Extra Fast Separation of 16 US EPA 610 Regulated PAHs on Agilent J&W Select PAH

Application Note

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Introduction

The difficulty in analyzing polycyclic aromatic hydrocarbons (PAHs) is that a number of them have the same mass. This makes their separation with GC/MS problematic, so that column selectivity and an optimized oven program are necessary for their resolution.

PAHs contain two or more aromatic rings and are formed during incomplete combustion or pyrolysis of organic matter, industrial processes, and cooking and food processing. Due to their carcinogenic activities, it is necessary to analyze PAHs in environmental and food samples. However, in PAH analysis, there is a difference between the European (EU) and American (EPA 610) legislation, with the EPA list used for environmental samples and the EU PAHs analyzed in food samples (Table 1). We describe here an optimized oven program for the Select PAH column that separates PAH in less than 7 minutes (Figure 1).

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Conditions

Technique:	GC/MS, Triple Quad
Column:	Select PAH, 15 m x 015 mm, df=0.10 µm (part number CP7461)
Sample:	SRM 1647c, concentration approximately 0.8-21 µg/mL (www.nist.com)
Injection Volume:	1 µL
Temperature:	70 °C (0.40 min), 120 °C/min, 180 °C, 40 °C/min, 350 °C (5 min)
Carrier Gas:	Helium, constant flow 1.2 mL/min
Injector:	300 °C, Splitless mode, 0.25 min @ 100 mL/min
Detector:	Triple Quad, EI in FS or SIM mode, ion source 275 °C, transfer line 300 °C

Results and Discussion

Conditions were optimized to give a fast separation of the 16 EPA PAHs. The most important isomers to resolve were phenanthrene and anthracene (m/z 178), benzo[b and k] fluoranthene (m/z 252), and indeno[1,2,3-c,d]pyrene and dibenzo[a,h]anthracene with m/z 276 and 278.

Table 1. Peak identification for Figure 1

Peak	MW	Compound	EPA 610	SFC1 and EFSA2 PAHs (15+1)	CAS
1	128	Naphthalene	x		91-20-3
2	152	Acenaphthylene	x		208-96-8
3	154	Acenaphthene	x		83-32-9
4	166	Fluorene	x		86-73-7
5	178	Phenanthrene	x		85-01-8
6	178	Anthracene	x		120-12-7
7	202	Fluoranthene	x		206-44-0
8	202	Pyrene	x		129-00-0
9	228	Benzo[a]anthracene	x	x	56-55-3
10	228	Chrysene	x	x	218-01-9
11	252	Benzo[b]fluoranthene	x	x	205-99-2
12	252	Benzo[k]fluoranthene	x	x	207-08-9
13	252	Benzo[a]pyrene	x	x	50-32-8
14	278	Dibenzo[a,h]anthracene	x	x	53-70-3
15	276	Indeno[1,2,3-c,d]pyrene	x	x	193-39-5
16	276	Benzo[g,h,i]perylene	x	x	191-24-2

[1] Scientific Committee on Food, one of the committees providing the European Commission with scientific advice on food safety. [2] European Food Safety Authority.

