Resolution Improvement for EPA Method 8270D using Zebron™ ZB-PAH-CT GC Column by GC-MS

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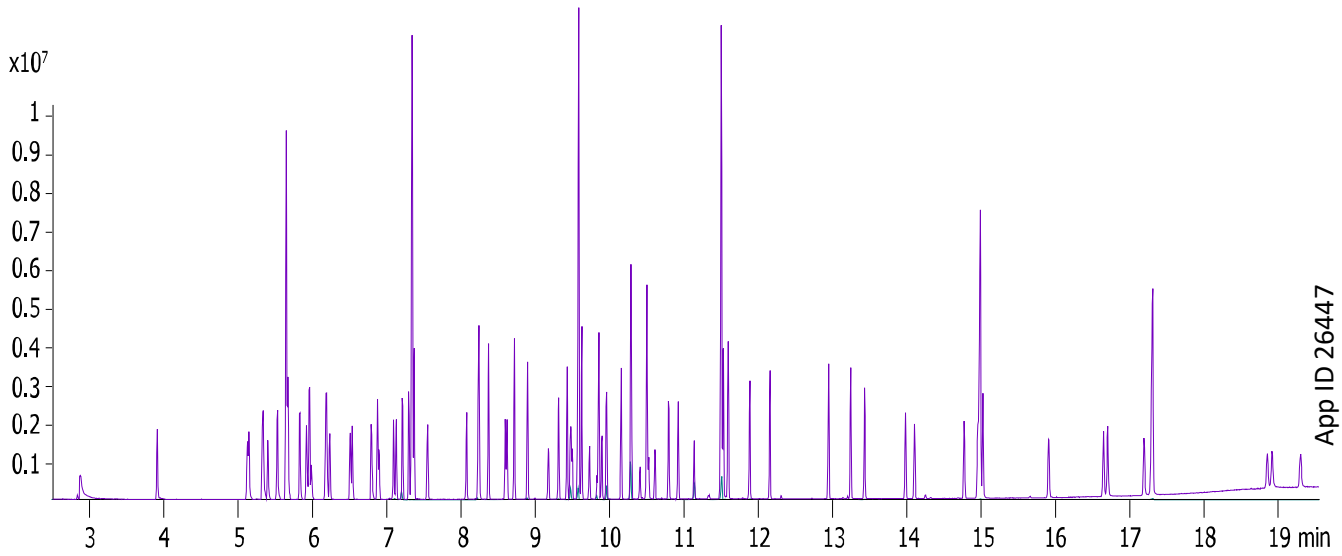
Overview

EPA Method 8270D is a common method for analysis of semivolatile organic compounds. It is a complicated method with one of the longest lists of analytes. A laboratory running a minimal list will still have over 80 compounds and laboratories adding appendix mixes can have over 200 compounds in their calibration curves. This large number of compounds can lead to chromatographic challenges that must be addressed when choosing columns and developing methods. Presented in this study is the separation of EPA 8270D analytes on a Zebron ZB-PAH-CT GC column. The unique stationary phase selectivity of the column provides recognition of aromatic compounds and improves the separation of semivolatile compounds.

