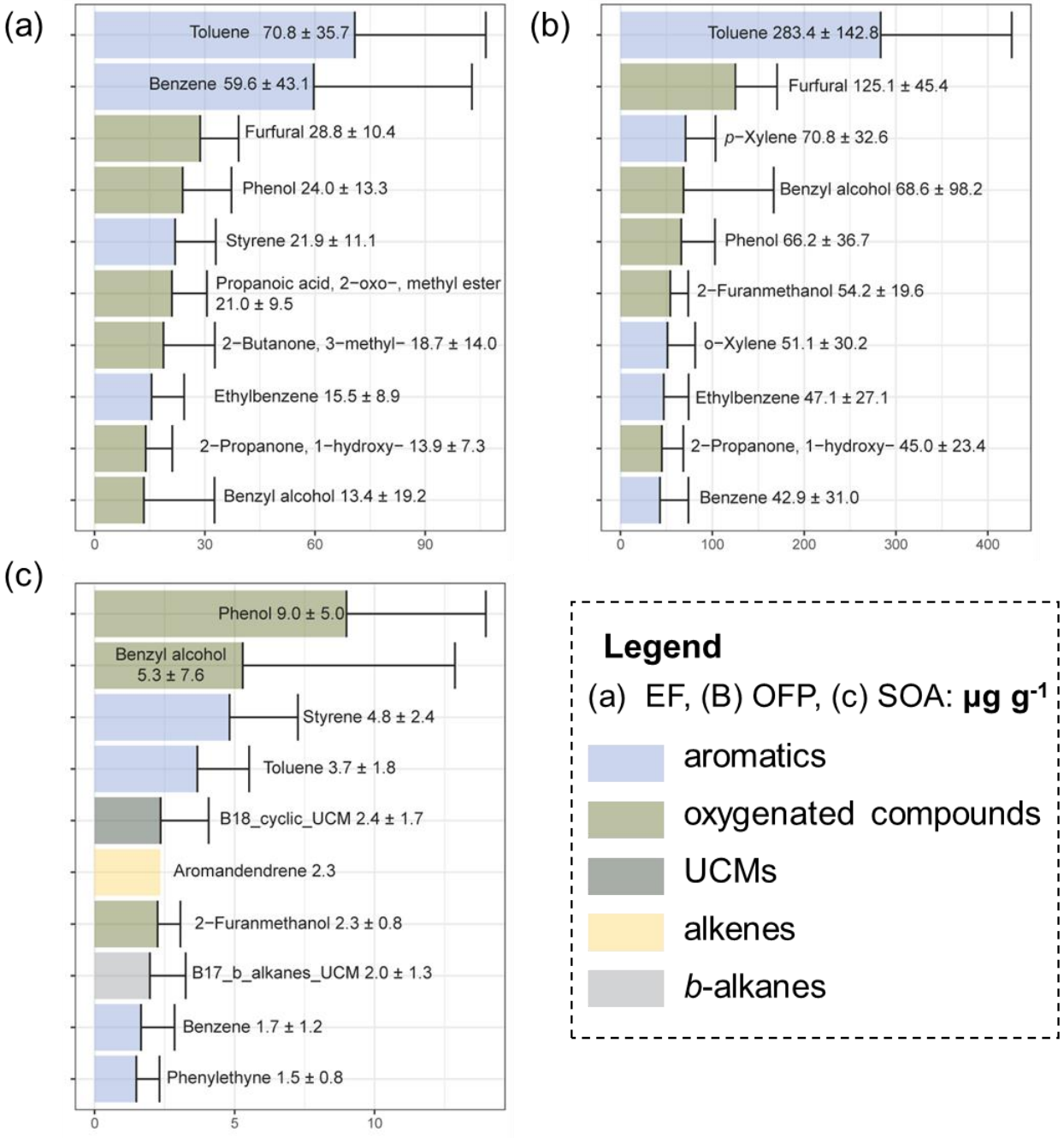


Figure S4. Top 10 chemicals of the incense burning emission factor (EF), ozone formation potential (OFP), and secondary organic aerosol (SOA) estimation. The unit of EF, OFP, and SOA is µg g^{-1}. Compounds are colored by chemical class.