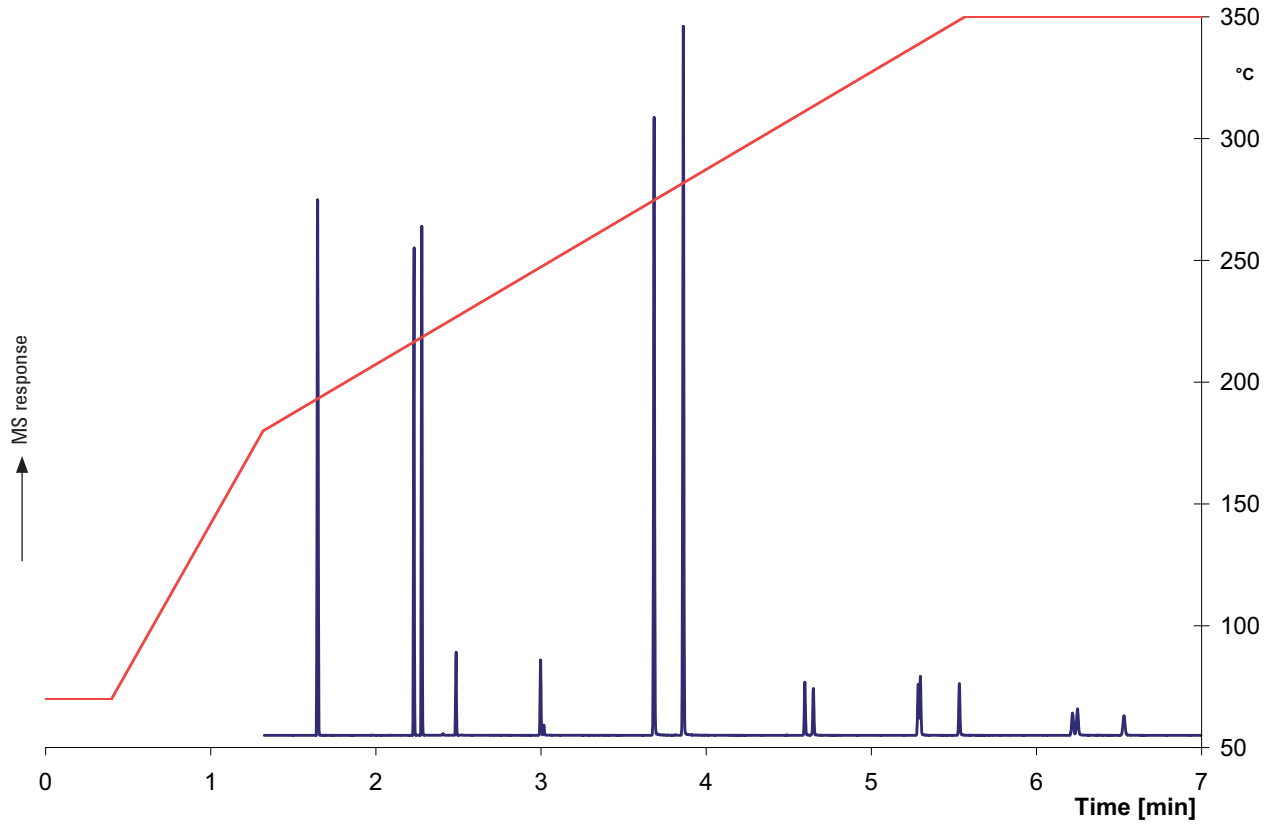

Figure 1. Fast GC/MS analysis of 16 US EPA PAHs on Select PAH

Table 2. Peak Identification for Figure 2

Peak	MW	Compound	EPA 610	CAS
1	128	Naphthalene	x	91-20-3
2	152	Acenaphthylene	x	208-96-8
3	154	Acenaphthene	x	83-32-9
4	166	Fluorene	x	86-73-7
5	178	Phenanthrene	x	85-01-8
6	178	Anthracene	x	120-12-7
7	202	Fluoranthene	x	206-44-0
8	202	Pyrene	x	129-00-0
9	228	Benzo[a]anthracene	x	56-55-3
10	228	Chrysene	x	218-01-9