GC-MS Conditions

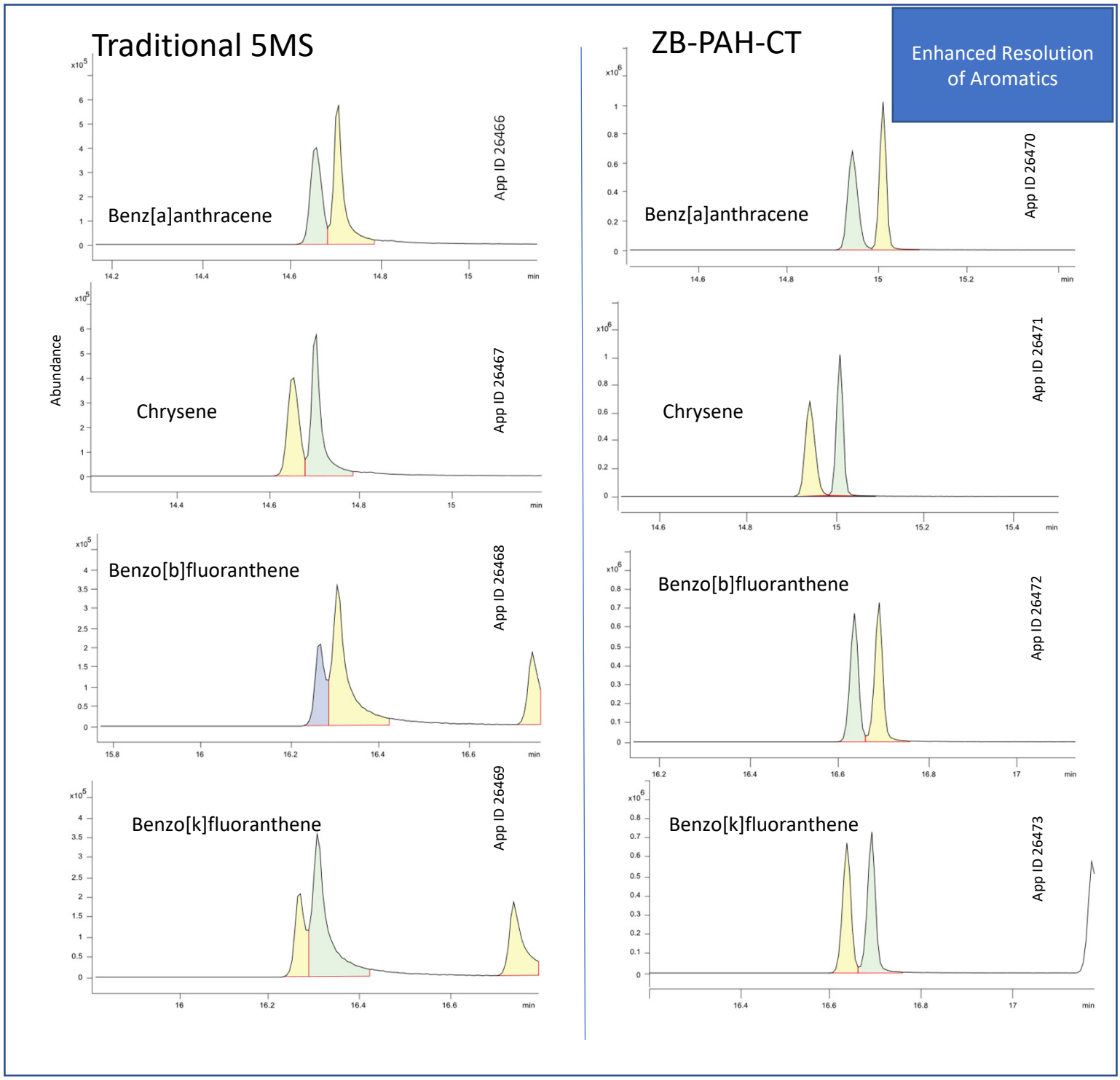
Column:	Zebron ZB-PAH-CT
Dimension:	30 meter x 0.25 mm x 0.20 µm
Part No.:	7HG-G044-10
Injection:	Splitless @ 250 °C, 1 µL, hold 1 min
Carrier Gas:	Helium @ 1.5 mL/min (constant flow)
Oven Program:	40 °C for 1 min to 100 °C @ 5 °C/min, to 250 °C @ 20 °C/min, to 320 °C at 12°C/min for 1 min
Detector:	GC-MS
Transfer Line Temperature:	300 °C
Mode	Scan (50-500 m/z) SIM parameters in Table 1
Source Temperature:	230 °C
Quad Temperature:	150 °C

Figure 1. Separation of Semivolatile Organic Compounds (SVOC) on a Zebron ZB-PAH-CT GC Column



Analyte retention in Page 3 and 4.
Data Courtesy: Weck Laboratories Inc. Phenomenex is not affiliated with Weck Laboratories Inc.

