Multi-residue Analysis for PAHs, PCBs and OCPs on Agilent J&W Select PAH

Application Note

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Introduction

Polycyclic aromatic hydrocarbons (PAHs) are often analyzed with other environmental pollutants, such as polychlorinated biphenyls (PCBs) and organochlorine pesticides (OCPs), in one run. This multi-residue analysis screens and quantifies a multitude of components in a short time span, thus reducing analysis costs.

Multi-residue analysis is challenging because of the wide range of compounds originating from different sources. Several components tend to co-elute, and in case of co-elution of isomers the mass spectrometer is unable to provide additional resolution, with false positives and inaccurate results as a consequence. Typical co-eluting isomers are PCB 28 and PCB 31, PCB 138 and PCB 163, benzo[b]fluoranthene and benzo[k]fluoranthene, indeno[1,2,3-c,d]pyrene and dibenz[a,h]anthracene, p,p'-DDT and o,p'-DDT, and lastly cis-heptachlor epoxide and trans-heptachlor epoxide.

This application note demonstrates the performance of the Select PAH GC column for multi-residue analysis. The Select PAH has unique capabilities for the separation of isomers, resolving false positives and inaccurate results and simplifying data processing.

Materials and Methods

Technique:	GC/MS
Column:	Select PAH, 30 m x 0.25 mm, df = 0.15 µm (part number CP7462)
Sample Conc:	OCPs and PCBs 0.1 µg/mL, PAHs 1 µg/mL
Injection Volume:	1 µL
Carrier Gas:	Helium, constant flow, 1 mL/min
Temperature:	70 °C (0.50 min), 60 °C/min, 210 °C, 5 °C/min, 250 °C, 10 °C/min, 280 °C (3 min), 10 °C/min, 350 °C (3min)
Injection:	100 °C, 180 °C/min, 300 °C (20 min), splitless
Detection:	MS, EI in SIM, source 275 °C, transfer line 300 °C

Results and Discussion

The Select PAH column delivered a multi-residue analysis of PAHs, PCBs and OCPs within 25 minutes (Figure 1).

In the PCB group, the important pairs PCB 28/PCB 31 and PCB 138/PCB 163, were adequately separated (Figures 2 and 3).

The first pair within the PAH group is the well-known benzo[b]fluoranthene/benzo[k]fluoranthene (Figure 4). The other critical PAH pair is indeno[1,2,3-c,d]pyrene/dibenz[a,h]anthracene (Figure 5). Both pairs were adequately separated.

In addition, the OCP pairs p,p′-DDD/o,p′-DDT and cis-heptachlor epoxide/trans-heptachlor epoxide were well separated (Figures 6 and 7). For SIM determination an extra m/z should be analyzed to confirm whether cis- or trans-heptachlor epoxide is present.

Conclusion

A Select PAH column successfully separated 57 PAH, PCB and OCP environmental pollutants. The column demonstrated high performance by combining adequate separation of isomers with high productivity.

Table 1. Peak Identification and SIM ions

Peak	Compound	Ions
1	Naphthalene	128
2	Acenaphthene	152
3	Acenaphthylene	154
4	Fluorene	166
5	Hexachlorobenzene	284, 142
6	α-HCH	181, 219
7	PCB 18	186, 256
8	γ-HCH	181, 219
9	Phenanthrene	178
10	β-HCH	181, 219
11	Anthracene	178
12	Heptachlor	100, 272
13	PCB 31	186, 256
14	PCB 28	186, 256
15	PCB 20	186, 256
16	δ-HCH	181, 219
17	Aldrin	66, 263
18	PCB 52	220, 292
19	PCB 44	220, 292
20	trans-Heptachlor epoxide	81, 353
21	PCB 155	360, 290
22	cis-Heptachlor epoxide	81, 353
23	trans-Chlordane	373, 237
24	PCB 101	326, 254
25	o,p'-DDE	246
26	cis-Chlordane	373, 237
27	Endosulfan I	241, 195
28	Fluoranthene	202
29	p,p'-DDE	246
30	Dieldrin	79, 263
31	o,p′-DDD	235, 165
32	PCB 149	290, 360
33	Pyrene	202
34	PCB 118	326, 254
35	Endrin	81, 195
36	PCB 153	360, 290
37	o,p'-DDT	235, 165
38	p,p'-DDD	235, 165
39	PCB 105	326, 254
40	Endosulfan II	195, 241
41	PCB 163	360, 290
42	PCB 138	360, 290
43	p,p'-DDT	235, 165
44	Endrin aldehyde	67, 345
45	Endosulfan sulfate	387, 272
46	PCB 180	324, 394
47	Methoxychlor	227
48	PCB 170	324, 394
49	Benz[a]anthracene	228
50	Chrysene	228
51	PCB 194	430, 356
52	Benzo[b]fluoranthene	252
53	Benzo[k]fluoranthene	252
54	Benzo[a]pyrene	252
55	Dibenz[a,h]anthracene	278
56	Indeno[1,2,3-c,d]pyrene	276
57	Benzo[g,h,i]perylene	276