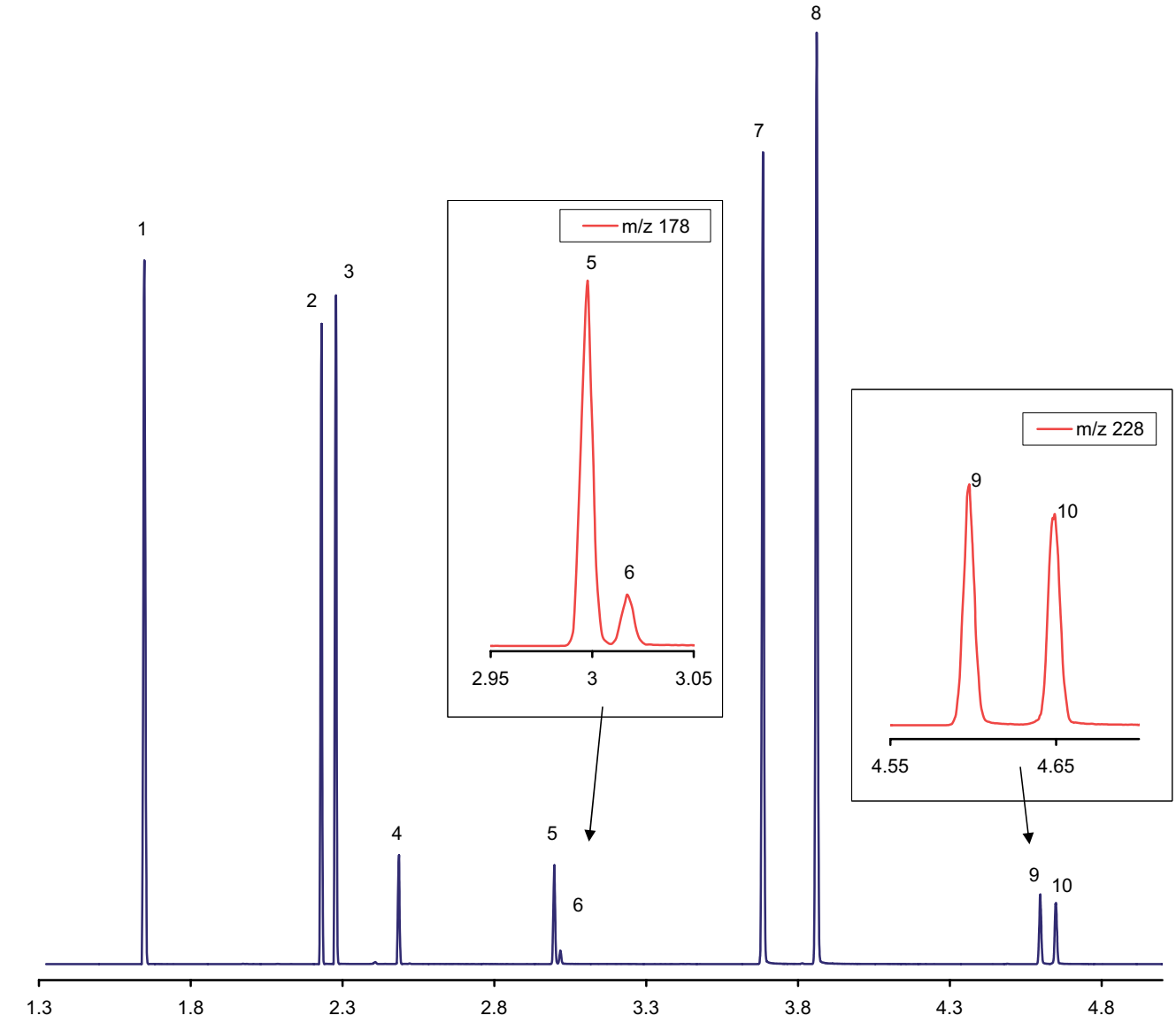

Figure 2. Details and peak identification, peak numbers 1 to 10

Table 3. Peak Identification for Figure 3

Peak	MW	Compound	EPA 610	CAS
11	252	Benzo[b]fluoranthene	x	205-99-2
12	252	Benzo[k]fluoranthene	x	207-08-9
13	252	Benzo[a]pyrene	x	50-32-8
14	278	Dibenz[a,h]anthracene	x	53-70-3
15	276	Indeno[1,2,3-c,d]pyrene	x	193-39-5
16	276	Benzo[g,h,i]perylene	x	191-24-2

