Exploring GC Column Selectivity for Analysis of Aromatic Compounds

Presented By

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Global Product Manager -GC

February 27th , 2020
Phenomenex

Overview

Polycyclic Aromatic Hydrocarbons

- PAH Terminologies & Regulations
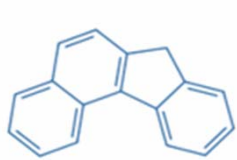- Challenges with PAH Analysis

ZB-PAH-EU

- Complete resolution of EU15+1 and EPA 610 PAHs
- Speed up your PAH Analysis
- PAH in Food
- One Column for PAH & PCB

ZB-PAH-CT

- Unique Selectivity for Chrysene & Triphenylene
- Short Run Time & better Sensitivity
- Phthalates in Food
- EPA-8270 Method Resolution Improvement
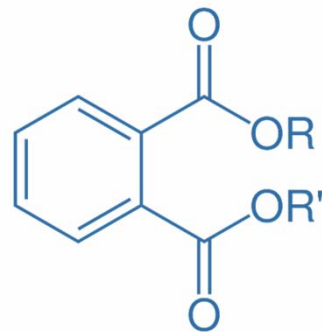
Aromatic Contaminants
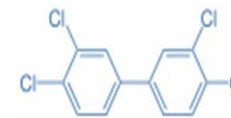
PAH

Benzo[c]fluorene

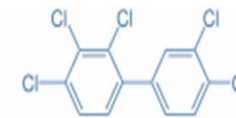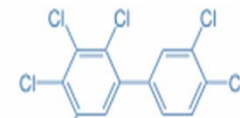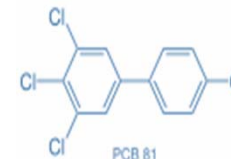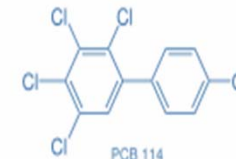Benz[a]anthracene

Cyclopenta[cd]pyrene

Phthalates

PCB

PCB 77   PCB 105   PCB 156
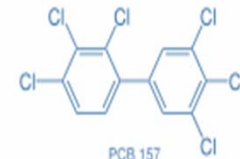
PCB 81   PCB 114   PCB 157
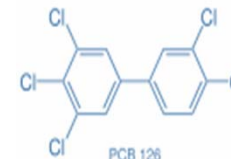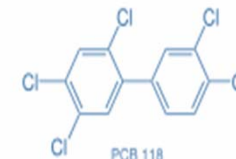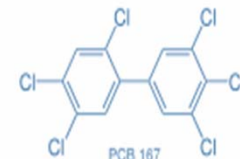
PCB 126   PCB 118   PCB 167

PAH Terminologies

- Polycyclic Aromatic Hydrocarbons
- Polynuclear Aromatic Hydrocarbons
- Poly Aromatic Hydrocarbons
- Polycyclic Organic Hydrocarbons
- Priority Pollutant
- Persistent Organic Pollutant(POPs)
- Poly Chlorinated Biphenyls (PCBs)
- Terphenyl

Regulations

- Environmental Protection Agency: **EPA**
- European Food Safety Authority: **EFSA**
- International Electrotechnical Commission: **IEC**
- AfPS GS 2014:01 pak regulation
- European Chemical Agency **ECHA**
- Health Canada
- EU 15+1

Common Challenges with PAH Testing

Time Intensive Analysis
- Generally 50-60 min run time
- Heavy PAHs have lower sensitivity
- Heavy PAH has inlet discrimination

Resolution of Critical pairs
- PAH isomers are very close in structure & difficult to resolve
- Different regulations require different pair separation

Matrix
- Matrix can have adverse effect on analysis quality
- Food matrix needs higher temperature bakeout
- Ghost peaks can appear from high boiling matrix contamination

Sensitivity
- Heavier PAH may loose sensitivity because of inlet discrimination and low column max temperature

Unleash the power of Fast GC PAH Analysis

Selectivity1: ZB-PAH-EU
- Up to 70% Faster PAH Analysis
- Elevated Temperature Stability $340/360^0$C

Selectivity2: ZB-PAH-CT
- Enhanced Resolution for Chrysene and Triphenylene
- Increased Benzo[b,k]fluoranthene Separation

Factors Influencing Resolution

Master Resolution Equation

$$R_S = \frac{\sqrt{N}}{4} \cdot \frac{a-1}{a} \cdot \frac{k}{1+k}$$

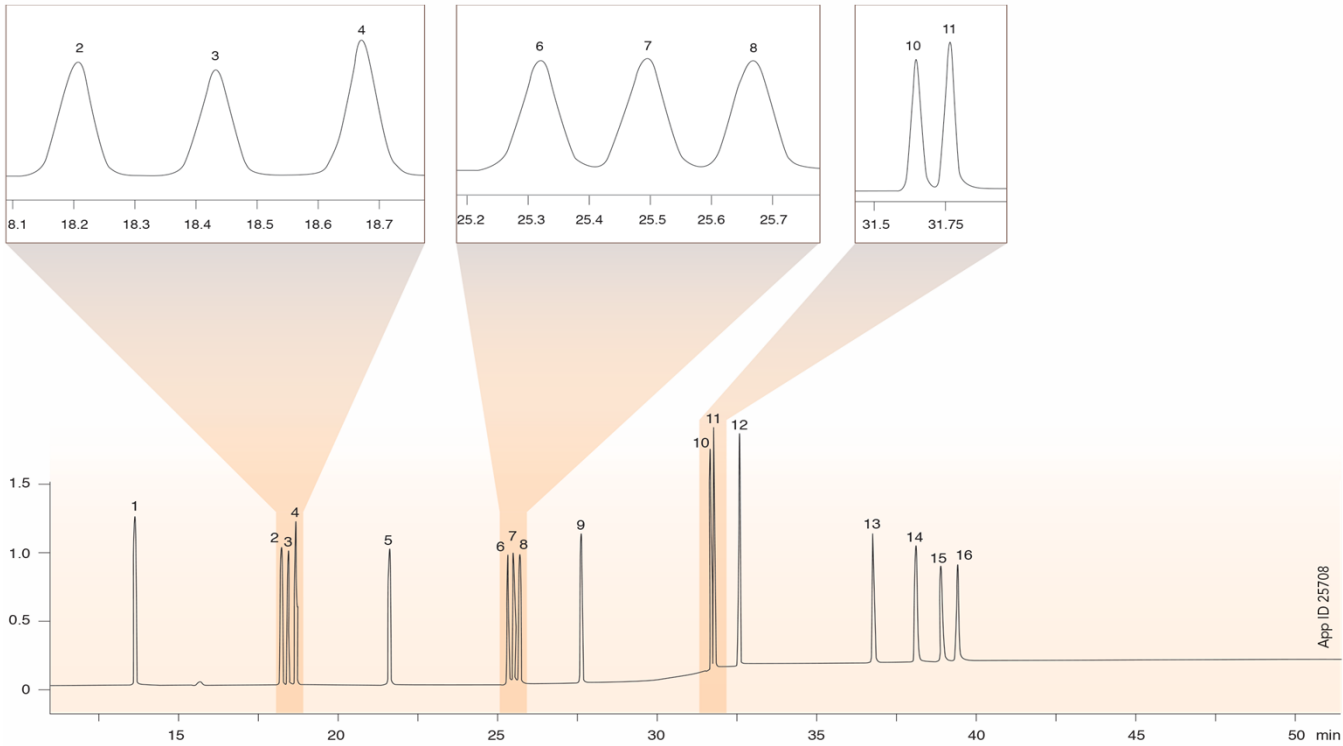| Efficiency	Selectivity	Retention

N = theoretical plates $\alpha = k_2/k_1$ $k = (t_R - t_o)/t_o$

Complete Resolution of EU 15+1 PAH

GC-MS Method Conditions
Column: Zebron ZB-PAH-EU
Dimensions: 30 meter x 0.25 mm x 0.20 μm
Part No.: 7HG-G043-10
Injection: Split 5:1 @ 330 °C, 1 μL
Recommended Liner: Zebron PLUS Single Taper Z- Liner™
Liner Part No.: AG2-4B13-05 (for Shimadzu 2010 GC)
Carrier Gas: Helium @ 24 psi (constant pressure)