Figure 2. Separation of Semivolatile Organic Compounds (SVOCs) on Traditional 5MS vs. ZB-PAH-CT GC Column



Analyte retention in Page 3 and 4.
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Table 1. **Semivolatile Organic Compounds Retention on ZB-PAH-CT**

Peak	Analyte Name	RT (min)	Sim Ions (m/z)	Concentration (mg/L)
1	N-Nitrosodimethylamine(NDMA)	2.858	74, 43	8.5558
2	Pyridine	3.896	79,52	10.4750
3	2-Fluorophenol (SSTD)	3.896	111,92, 64	15.1345
4	Phenol-d5 (SSTD)	5.113	99, 71, 42	18.4146
5	Phenol (CC)	5.132	94,66	18.3206
6	Aniline	5.311	93,66	22.6076
7	2-Chlorophenol	5.323	128,64, 130	15.4539
8	bis (2-chloroethyl) ether	5.385	92,63,95	14.3546
9	1,3-Dichlorobenzene	5.515	146, 148, 110	18.6464
10	1,4-Dichlorobenzene (CC)	5.657	146, 148, 110	18.9806
11	1,2-Dichlorobenzene	5.818	146, 148, 111	17.9633
12	Benzyl alcohol	5.904	108, 79, 51	8.6580
13	2-Methylphenol	5.941	107, 108, 79	12.7840
14	Bis (2-chloroisopropyl) ether	5.947	45, 121	9.9582
15	3- and 4-Methylphenols	6.164	107, 108	15.3823
16	Hexachloroethane	6.176	200, 116, 165	6.8428
17	N-Nitroso-di-n-propylamine (NDPA) (SP)	6.219	70, 43,130	11.2333
18	Nitrobenzene-d5 (SSTD)	6.497	82, 54, 128	16.0045
19	Nitrobenzene	6.522	77,51, 123	16.0799
20	Isophorone	6.775	82, 138, 54	28.7534
21	2,4-Dimethylphenol	6.862	122, 107, 121	12.9483
22	Benzoic acid	6.862	122, 105,77	ND
23	2-Nitrophenol (CC)	6.88	139, 81, 109	7.8679
24	bis (2-Chloroethoxy) methane	7.078	93, 95, 123	16.9629
25	2,4-Dichlorophenol (CC)	7.115	162, 163, 97	12.7863
26	1,2,4-Trichlorobenzene	7.195	179, 181, 144	15.5531
27	Hexachlorobutadiene (CC)	7.282	224,226, 222	3.7682
28	Naphthalene	7.356	128,129,126	19.4055
29	4-Chloroaniline	7.535	127,129, 65	7.2401
30	4-Chloro-3-methylphenol (CC)	8.06	107,142,144	4.9281
31	Hexachlorocyclopentadiene (SP)	8.215	236,234,271	3.6914
32	2-Methylnaphthalene	8.227	142,141,115	13.5397
33	1-Methylnaphthalene	8.357	142,141,115	12.7486
34	2,4,6-Trichlorophenol (CC)	8.579	195,197,199	3.3466
35	2,4,5-Trichlorophenol	8.604	195,198,97	3.5454
36	2-Fluorobiphenyl (SSTD)	8.703	172,171,170	14.7471
37	2-Chloronaphthalene	8.882	162,127,164	12.1502
38	o-Nitroaniline	9.16	65,138,92	2.7961
39	Dimethyl phthalate	9.302	163,77,194	13.3250
40	Acenaphthylene	9.413	152,151,153	17.7443
41	2,6-Dinitrotoluene	9.469	165,63,89	2.8922

Results and Discussion:

Presented in **Figure 1** is the separation of 80 Semivolatile Organic Compounds (SVOCs) on a ZB-PAH-CT GC Column. **Table 1** presents all the 80 Semivolatile analytes and their corresponding retention time. As shown in **Figure 2**, ZB-PAH-CT provide enhanced resolution of many critical pairs compared to a traditional 5MS phase. In addition to meeting system suitability criteria for EPA 8270D, ZB-PAH-CT GC columns provide better resolution of aromatic compounds. This is due to the specially designed, proprietary stationary phase that recognizes even small differences in aromatic electron density. In addition, this column is MS compatible and suitable for GC-MS applications.