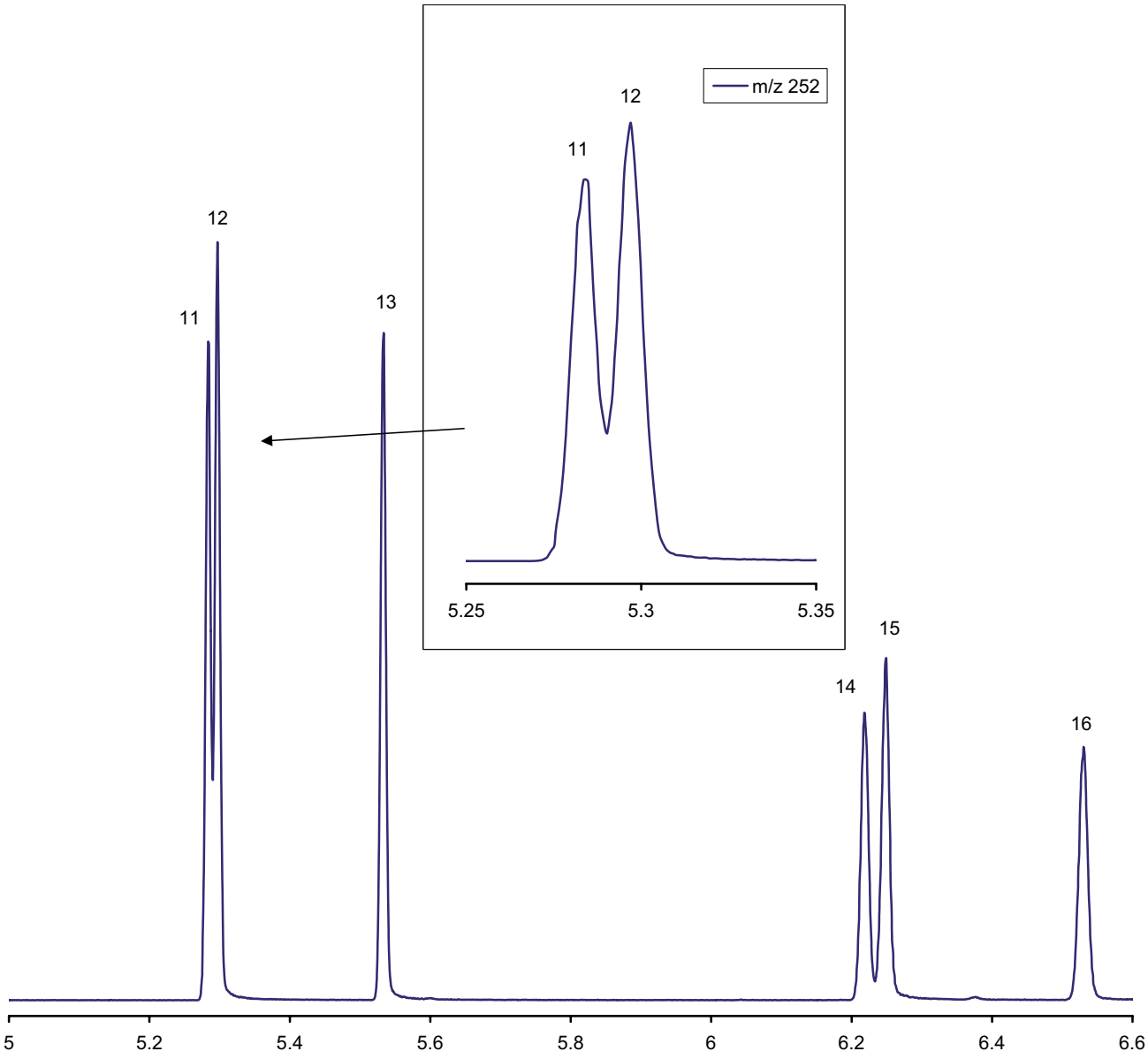

Figure 3. Details and peak identification, peak numbers 11 to 16

Conclusion

With the Select PAH GC column and the optimized oven program described here, all 16 EPA PAHs were resolved in a single run with a runtime of less than 7 minutes.

The Select PAH column also offers enhanced resolution of PAHs, preventing co-elution of interfering PAHs that can cause false positives and inaccurate results. Typical interferences are triphenylene on chrysene, and benzo[j] fluoranthene on benzo[k]fluoranthene. Application note SI-02259 describes the separation of 54 PAHs, including the 16 EPA PAHs and their interferences.

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Published in UK, October 11, 2010

SI-02282

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