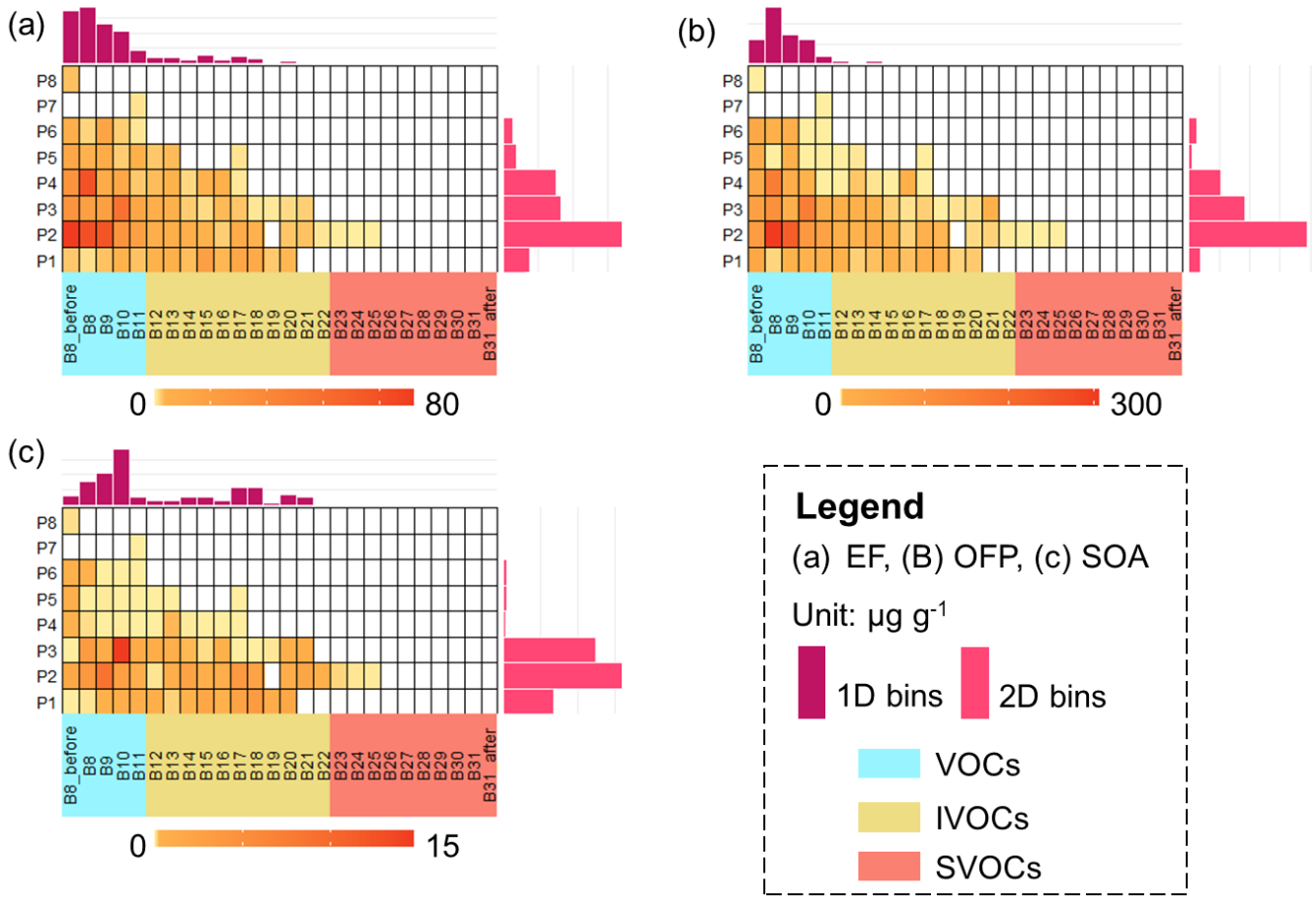


Figure S5. Volatility-polarity distribution of emission factor (EF), ozone formation potential (OFP), and secondary organic aerosol (SOA) estimation. VOCs (blue color on the *x*-axis), IVOCs (orange color on the *x*-axis), and SVOCs (red