Oven Program: 45 °C for 0.8 min to 200 °C @ 45 °C/min to 226 °C @ 3 °C/min for 0 min to 320 °C @ 10 °C/min for 20 min

Detector: MSD, 50-500 m/z
Transfer line Temperature: 300 °C
Source Temperature: 300 °C

Sample:
1. Benzo[c]fluorene
2. Benz[a]anthracene
3. Cyclopenta[c,d]pyrene
4. Chrysene
5. 5-Methylchrysene
6. Benzo[b]fluoranthene
7. Benzo[k]fluoranthene
8. Benzo[j]fluoranthene
9. Benzo[a]pyrene
10. Indeno[1,2,3-cd]pyrene
11. Dibenzo[a,h]anthracene
12. Benzo[g,h,i]perylene
13. Dibenzo[a,l]pyrene
14. Dibenzo[a,e]pyrene
15. Dibenzo[a,i]pyrene
16. Dibenzo[a,lh]pyrene

App ID 25708

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Complete Resolution of EU (15+1) and EPA 610 PAHs

Great separation of 24 PAH in Single run

GC-MS Method Conditions
Column: Zebron ZB-PAH-EU
Dimensions: 30 meter x 0.25 mm x 0.20 µm
Part No.: 7HG-G043-10
Injection: Split 5:1 @ 330 °C, 1 µL
Recommended Liner: Zebron PLUS Single Taper Z- Liner™
Liner Part No.: AG2-4B13-05 (for Shimadzu 2010 GC)
Carrier Gas: Helium @ 24 psi (constant pressure)

Oven Program: 45 °C for 0.8 min to 200 °C @ 45 °C/min to 226 °C @ 3 °C/min for 0 min to 320 °C @ 10 °C/min for 20 min
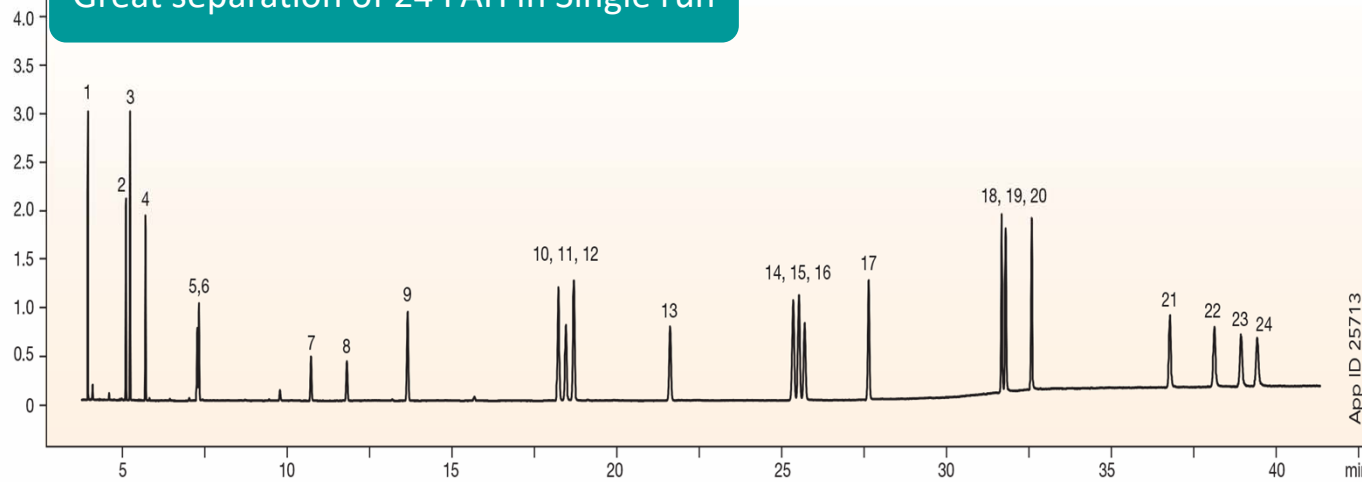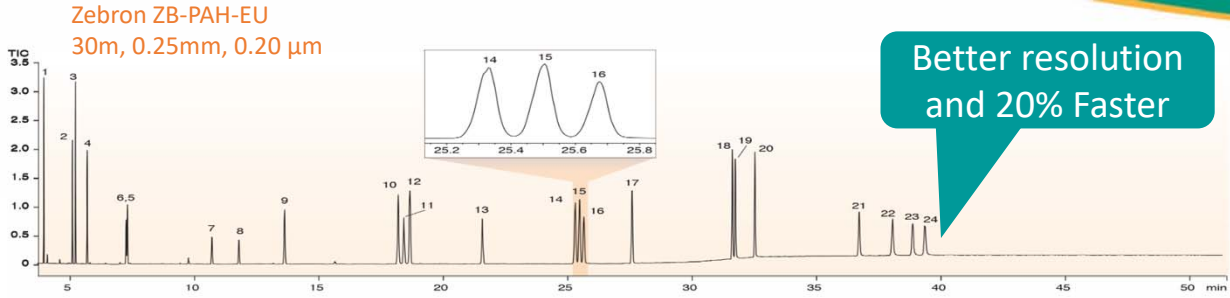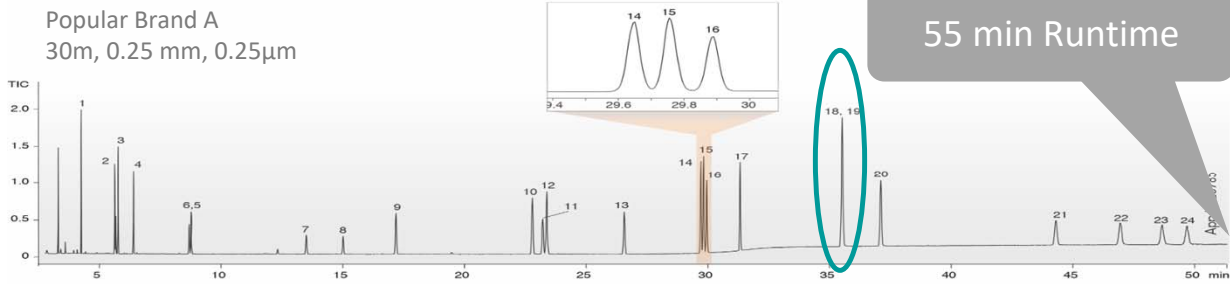
Detector: MSD, 50-500 m/z
Transfer line Temperature: 300 °C
Source Temperature: 300 °C

1. Naphthalene
2. Acenaphthylene
3. Acenaphthene
4. Fluorene
5. Phenanthrene
6. Anthracene
7. Fluoranthene
8. Pyrene
9. Benzo[c]fluorene
10. Benz[a]anthracene
11. Cyclopenta[c,d]pyrene
12. Chrysene
13. 5-Methylchrysene
14. Benzo[b]fluoranthene
15. Benzo[k]fluoranthene
16. Benzo[j]fluoranthene
17. Benzo[a]pyrene
18. Indeno[1,2,3-cd]pyrene
19. Dibenz[a,h]anthracene
20. Benzo[g,h,i]perylene
21. Dibenzo[a,l]pyrene
22. Dibenzo[a,e]pyrene
23. Dibenzo[a,i]pyrene
24. Dibenzo[a,h]pyrene

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Zebron
GC Columns

Zebron ZB-PAH-EU
30m, 0.25mm, 0.20 µm

Popular Brand A
30m, 0.25 mm, 0.25µm

Popular Brand R
30 meter x 0.25 mm x 0.10 µm

Comparative separations may not be representative of all applications.