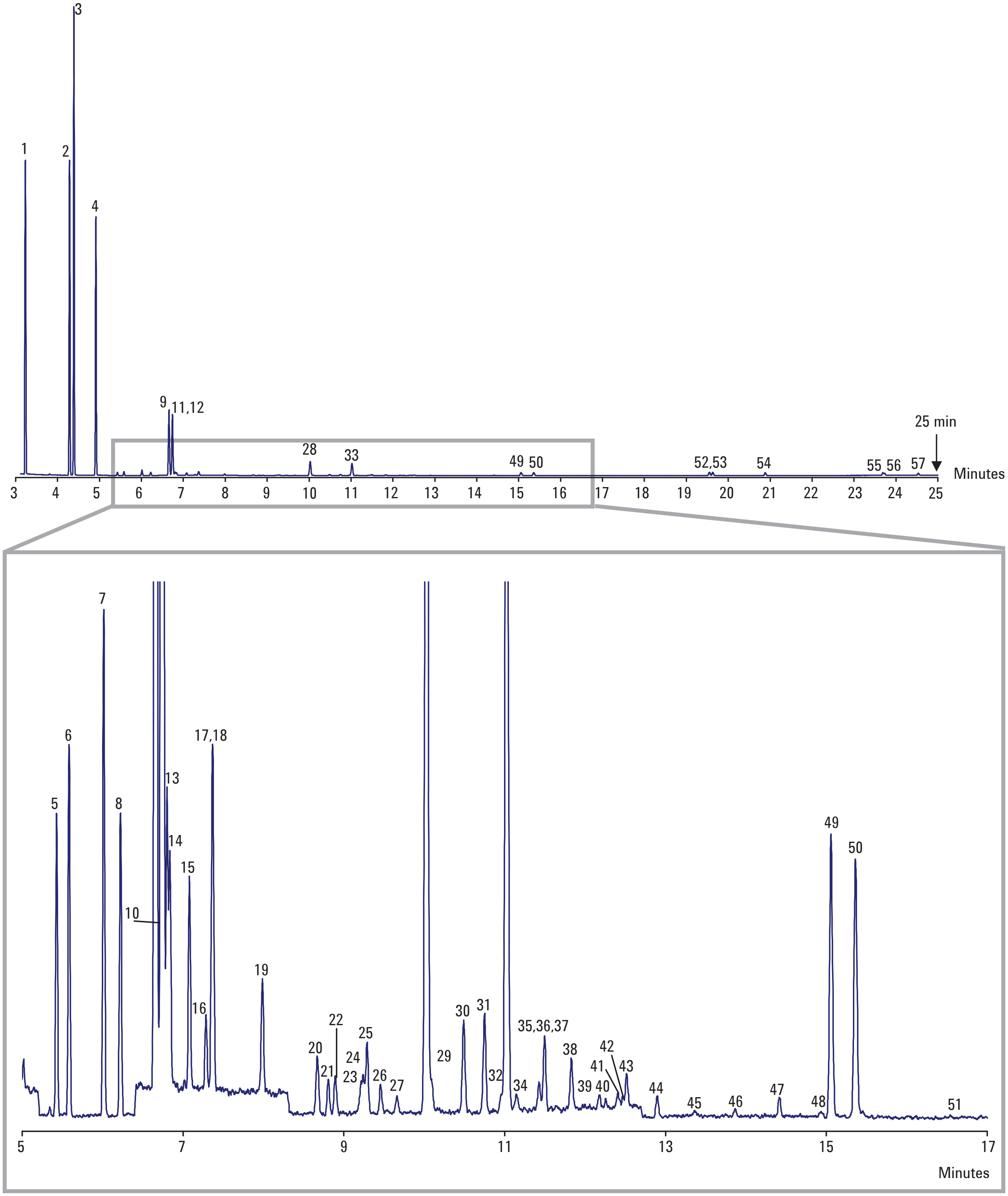

Figure 1. Total ion chromatogram multi-residue analysis on a Select PAH column

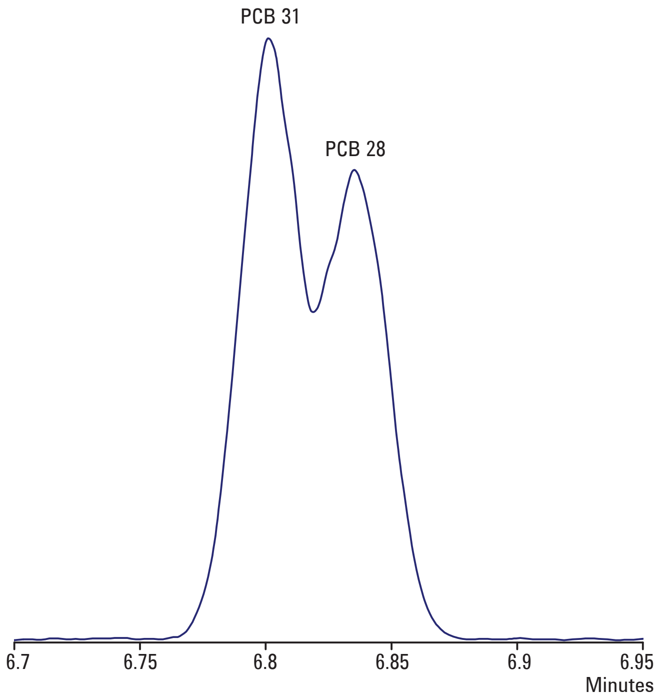