color on the *x*-axis) are displayed in volatility bins (a decrease of volatility from B8 to B31) along with their polarity (an increase from P1 to P8 in the *y*-axis). The EF unit is μg g^{-1}.

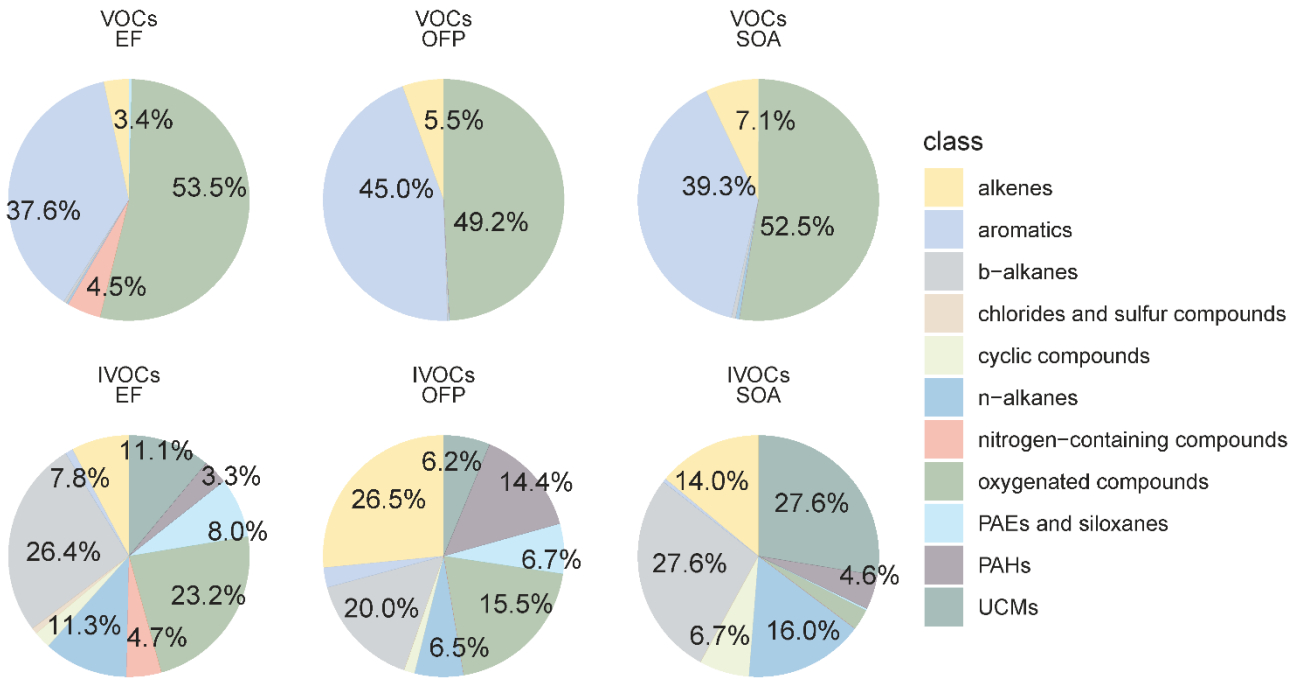
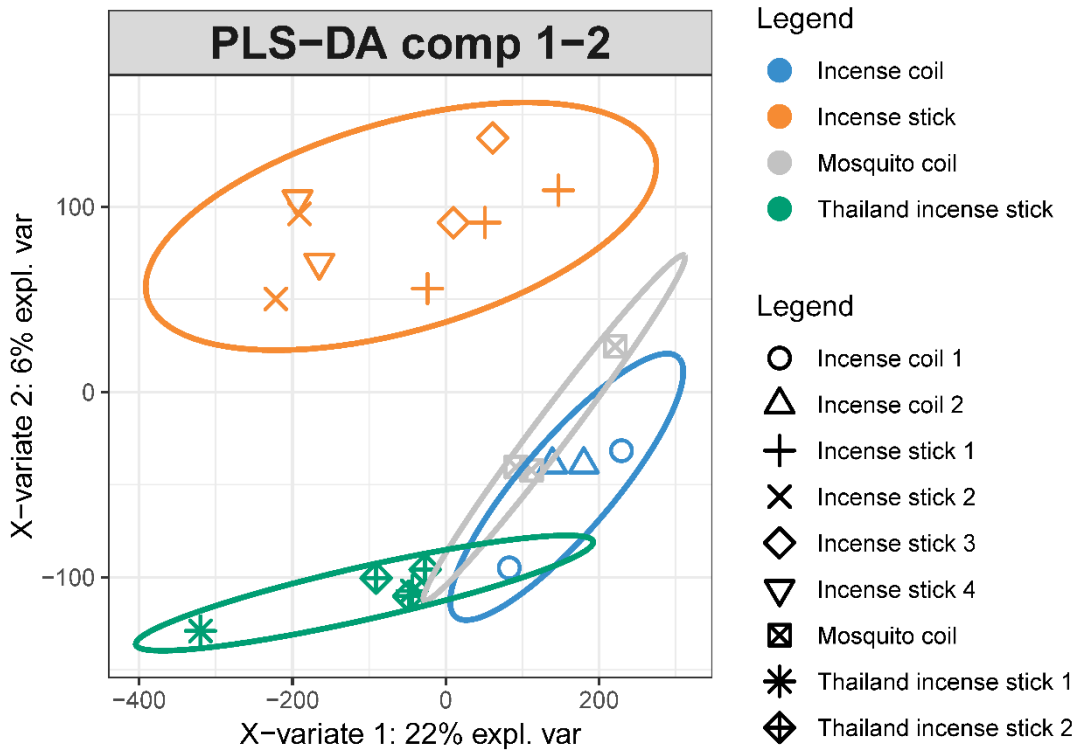