Better resolution and 20% Faster

55 min Runtime

Coeluting peaks

Better Combination of Resolution and Speed

GC-MS Conditions
Column: As Indicated
Dimension: As indicated
Part No.: 7HG-G043-10 (Zebron ZB-PAH-EU column)
Injection: Split 5:1 @ 330 °C, 1 µL
Recommended Liner: Zebron PLUS Single Taper Z- Liner™
Liner Part No.: AG2-4B13-05 (for Shimadzu 2010 GC)
Carrier Gas: Helium @ 24 psi (constant pressure)
Oven Program: 45 °C for 0.8 min to 200 °C @ 45 °C/min
to 226 °C @ 3 °C/min for 0 min to 320 °C @ 10 °C/min for 20 min
Detector: MSD, 50-500 m/z
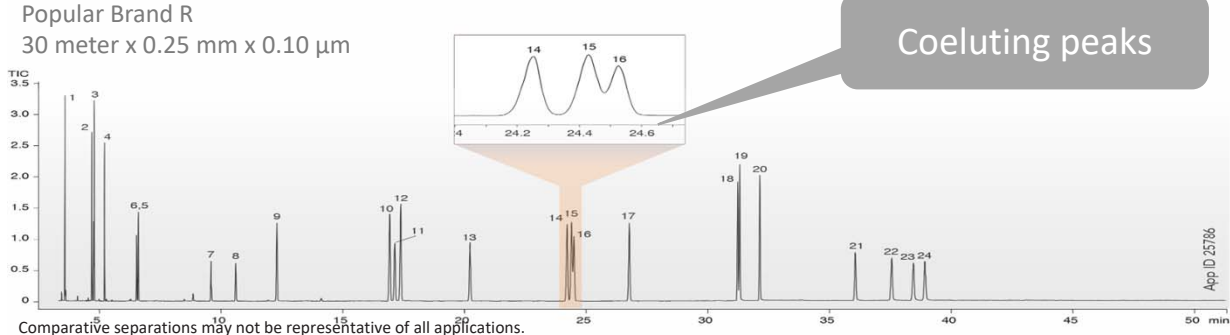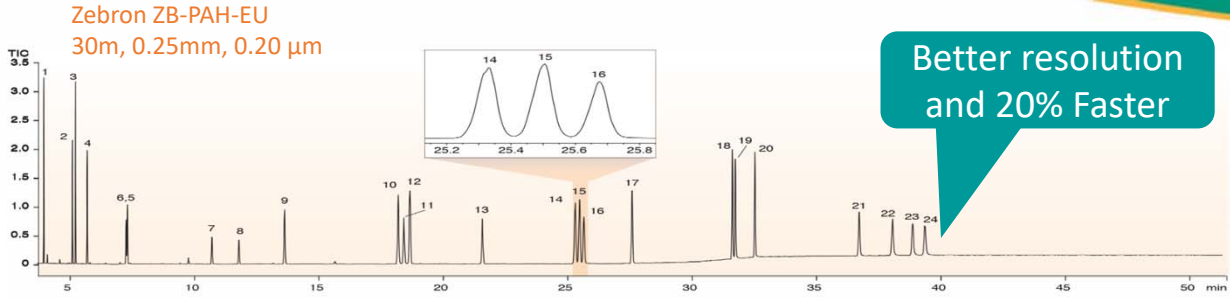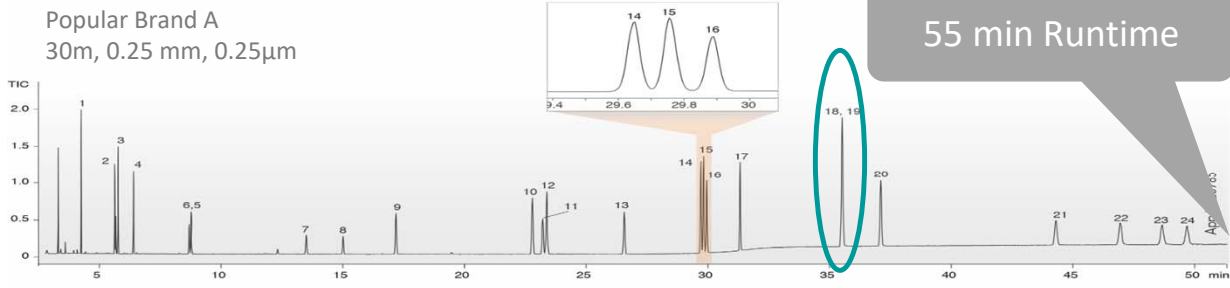Transfer line Temperature: 300 °C
Source Temperature: 300 °C

Sample:
1. Naphthalene
2. Acenaphthylene
3. Acenaphthene
4. Fluorene
5. Phenanthrene
6. Anthracene
7. Flouranthene
8. Pyrene
9. Benzo[c]fluorene
10. Benz[a]anthracene
11. Cyclopenta[c,d]pyrene
12. Chrysene
13. 5-Methylchrysene
14. Benzo[b]fluoranthene
15. Benzo[k]fluoranthene
16. Benzo[j]fluoranthene
17. Benzo[a]pyrene
18. Indeno[1,2,3-cd]pyrene
19. Dibenz[a,h]anthracene
20. Benzo[g,h,i]perylene
21. Dibenzo[a,l]pyrene
22. Dibenzo[a,e]pyrene
23. Dibenzo[a,i]pyrene
24. Dibenzo[a,h]pyrene

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Zebron ZB-PAH-EU
30m, 0.25mm, 0.20 µm

Popular Brand A
30m, 0.25 mm, 0.25µm

Popular Brand R
30 meter x 0.25 mm x 0.10 µm

Comparative separations may not be representative of all applications.

Better resolution and 20% Faster

55 min Runtime

Coeluting peaks

Better Combination of Resolution and Speed

GC-MS Conditions
Column: As Indicated
Dimension: As indicated
Part No.: 7HG-G043-10 (Zebron ZB-PAH-EU column)
Injection: Split 5:1 @ 330 °C, 1 µL
Recommended Liner: Zebron PLUS Single Taper Z- Liner™
Liner Part No.: AG2-4B13-05 (for Shimadzu 2010 GC)
Carrier Gas: Helium @ 24 psi (constant pressure)
Oven Program: 45 °C for 0.8 min to 200 °C @ 45 °C/min
to 226 °C @ 3 °C/min for 0 min to 320 °C @ 10 °C/min for 20 min
Detector: MSD, 50-500 m/z
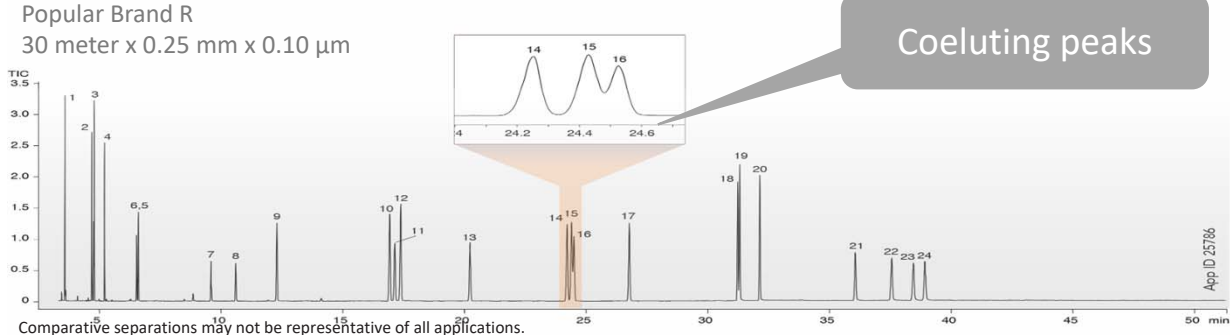Transfer line Temperature: 300 °C
Source Temperature: 300 °C