Conclusion

EPA 8270D comprises an expansive list of analytes, hence a column with the right selectivity is necessary to maximize chromatographic resolution. Zebron ZB-PAH-CT not only meets the method requirement, but also provides enhanced resolution for aromatic compounds.

Table 1. **Semivolatile Organic Analyte Retention on ZB-PAH-CT (Continued)**

Peak	Analyte Name	RT (min)	Sim Ions (m/z)	Concentration (mg/L)
42	1,3-Dinitrobenzene	9.481	168, 76, 50	1.8444
43	Acenaphthene (CC)	9.611	154, 153, 152	21.7976
44	m-Nitroaniline	9.716	138, 92	2.6515
45	2,4-Dinitrophenol (SP)	9.815	184, 91, 107	1.7052
46	4-Nitrophenol (SP)	9.839	109, 81, 93	2.3582
47	Dibenzofuran	9.839	168, 139, 169	30.3223
48	2,3,4,6-Tetrachlorophenol	9.883	232, 230, 234	4.8657
49	2,3,5,6-Tetrachlorophenol	9.938	232, 230, 234	4.9819
50	2,4-Dinitrotoluene	9.951	165, 63, 89	6.8875
51	Diethyl phthalate	10.142	149, 177, 150	25.0716
52	Fluorene	10.272	166, 165, 163	24.3968
53	4-Chlorophenyl phenyl ether	10.278	204, 141, 206	12.2804
54	2-Methyl-4,6-Dinitrophenol	10.396	198, 51, 105	2.8308
55	N-Nitrosodiphenylamine(NDPhA)	10.488	169, 168, 167	19.5951
56	Azobenzene(1,2- Diphenylhydrazine)	10.488	77, 51, 182	24.6120
57	p-Nitroaniline	10.513	138, 65, 108	4.1257
58	2,4,6-Tribromophenol (SSTD)	10.599	329, 62, 142	3.4104
59	Hexachlorobenzene	10.785	283, 141, 248	7.7016
60	4-Bromophenyl phenyl Ether	10.908	248, 250, 141	6.8735
61	Pentachlorophenol (CC)	11.123	265, 267, 164	4.4454
62	Phenanthrene	11.52	178, 176, 179	21.4056
63	Anthracene	11.582	178, 176, 179	21.9028
64	Carbazole	11.872	167, 139, 83	17.1745
65	Di-n-butyl Phthalate	12.144	149, 150, 103	23.3370
66	Fluoranthene (CC)	12.935	202, 203, 101	18.7346
67	Benzidine	13.417	184, 185, 92	
68	Pyrene	13.231	202, 203, 100	18.6765
69	p-Terphenyl-d14 (SSTD)	13.417	244, 243, 122	12.3592
70	Butyl benzyl phthalate	14.09	149, 91, 206	7.3062
71	bis(2-Ethylhexyl) phthalate	14.757	149, 167, 57	9.8141
72	Benz[a]anthracene	14.943	222,226, 229	14.0897
73	Chrysene	15.011	228, 226, 229	23.4236
74	Di-n-octyl phthalate (CC)	15.9	149, 43, 279	4.5373
75	Benz[b]fluoranthene	16.635	252, 250, 253	19.0974
76	Benz[k]fluoranthene	16.691	252, 250, 253	20.4230
77	Benzo [a] pyrene(CC)	17.179	252, 250, 253	17.2039
78	Indeno[1,2,3-cd]pyrene	18.841	276, 137, 274	14.4903
79	Dibenz[a,h]anthracene	18.903	278, 139, 279	15.2158
80	Benzo[g,h,i]perylene	19.286	276, 138, 274	14.9669

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