Figure S6. Emission factor (EF), ozone formation potential (OFP), and secondary organic aerosol (SOA) in both VOC and IVOC ranges. SVOCs are only *n*-alkane compounds.



93

94 **Figure S7.** Pixel-based partial least squares-discriminant analysis (PLS-DA) of incense burning using

95 different forms of incense. The pre-grouping variable is the incense shape.

96

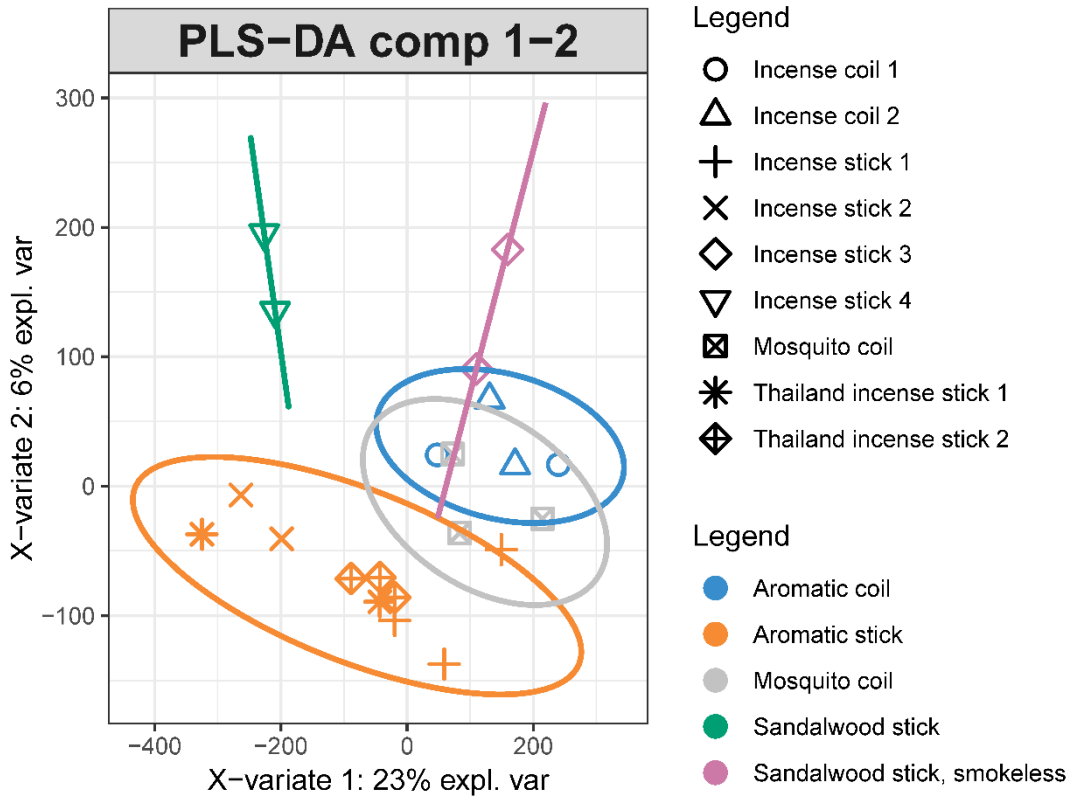


Figure S8. Pixel-based partial least squares-discriminant analysis (PLS-DA) of incense burning made in different materials. The pre-grouping variable is the incense material.