Sample:
1. Naphthalene
2. Acenaphthylene
3. Acenaphthene
4. Fluorene
5. Phenanthrene
6. Anthracene
7. Flouranthene
8. Pyrene
9. Benzo[c]fluorene
10. Benz[a]anthracene
11. Cyclopenta[c,d]pyrene
12. Chrysene
13. 5-Methylchrysene
14. Benzo[b]fluoranthene
15. Benzo[k]fluoranthene
16. Benzo[j]fluoranthene
17. Benzo[a]pyrene
18. Indeno[1,2,3-cd]pyrene
19. Dibenz[a,h]anthracene
20. Benzo[g,h,i]perylene
21. Dibenzo[a,l]pyrene
22. Dibenzo[a,e]pyrene
23. Dibenzo[a,i]pyrene
24. Dibenzo[a,h]pyrene

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Up to 70% Faster PAH Analysis

40 min PAH Analysis

26 min PAH Analysis

16 min PAH Analysis

ZB-PAH-EU 30m, 0.25mm, 0.20 µm

ZB-PAH-EU 20m, 0.18mm, 0.14 µm

ZB-PAH-EU 10m, 0.10mm, 0.08µm

Fast & Accurate PAH Analysis in Food

Sample:
1. Benz[a]anthracene
2. Chrysene
3. Benzo[b]fluoranthene
4. Benzo[a]pyrene

Separation of EFSA PAH4 in less than 10 mins!

Technote TN-2093

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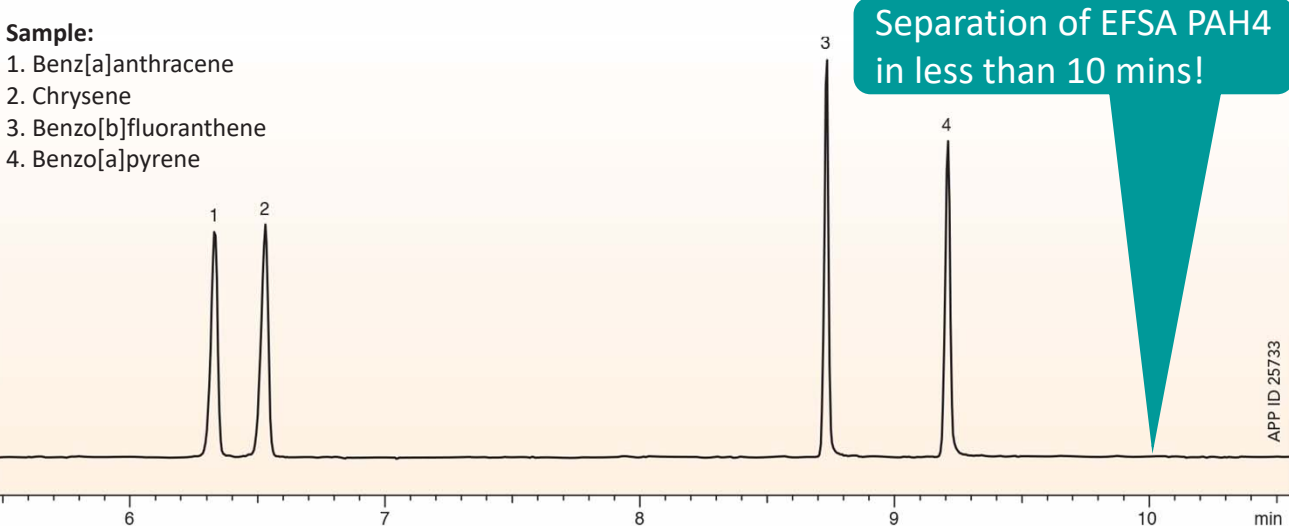
GC-MS Conditions
Column: Zebron ZB-PAH-EU
Dimensions: 10 meter x 0.10 mm x 0.08 µm
Part No.: 7CB-G043-59
Recommended Liner: Zebron PLUS Single Taper Z- Liner™
Liner Part No.: AG2-4B13-05 (for Shimadzu® 2010 GC System)
Injection: Split (15:1) @ 320 °C, 1 µL
Carrier Gas: Helium @ 0.88 mL/min (constant Flow)

Oven Program: 70 °C for 0.4 min to 180 °C @ 140 °C/min to 230 °C @ 14 °C/ min for 3 min to 280 °C @ 85 °C/ min for 5 min 330 °C @ 40 °C/min for 5 min
Detector: MSD, 100-500 m/z
Transfer line Temperature: 300 °C
Source Temperature: 300 °C

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POPs Compound Classes

PAH
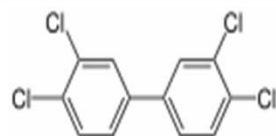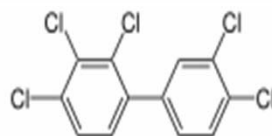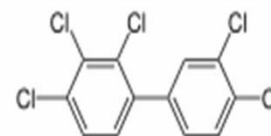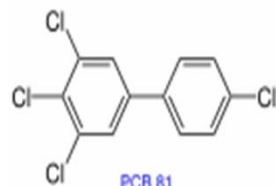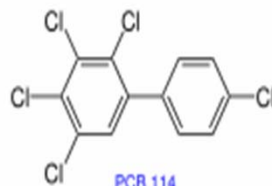
PCB

Chloroterphenyl

PAH & PCB in One Method

Separation of 40 PAH & PCB in one run

Sample:

1. TCMX
2. DCB 22
3. PCB 31
4. PCB 28
5. PCB 69
6. PCB 52
7. PCB 70
8. PCB101
9. PCB 81
10. PCB 77
11. PCB 123
12. PCB 153
13. PCB 118
14. Benzo[c]fluorene
15. PCB 105
16. PCB 164
17. PCB 163
18. PCB 138
19. PCB 126
20. PCB 167
21. PCB 156
22. PCB 180
23. PCB 157
24. Benz[a]anthracene
25. Cyclopenta[c,d]pyrene
26. PCB 169
27. Chrysene
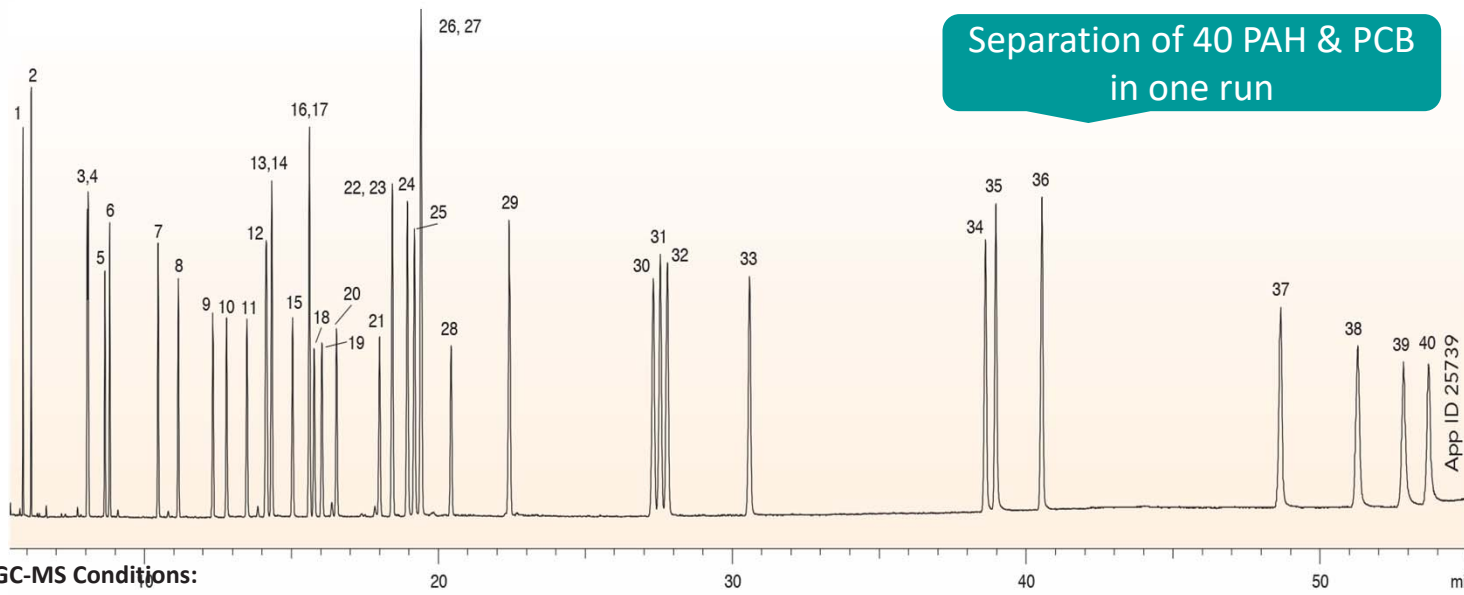
28. PCB 170
29. 5-Methylchrysene
30. Benzo[b]fluoranthene
31. Benzo[k]fluoranthene
32. Benzo[j]fluoranthene
33. Benzo[a]pyrene
34. Indeno[1,2,3-cd]pyrene
35. Dibenzo[a,h]anthracene
36. Benzo[g,h,i]perylene
37. Dibenzo[a,l]pyrene
38. Dibenzo[a,e]pyrene
39. Dibenzo[a,i]pyrene
40. Dibenzo[a,h]pyrene

GC-MS Conditions:
Column: Zebron ZB-PAH-EU
Dimension: 30 meter x 0.25 mm x 0.20 μm
Part No.: 7HG-G043-10
Injection: Splitless for 0.5 min @ 320 °C, 1 μL
Recommended Liner: Zebron PLUS Single Taper Z- Liner™
Liner Part No.: AG2-4B13-05 (for Shimadzu 2010 GC)
Carrier Gas: Helium @ 1.3 mL/min (constant flow)

Oven Program: 45 °C for 1 min to 200 °C @ 50 °C/min to 250 °C @ 3 °C/min for 5 min to 300 °C @ 3 °C/min for 10 min to 340 °C @ 5 °C/min for 0 min
Detector: MSD, 50-500 m/z
Transfer line Temperature: 300 °C
Source Temperature: 300 °C

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PAH & PCB in One Method

Peak No	Analyte	EI Ion (m/z)	EI Ion (m/z)
3	PCB31	256	186
4	PCB28	256	186
12	PCB118	326	254
13	PCB153	360	290
16	PCB163	360	290
17	PCB164	360	290
22	PCB180	394	359
23	PCB 157	360	290
26	PCB169	360	290
27	Chrysene	228	202
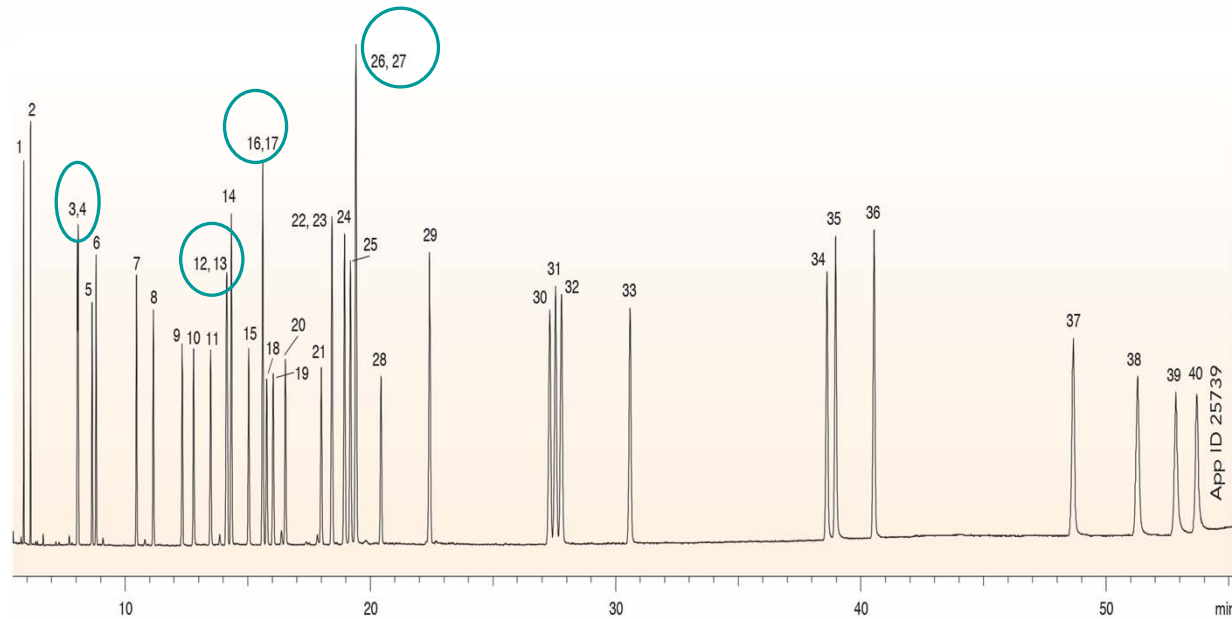
PAH, PCB and Terphenyl in One Method

Sample:
1. PCB 31
2. PCB 28
3. PCB-52
4. PCB 101
5. PCB 153
6. PCB118
7. Benzo[c]fluorene
8. PCB138
9. PCB180
10. Benz[a]anthracene
11. Cyclopenta[c,d]pyrene
12. Chrysene
13. Trichlorotriphenyl
14. 5-Methylchrysene
15. Tetrachloroterphenyl
16. Benzo[b]fluoranthene
17. Benzo[k]fluoranthene
18. Benzo[j]fluoranthene
19. Benzo[e]pyrene
20. Benzo[a]pyrene
21. Pentachloroterphenyl
22. Indeno[1,2,3-cd]pyrene
23. Dibenzo[a,h]anthracene
24. Benzo[g,h,i]perylene
25. Dibenzo[a,l]pyrene
26. Dibenzo[a,e]pyrene
27. Dibenzo[a,i]pyrene
28. Dibenzo[a,h]pyrene

GC-MS Conditions
Column: Zebron ZB-PAH-EU
Dimension: 30 meter x 0.25 mm x 0.20 µm
Part No.: 7HG-G043-10
Injection: Split 2:1 @ 320 °C, 1 µL
Recommended Liner: Zebron PLUS Single Taper Z-Liner™
Liner Part No.: AG2-4B13-05 (for Shimadzu 2010 GC)

Carrier Gas: Helium @ 72.8 kPa (constant pressure)
Oven Program: 45 °C for 1 min to 200 °C @ 50 °C/min to 250 °C @ 3 °C/min for 5 min to 300 °C @ 3 °C/min for 10 min to 340 °C @ 5 °C/min for 0 min
Detector: MSD, 100-500 m/z
Transfer line Temperature: 300 °C
Source Temperature: 300 °C