Figure 2. Selected ion chromatogram (m/z 256) of PCB 28 and PCB 31

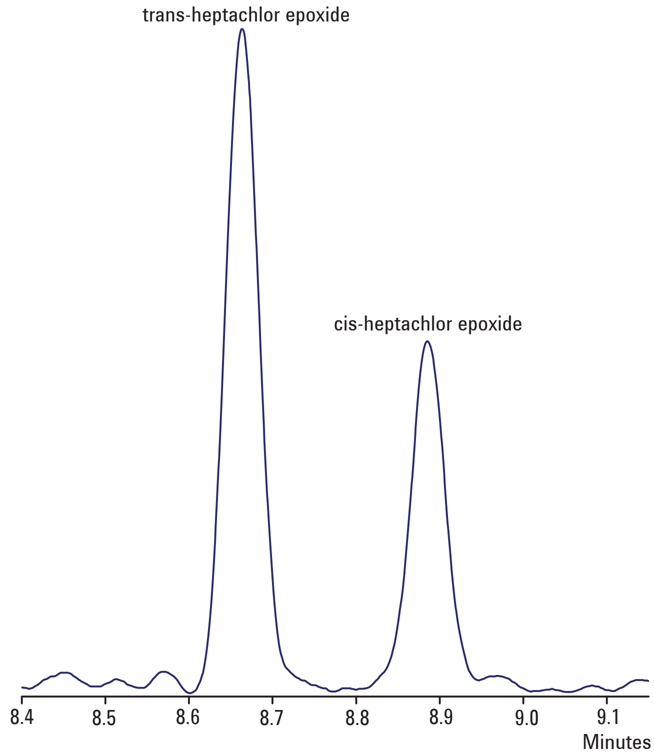

Figure 3. Selected ion chromotogram (m/z 81) of cis-heptachlor epoxide and trans-heptachlor epoxide