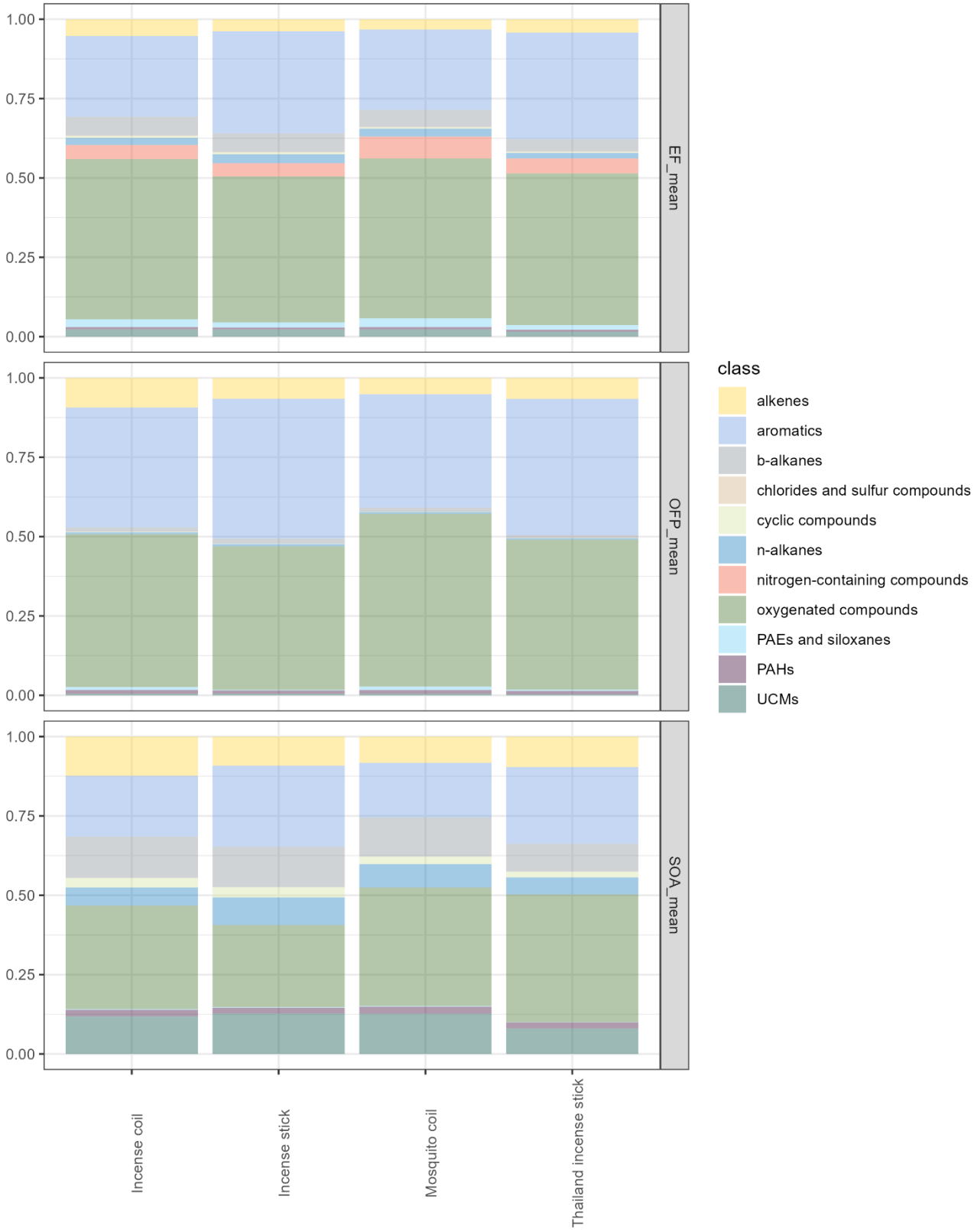
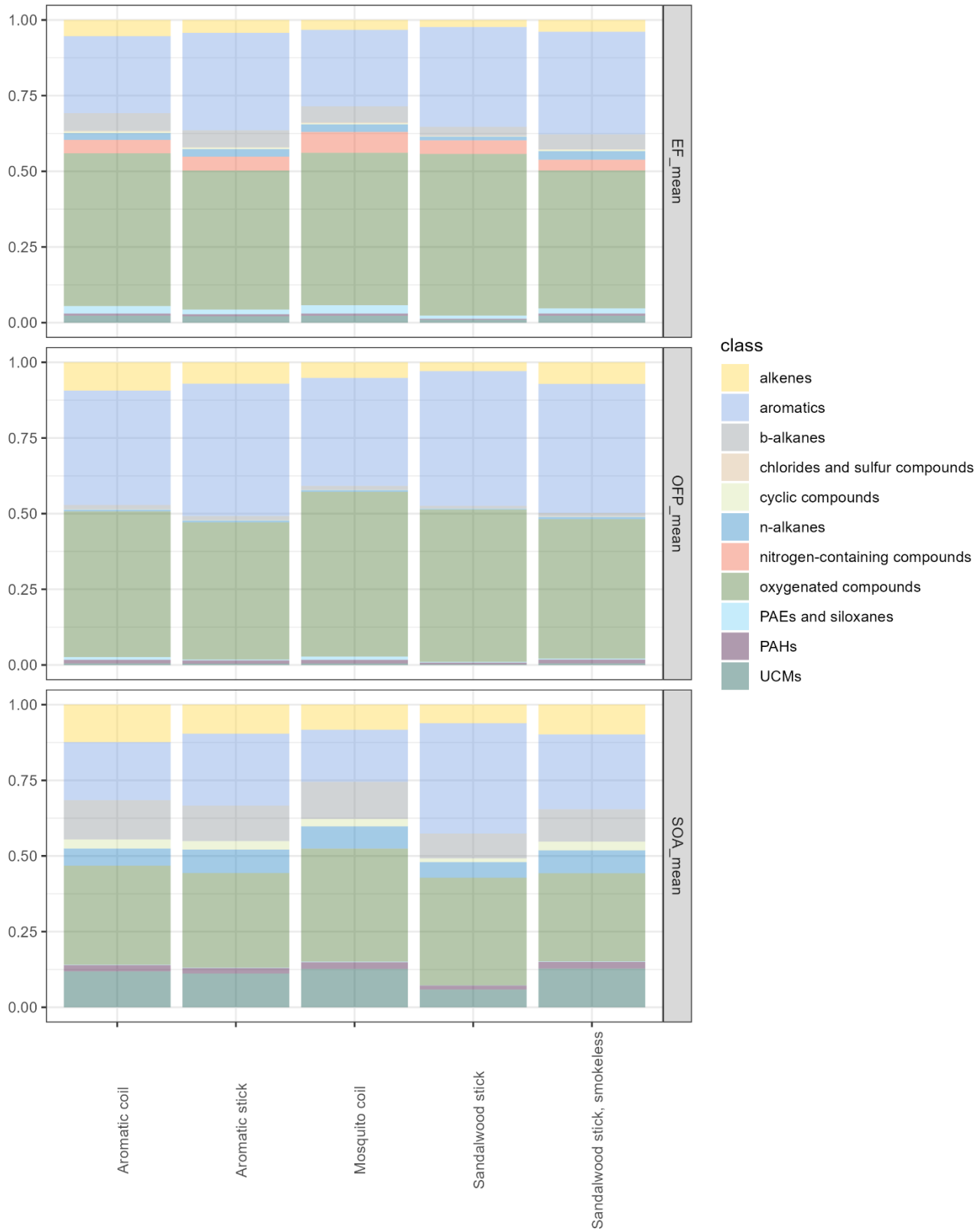


Figure S9. Compositions of EFs, OFP, and SOA estimation of different types of incense: incense coil, incense stick, mosquito coil, and Thailand incense stick.



104

105 **Figure S10.** Compositions of EFs, OFP, and SOA estimation of different types of incense: aromatic

106 coil, aromatic stick, mosquito coil, sandalwood stick, and smokeless sandalwood stick.