PAH, PCB and Terphenyl in One Method

Peak	Analyte	EI Ion (m/z)	EI Ion (m/z)
1	PCB31	256	186
2	PCB28	256	186
5	PCB118	326	254
6	PCB153	360	290
15	Tetrachloroterphernyl	368	296
16	Benzo[b]fluoranthene	252	224

Sample:
1. PCB 31
2. PCB 28
3. PCB-52
4. PCB 101
5. PCB 153
6. PCB118
7. Benzo[c]fluorene
8. PCB138
9. PCB180
10. Benz[a]anthracene
11. Cyclopenta[c,d]pyrene
12. Chrysene
13. Trichlorotriphenyl
14. 5-Methylchrysene
15. Tetrachloroterphenyl
16. Benzo[b]fluoranthene
17. Benzo[k]fluoranthene
18. Benzo[j]fluoranthene
19. Benzo[e]pyrene
20. Benzo[a]pyrene
21. Pentachloroterphenyl
22. Indeno[1,2,3-cd]pyrene
23. Dibenzo[a,h]anthracene
24. Benzo[g,h,i]perylene
25. Dibenzo[a,l]pyrene
26. Dibenzo[a,e]pyrene
27. Dibenzo[a,i]pyrene
28. Dibenzo[a,h]pyrene

Unleash the Power of Fast GC PAH Analysis

ZB-PAH-EU
- Up to 70% Faster PAH Analysis
- Elevated Temperature Stability

- ZB-PAH-CT
- Enhanced Resolution for **Chrysene** and **Triphenylene**
- Increased Benzo[b,k]fluoranthene Separation

Factors Influencing Resolution

Master Resolution Equation

$$R_S = \frac{\sqrt{N}}{4} \cdot \frac{a-1}{a} \cdot \frac{k}{1+k}$$

Efficiency   **Selectivity**   **Retention**

N = theoretical plates $\alpha = k_2/k_1$ $k = (t_R - t_o)/t_o$

ZB-PAH-CT
Excellent Resolution of Chrysene and Triphenylene

Column: Zebron ZB-PAH-CT
40 meter x 0.18 mm x 0.14 μm
Sample:
1. Benzo[c]fluorene
2. Cyclopenta[c,d]pyrene
3. Benz[a]anthracene
4. Triphenylene
5. Chrysene
6. 5-Methylchrysene
7. Benzo[b]fluoranthene
8. Benzo[j]fluoranthene
9. Benzo[k]fluoranthene
10. Benzo[a]pyrene
11. Indeno[1,2,3-c,d]pyrene
12. Dibenzo[a,h]anthracene
13. Benzo[g,h,i]perylene
14. Dibenzo[a,l]perene
15. Dibenzo[a,e]perene
16. Dibenzo[a,i]perene
17. Dibenzo[a,h] perene

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ZB-PAH CT: Shorter Run Time & Better Sensitivity

Great resolution of Chrysene and Triphenylene

Zebron ZB-PAH-CT
30 meter x 0.25 mm x 0.20 μm

Better Sensitivity for later eluters

Popular Brand A
30 meter x 0.25 mm x 0.15 μm

27% Faster Analysis!

Sample:
1. Benzo[c]fluorene
2. Cyclopenta[c,d]pyrene
3. Benz[a]anthracene
4. Triphenylene
5. Chrysene
6. 5-Methylchrysene
7. Benzo[b]fluoranthene
8. Benzo[j]fluoranthene
9. Benzo[k]fluoranthene
10. Benzo[a]pyrene
11. Indeno[1,2,3-c,d]pyrene
12. Dibenzo[a,h]anthracene
13. Benzo[g,h,i]perylene
14. Dibenzo[a,l]perene
15. Dibenzo[a,e]perene
16. Dibenzo[a,i]perene
17. Dibenzo[a,h] perene

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ZB-PAH CT: Notice Selectivity Change
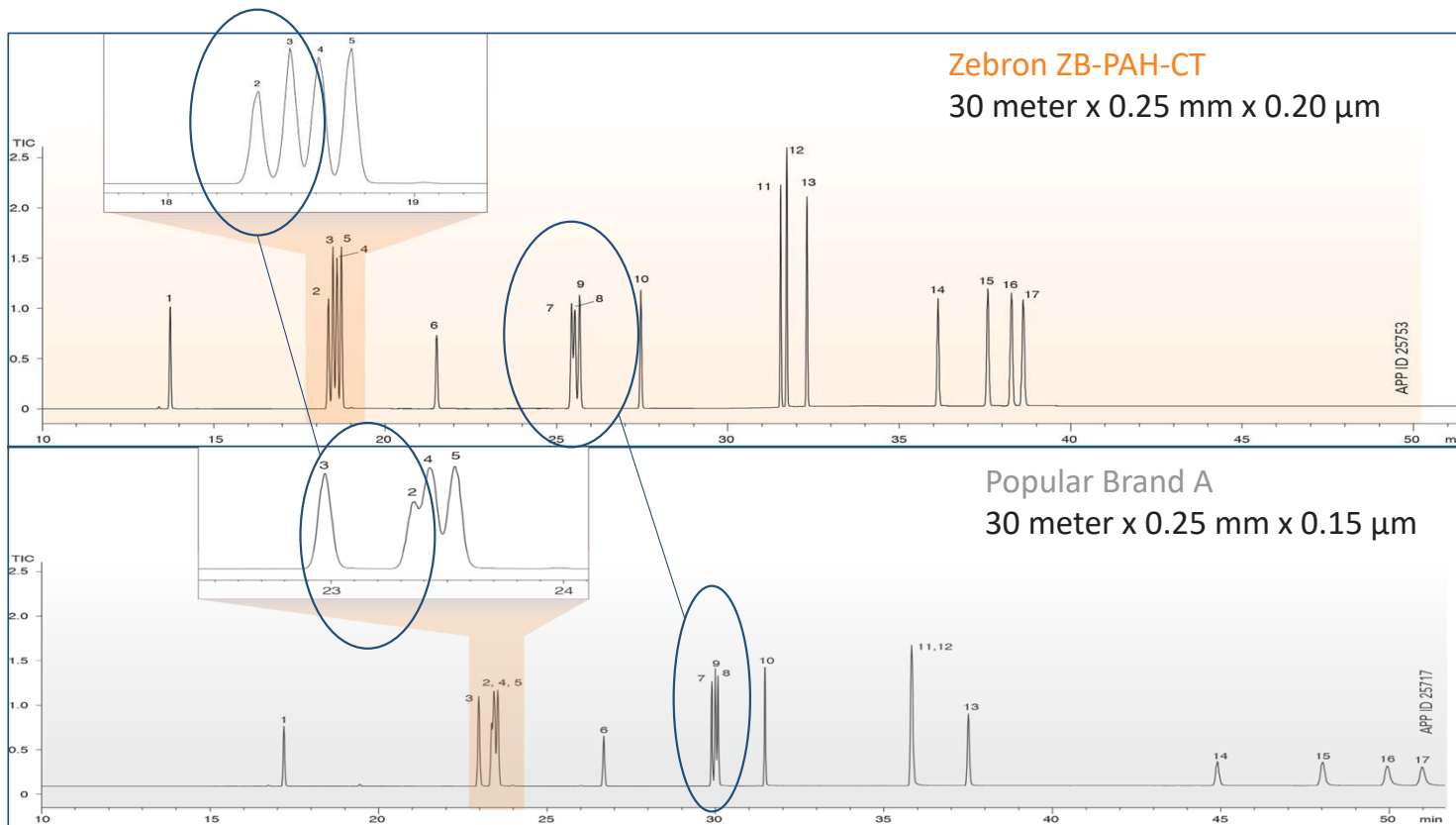
Zebron ZB-PAH-CT
30 meter x 0.25 mm x 0.20 μm