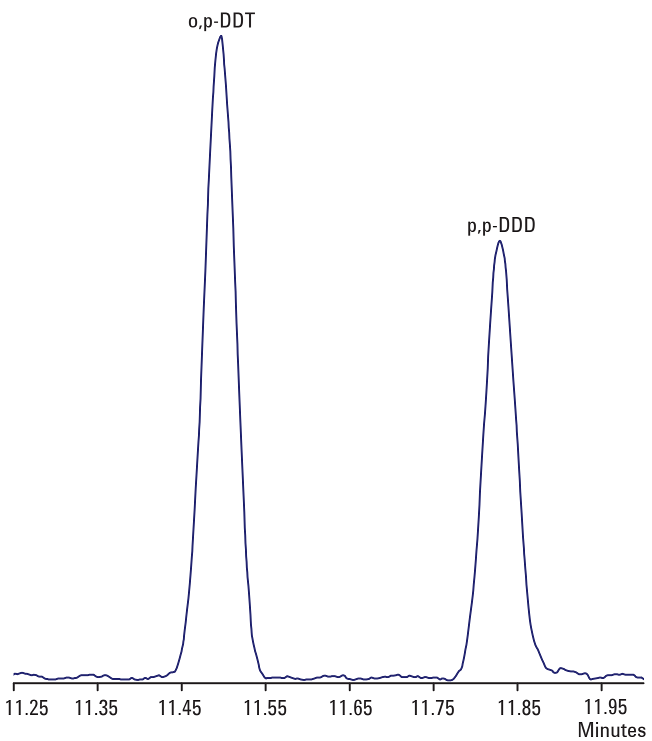

Figure 4. Selected ion chromatogram (m/z 235) of p,p′-DDD and o,p′-DDT

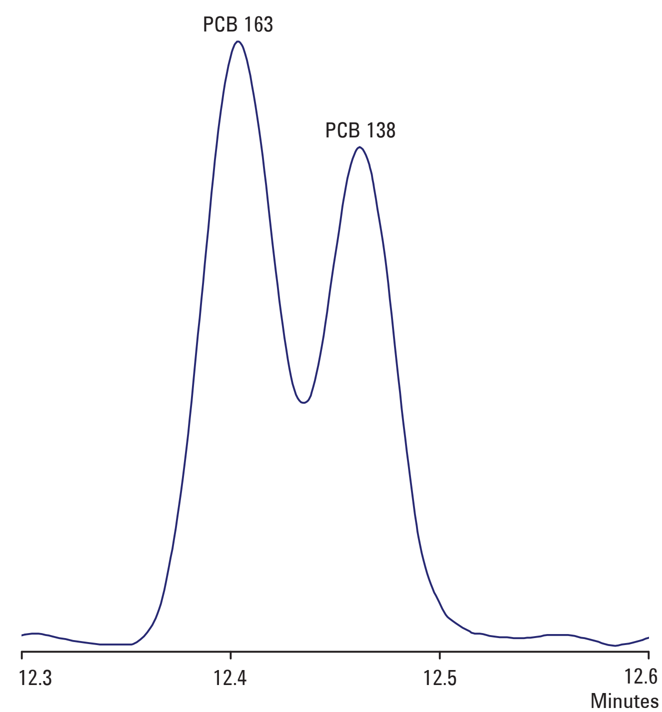

Figure 5. Selected ion chromatogram (m/z 360) of PCB 138 and PCB 163

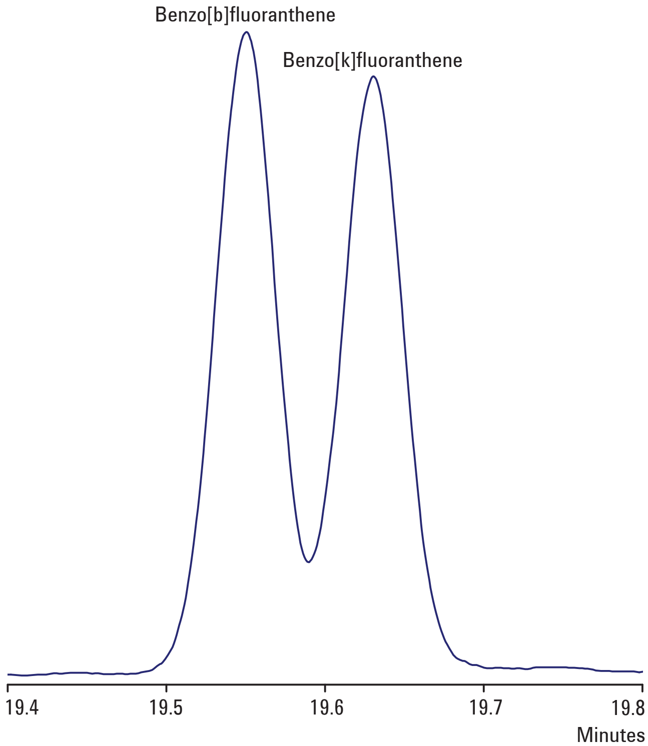

Figure 6. Selected ion chromatogram (m/z 252) of benzo[b]fluoranthene and benzo[k]fluoranthene

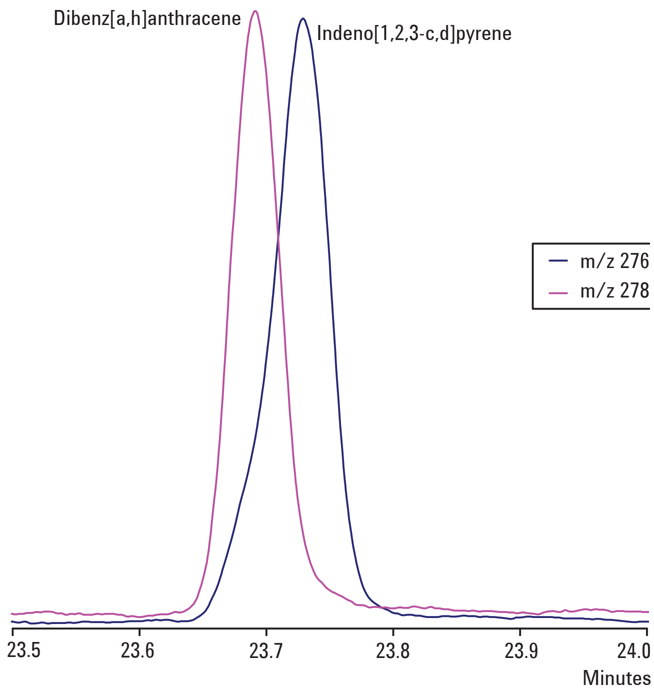

Figure 7. Selected ion chromatogram (m/z 276 and 278) of indeno[1,2,3-c,d]pyrene and dibenz[a,h]anthracene

References

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