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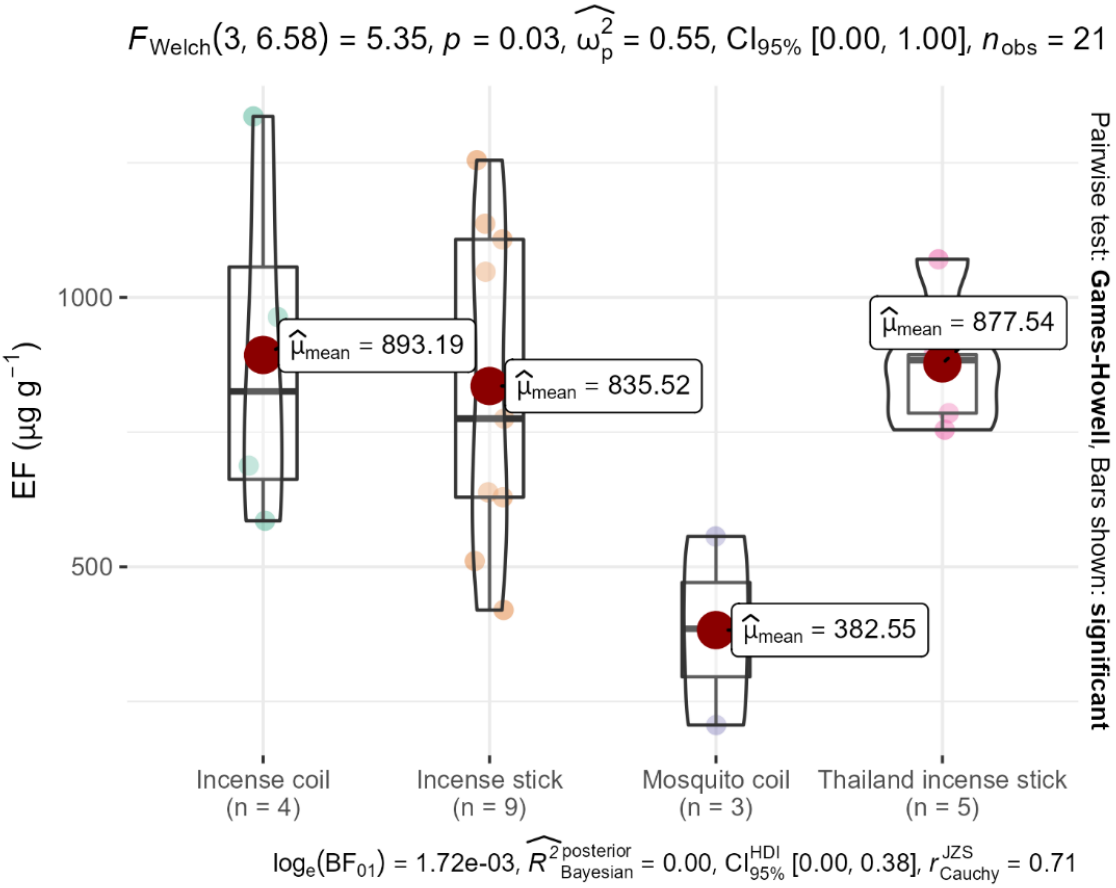


Figure S11. Compositions of EFs of different types of incense: incense coil, incense stick, mosquito coil, and Thailand incense stick.

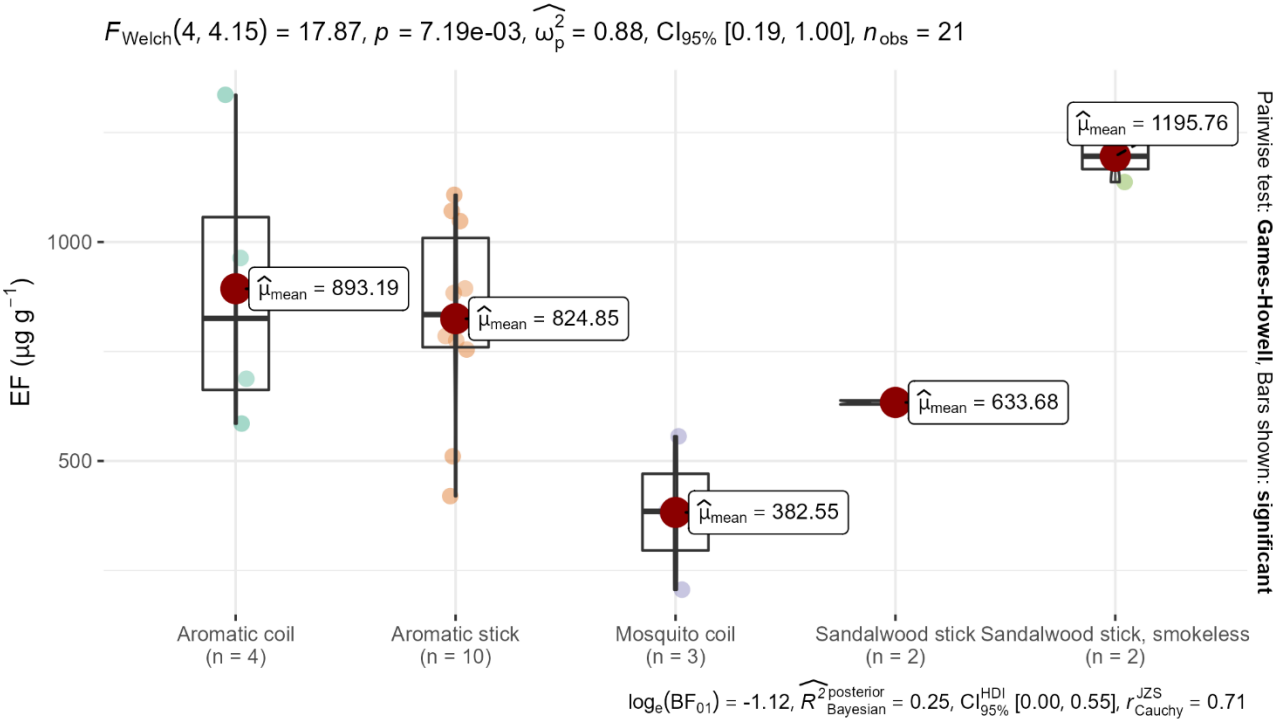
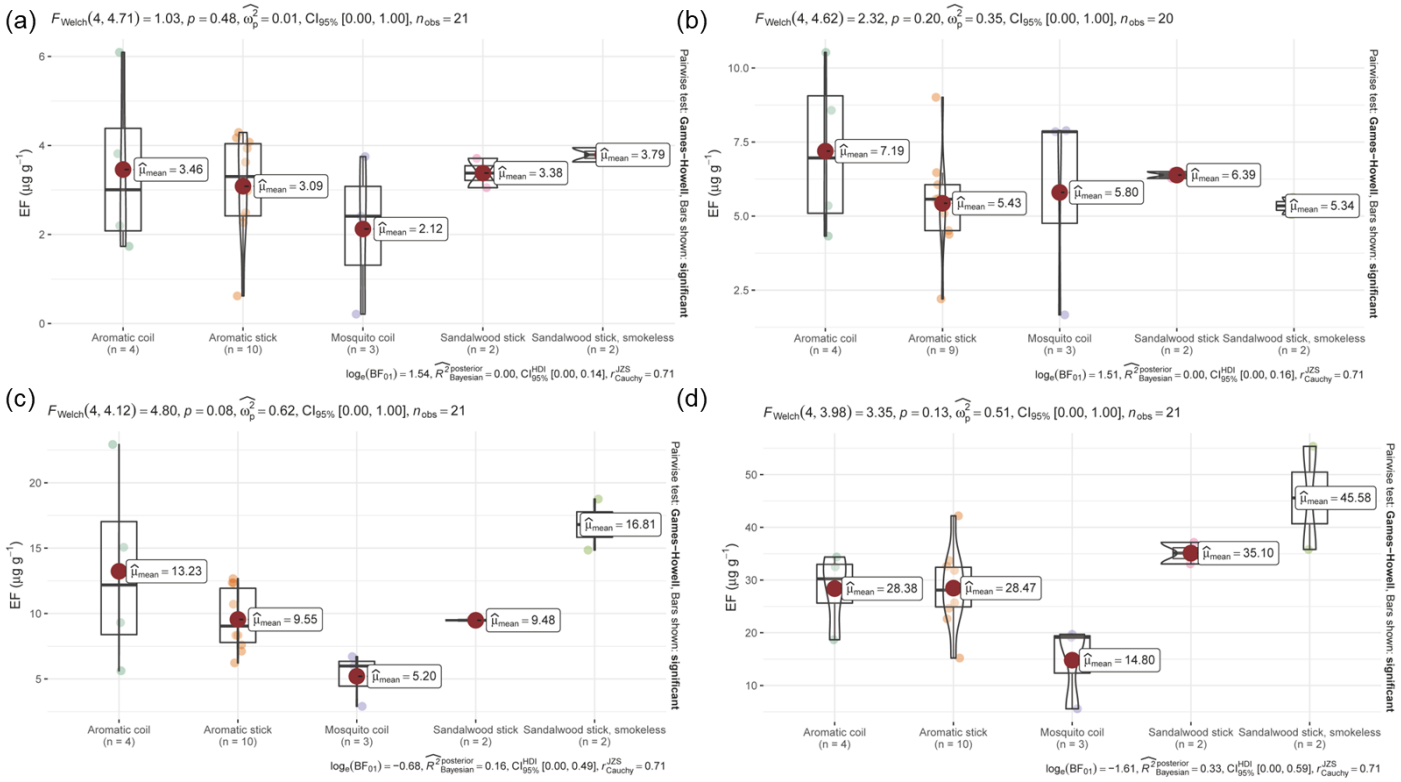