Popular Brand A
30 meter x 0.25 mm x 0.15 μm

Sample:
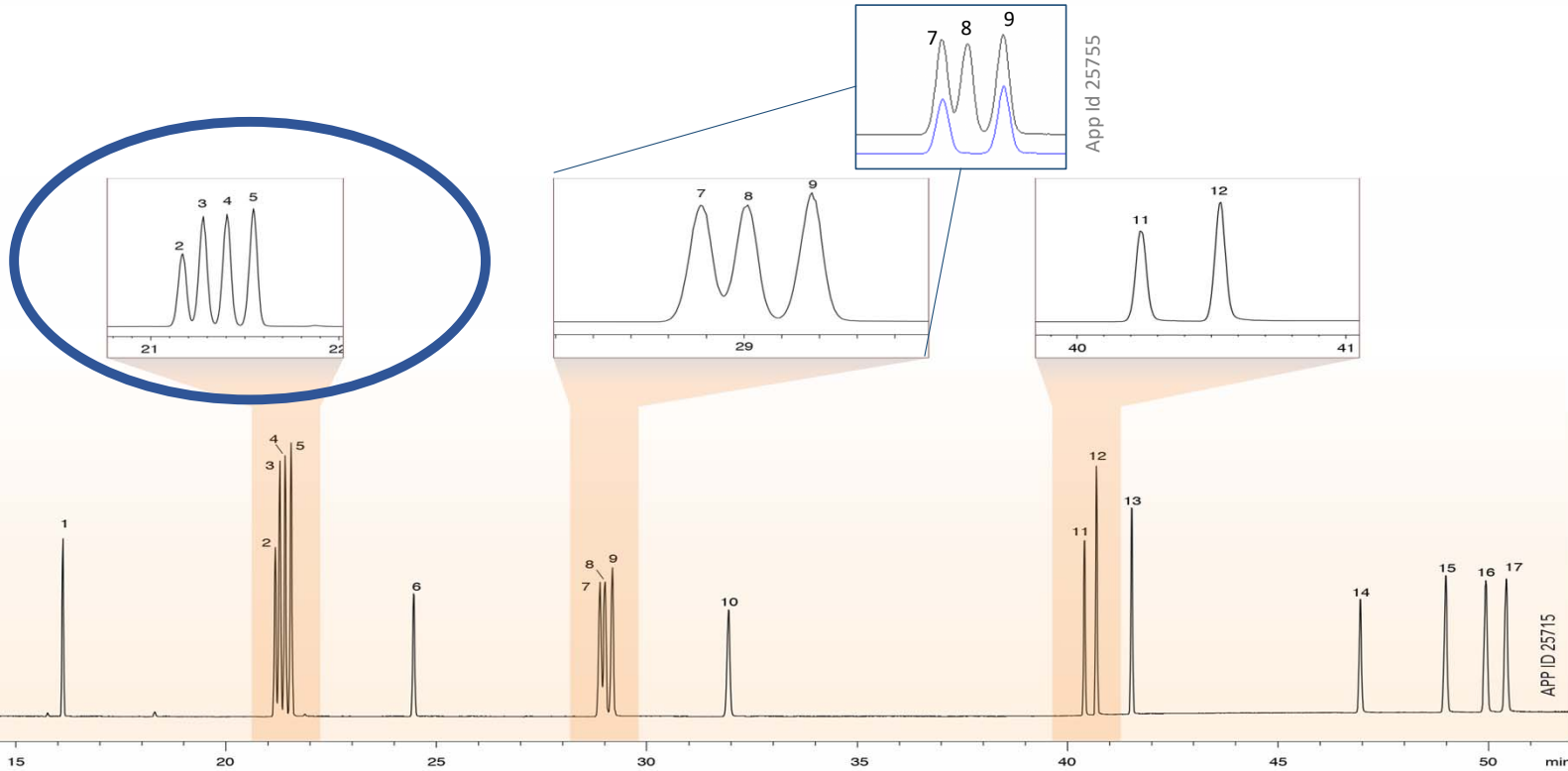1. Benzo[c]fluorene
2. **Cyclopenta[c,d]pyrene**
3. **Benz[a]anthracene**
4. Triphenylene
5. Chrysene
6. 5-Methylchrysene
7. **Benzo[b]fluoranthene**
8. **Benzo[j]fluoranthene**
9. **Benzo[k]fluoranthene**
10. Benzo[a]pyrene
11. Indeno[1,2,3-c,d]pyrene
12. Dibenzo[a,h]anthracene
13. Benzo[g,h,i]perylene
14. Dibenzo[a,l]perene
15. Dibenzo[a,e]perene
16. Dibenzo[a,i]perene
17. Dibenzo[a,h] perene

23

20m ZB-PAH CT

Short Run Time

App ID 26242

10m ZB-PAH CT

Short Run Time

App ID 26243
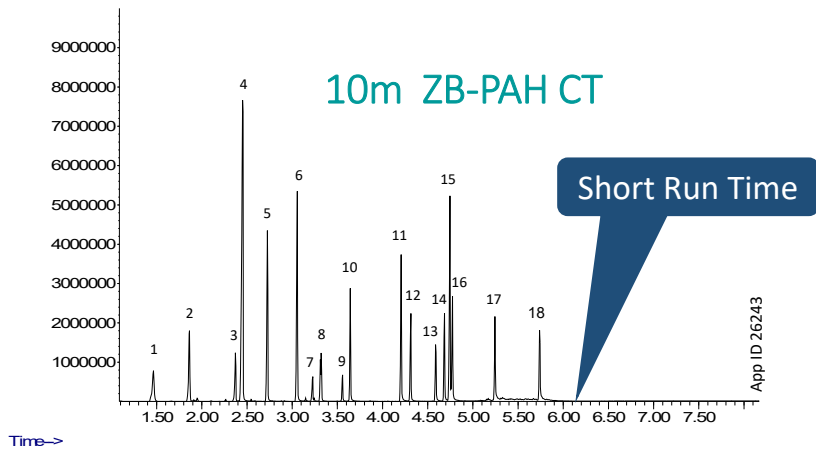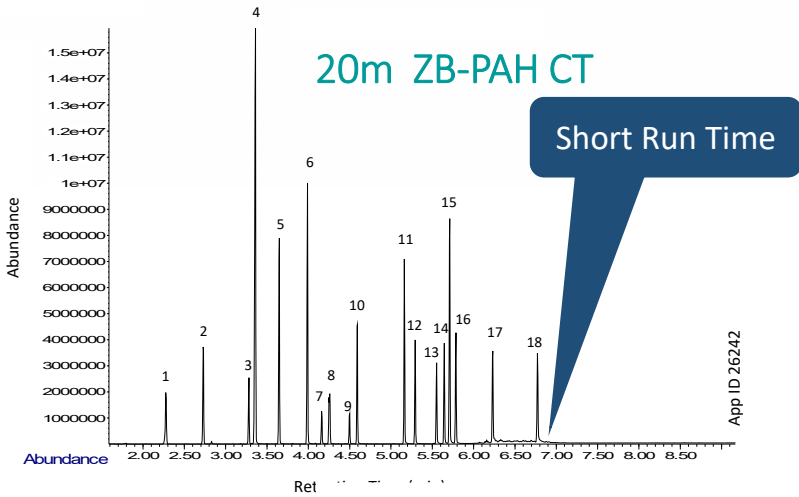
Separation of Phthalate on ZB-PAH CT