Figure S12. Compositions of EFs of different types of incense: aromatic coil, aromatic stick, mosquito coil, sandalwood stick, and smokeless sandalwood stick.



(a) 2-Cyclopenten-1-one, 2-hydroxy-, (b) 2-Furanmethanol, (c) 2-Pentanone, 3-ethyl-, (d) Furfural

Figure S13. Relationships of 2-hydroxy-2-cyclopenten-1-one (a), 2-furanmethanol (b), 3-ethyl-2-pentanone (c), furfural (d) emission factors (EFs) among different incense types.

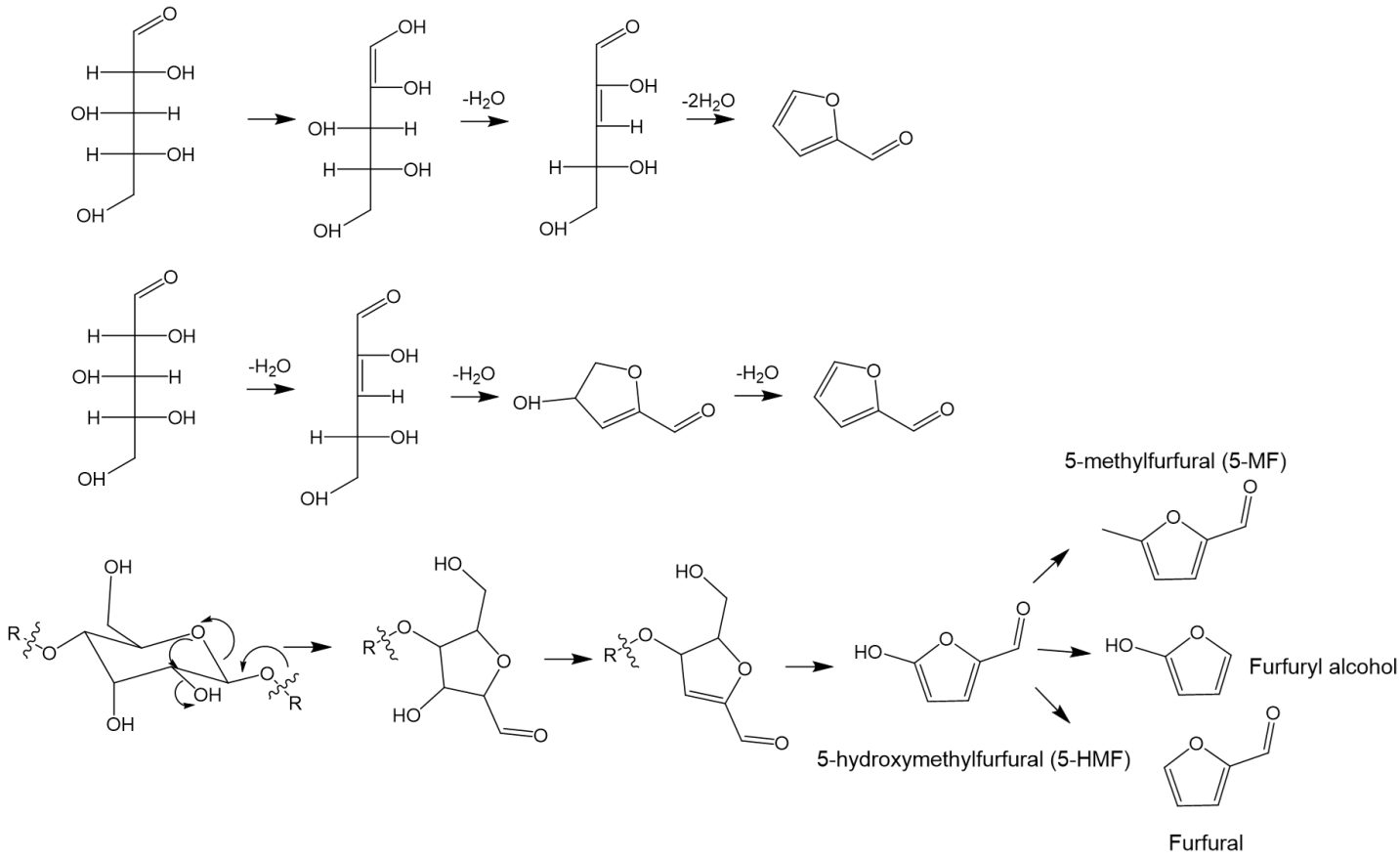
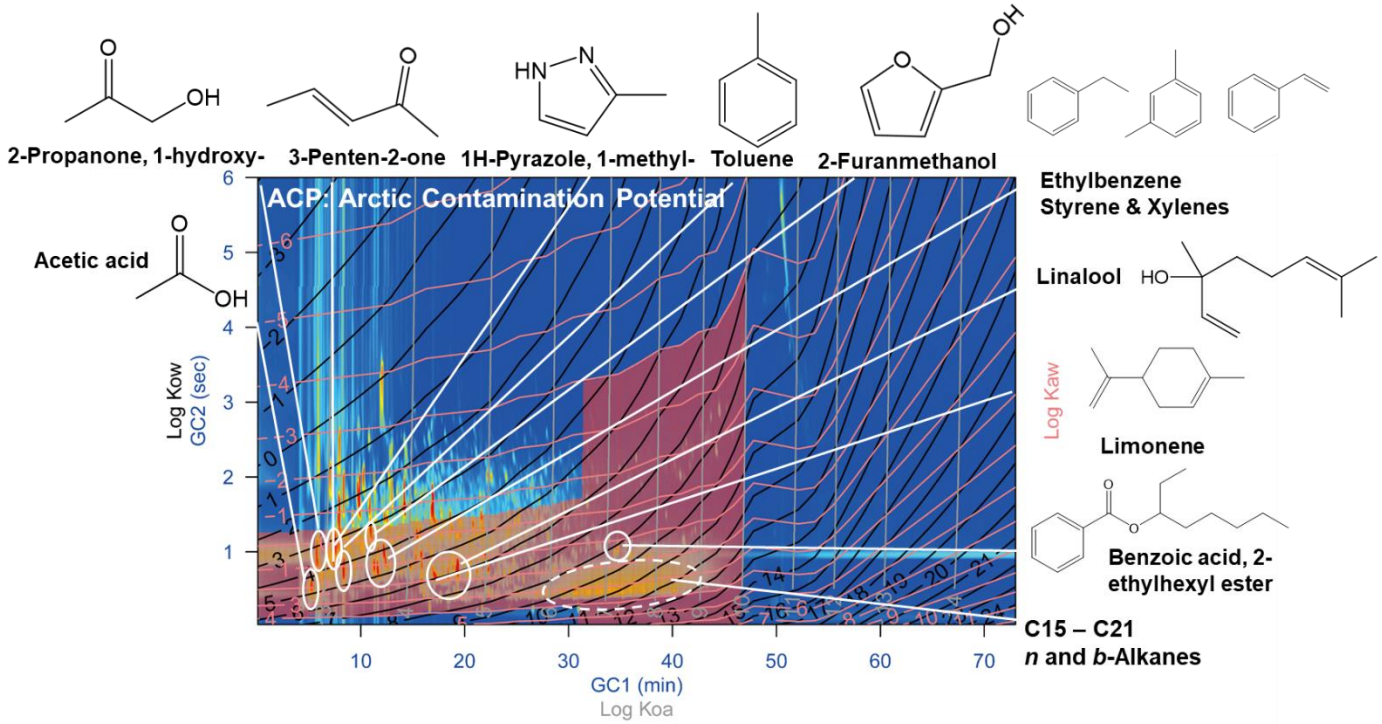


Figure S14. The formation mechanism of furfural from xylose and D-xylopyranose (Ahmad et al., 1995; Bonner and Roth1, 1959; Nimlos et al., 2006).



123

124 **Figure S15.** Chemicals with high arctic contamination potential (ACP) assesses by pixel-based

125 approaches.

126

References

Ahmad, T., Kenne, L., Olsson, K., and Theander, O.: The formation of 2-furaldehyde and formic acid from pentoses in slightly acidic deuterium oxide studied by 1H NMR spectroscopy, Carbohydr Res, 276, 309–320, https://doi.org/10.1016/0008-6215(95)00176-T, 1995.

Algrim, L. B. and Ziemann, P. J.: Effect of the Keto Group on Yields and Composition of Organic Aerosol Formed from OH Radical-Initiated Reactions of Ketones in the Presence of NOx, Journal of Physical Chemistry A, 120, 6978–6989, https://doi.org/10.1021/acs.jpca.6b05839, 2016.

Algrim, L. B. and Ziemann, P. J.: Effect of the Hydroxyl Group on Yields and Composition of Organic Aerosol Formed from OH Radical-Initiated Reactions of Alcohols in the Presence of NOx, ACS Earth Space Chem, 3, 413–423, https://doi.org/10.1021/acsearthspacechem.9b00015, 2019.

Bonner, W. A. and Roth1, M. R.: The Conversion of d-Xylose-l-C14 into 2-Furaldehyde-α-C14, J Am Chem Soc, 81, 5454–5456, https://doi.org/10.1021/ja01529a051, 1959.

Chan, A. W. H., Kautzman, K. E., Chhabra, P. S., Surratt, J. D., Chan, M. N., Crounse, J. D., Kürten, A., Wennberg, P. O., Flagan, R. C., and Seinfeld, J. H.: Secondary organic aerosol formation from photooxidation of naphthalene and alkylnaphthalenes: Implications for oxidation of intermediate volatility organic compounds (IVOCs), Atmos Chem Phys, 9, 3049–3060, https://doi.org/10.5194/acp-9-3049-2009, 2009.

Chan, A. W. H., Chan, M. N., Surratt, J. D., Chhabra, P. S., Loza, C. L., Crounse, J. D., Yee, L. D., Flagan, R. C., Wennberg, P. O., and Seinfeld, J. H.: Role of aldehyde chemistry and NOx concentrations in secondary organic aerosol formation, Atmos Chem Phys, 10, 7169–7188, https://doi.org/10.5194/ACP-10-7169-2010, 2010.

Charan, S. M., Buenconsejo, R. S., and Seinfeld, J. H.: Secondary organic aerosol yields from the oxidation of benzyl alcohol, Atmos Chem Phys, 20, 13167–13190, https://doi.org/10.5194/acp-20-13167-2020, 2020.

Harvey, R. M. and Petrucci, G. A.: Control of ozonolysis kinetics and aerosol yield by nuances in the molecular structure of volatile organic compounds, Atmos Environ, 122, 188–195, https://doi.org/10.1016/j.atmosenv.2015.09.038, 2015.

Lee, S. C. and Wang, B.: Characteristics of emissions of air pollutants from burning of incense in a

large environmental chamber, Atmos Environ, 38, 941–951, https://doi.org/10.1016/j.atmosenv.2003.11.002, 2004.

Li, L., Tang, P., Nakao, S., and Cocker, D. R.: Impact of molecular structure on secondary organic aerosol formation from aromatic hydrocarbon photooxidation under low-NOx conditions, Atmos Chem Phys, 16, 10793–10808, https://doi.org/10.5194/acp-16-10793-2016, 2016.

Liu, T., Wang, Z., Huang, D. D., Wang, X., and Chan, C. K.: Significant Production of Secondary Organic Aerosol from Emissions of Heated Cooking Oils, Environ Sci Technol Lett, 5, 32–37, https://doi.org/10.1021/acs.estlett.7b00530, 2018.

Loza, C. L., Craven, J. S., Yee, L. D., Coggon, M. M., Schwantes, R. H., Shiraiwa, M., Zhang, X., Schilling, K. A., Ng, N. L., Canagaratna, M. R., Ziemann, P. J., Flagan, R. C., and Seinfeld, J. H.: Secondary organic aerosol yields of 12-carbon alkanes, Atmos Chem Phys, 14, 1423–1439, https://doi.org/10.5194/acp-14-1423-2014, 2014.

Manoukian, A., Buiron, D., Temime-Roussel, B., Wortham, H., and Quivet, E.: Measurements of VOC/SVOC emission factors from burning incenses in an environmental test chamber: influence of temperature, relative humidity, and air exchange rate, Environmental Science and Pollution Research, 23, 6300–6311, https://doi.org/10.1007/s11356-015-5819-2, 2016.

Matsunaga, A., Docherty, K. S., Lim, Y. B., and Ziemann, P. J.: Composition and yields of secondary organic aerosol formed from OH radical-initiated reactions of linear alkenes in the presence of NOx: Modeling and measurements, Atmos Environ, 43, 1349–1357, https://doi.org/10.1016/j.atmosenv.2008.12.004, 2009.

McDonald, B. C., De Gouw, J. A., Gilman, J. B., Jathar, S. H., Akherati, A., Cappa, C. D., Jimenez, J. L., Lee-Taylor, J., Hayes, P. L., McKeen, S. A., Cui, Y. Y., Kim, S. W., Gentner, D. R., Isaacman-VanWertz, G., Goldstein, A. H., Harley, R. A., Frost, G. J., Roberts, J. M., Ryerson, T. B., and Trainer, M.: Volatile chemical products emerging as largest petrochemical source of urban organic emissions, Science (1979), 359, 760–764, https://doi.org/10.1126/science.aaq0524, 2018.

Nimlos, M. R., Qian, X., Davis, M., Himmel, M. E., and Johnson, D. K.: Energetics of xylose decomposition as determined using quantum mechanics modeling, Journal of Physical Chemistry A, 110, 11824–11838, https://doi.org/10.1021/jp0626770, 2006.

Shah, R. U., Coggon, M. M., Gkatzelis, G. I., McDonald, B. C., Tasoglou, A., Huber, H., Gilman, J., Warneke, C., Robinson, A. L., and Presto, A. A.: Urban Oxidation Flow Reactor Measurements Reveal Significant Secondary Organic Aerosol Contributions from Volatile Emissions of Emerging Importance, Environ Sci Technol, 54, 714–725, https://doi.org/10.1021/acs.est.9b06531, 2020.

Tkacik, D. S., Presto, A. A., Donahue, N. M., and Robinson, A. L.: Secondary organic aerosol formation from intermediate-volatility organic compounds: Cyclic, linear, and branched alkanes, Environ Sci Technol, 46, 8773–8781, https://doi.org/10.1021/es301112c, 2012.

Wu, W., Zhao, B., Wang, S., and Hao, J.: Ozone and secondary organic aerosol formation potential from anthropogenic volatile organic compounds emissions in China, J Environ Sci (China), 53, 224–237, https://doi.org/10.1016/j.jes.2016.03.025, 2017.

Yang, T. T., Lin, T. S., and Chang, M.: Characteristics of emissions of volatile organic compounds from smoldering incense, Bull Environ Contam Toxicol, 78, 308–313, https://doi.org/10.1007/s00128-007-9184-9, 2007.

Zhao, Y., Hennigan, C. J., May, A. A., Tkacik, D. S., De Gouw, J. A., Gilman, J. B., Kuster, W. C., Borbon, A., and Robinson, A. L.: Intermediate-volatility organic compounds: A large source of secondary organic aerosol, Environ Sci Technol, 48, 13743–13750, https://doi.org/10.1021/es5035188, 2014.

Zhao, Y., Saleh, R., Saliba, G., Presto, A. A., Gordon, T. D., Drozd, G. T., Goldstein, A. H., Donahue, N. M., and Robinson, A. L.: Reducing secondary organic aerosol formation from gasoline vehicle exhaust, Proc Natl Acad Sci U S A, 114, 6984–6989, https://doi.org/10.1073/pnas.1620911114, 2017.

Zushi, Y., Yamatori, Y., Nagata, J., and Nabi, D.: Comprehensive two-dimensional gas-chromatography-based property estimation to assess the fate and behavior of complex mixtures: A case study of vehicle engine oil, Science of the Total Environment, 669, 739–745, https://doi.org/10.1016/j.scitotenv.2019.03.157, 2019.