#	Analyte	Average RT(min) 20m Column	%RSD 20m column RT	Peak Area	Average RT (min) 10m column	%RSD 10m Column RT	Peak Area
1	Dimethyl phthalate	2.279	0.02	1.31	1.466	0.02	1.51
2	Diethyl phthalate	2.731	0.02	1.08	1.864	0.02	1.23
3	Diallyl phthalate	3.282	0.02	1.21	2.375	0.02	0.83
4	Dipropyl phthalate	3.361	0.02	9.57	2.454	0.02	0.72
5	Diisobutyl phthalate	3.649	0	0.7	2.729	0.02	1.51
6	Dibutyl phthalate	3.991	0	0.69	3.058	0.02	1.23
7	bis(2-Methoxyethyl)phthalate	4.164	0.01	0.53	3.229	0.02	8.41
8	bis(4-Methyl-2-pentyl)phthalate	4.261	0.01	0.98	3.325	0.02	0.72
9	bis(2-Ethoxyethyl)phthalate	4.501	0.01	1.28	3.559	0.01	3.46
10	Dipentyl phthalate	4.594	0.01	0.67	3.646	0.02	1.22
11	Dihexyl phthalate	5.164	0.01	0.72	4.208	0.01	0.97
12	Butylbenzyl phthalate	5.295	0.01	0.48	4.313	0.01	2.42
13	bis(2-Butoxyethyl)phthalate	5.554	0.02	1.29	4.592	0.02	3.41
14	Di(ethylhexyl) phthalate	5.646	0.03	0.5	4.687	0.01	0.94
15	Diheptyl phthalate	5.711	0.04	0.19	4.747	0.01	1.1
16	Dicyclohexyl phthalate	5.787	0.05	0.47	4.776	0.01	0.6
17	Di-n-octyl phthalate	6.232	0.09	0.57	5.246	0.02	0.84
18	Dinonyl phthalate	6.775	0.11	1.26	5.737	0.04	0.73

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EPA-8270 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

Peak	Analyte Name	RT (min)	Sim Ions (m/z)	Concentration (mg/L)
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

- Meets Tuning requirement for EPA 8270
- Over 40 different compounds
- Pesticides, Aromatics, Phenols, Amines, PAH

App No: 26447
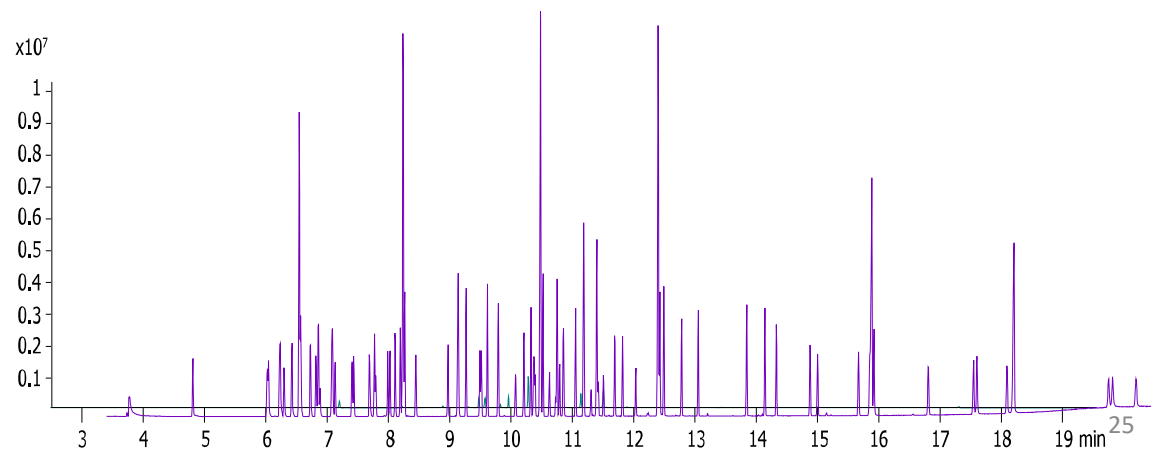
EPA-8270 on ZB-PAH CT
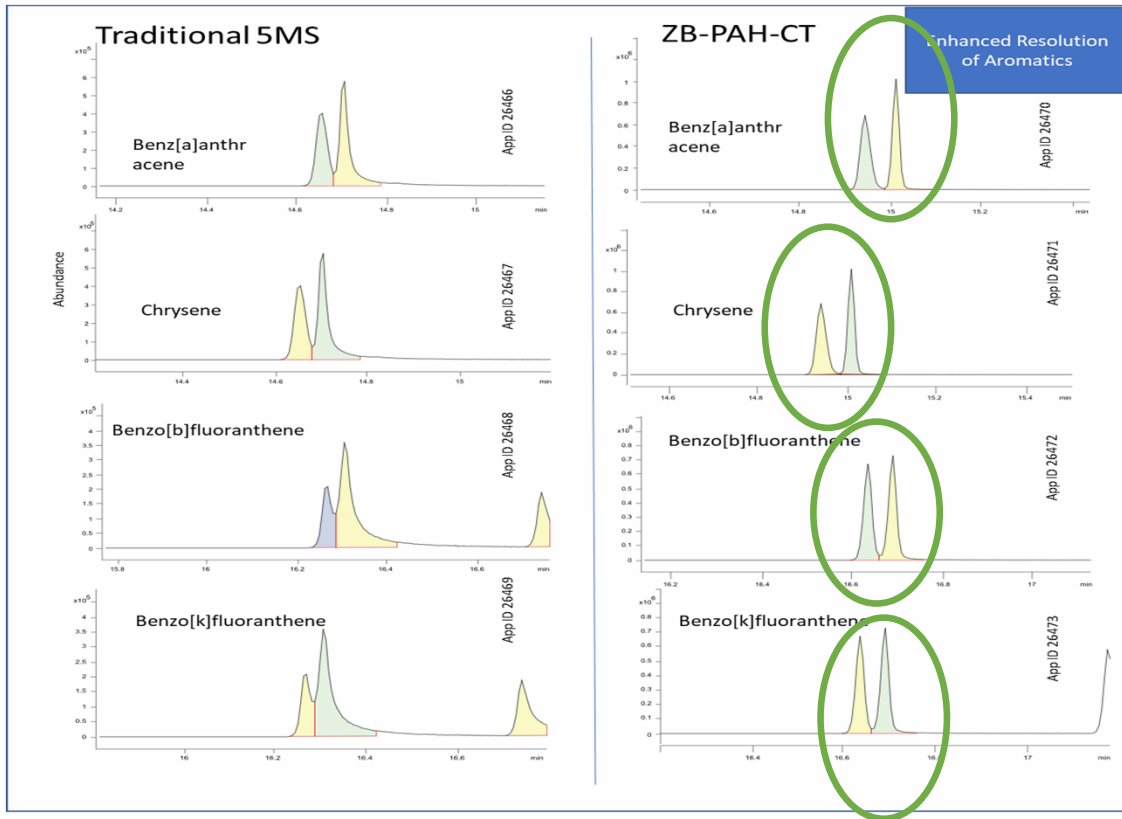
Enhanced Resolution of Aromatic Compounds

Summary

Polycyclic Aromatic Hydrocarbons

- PAH Terminologies & Regulations
- Challenges with PAH Analysis

ZB-PAH-EU

- Complete resolution of EU15+1 and EPA 610 PAHs
- Speed up your PAH Analysis
- PAH in Food
- One Column for PAH & PCB

ZB-PAH-CT

- Unique Selectivity for Chrysene & Triphenylene
- Short Run Time & better Sensitivity
- Phthalates in Food
- EPA-8270 Method Resolution Improvement

Thank You

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