Application Note

230006X

Analysis of Diesel Particulate Matters by Ultra High-Performance Liquid Chromatography using a High Theoretical Plate Column

Introduction

Ultra High-Performance Liquid Chromatography (UHPLC) is a separation method that employs columns packed with sub 2 µm packing materials, offering high column efficiency even at a high mobile phase linear velocity. The typical length of commercial column is 50 mm, however, 100 and 150 mm long columns are now available, offering much higher efficiency.

In this report, such a high-efficiency column is used for the analysis of diesel particulate matters, which are included in a complex matrix containing many concomitants.

Keyword: UHPLC, PAH, Diesel Particulate, 1.8 µm, C18 column, UV detector

Experimental

Equipment.		Conditions.	
Pump:	X-LC 3185PU x 2	Column:	ZORBAX SB-C18 (2.0 mmID x 50, 150 mmL, 1.8 µm)
Degasser:	X-LC 3080DG	Eluent:	A; Water, B; Acetonitrile, High-pressure gradient
Mixer:	X-LC 3180MX	Flow rate:	0.33, 0.5 mL/min
Column oven:	X-LC 3067CO	Column temp.:	40ºC
Autosampler:	X-LC 3159AS	Wavelength:	254 nm
Detector:	X-LC 3070UV	Injection volume:	1 µL
		Standard sample:	PAH mixture (EPA 610 16 Mix Solution 20 ppm each in acetonitrile), Diesel exhaust particles

Results

Fig. 1 shows the chromatograms of the standard mixture of 16 polycyclic aromatic hydrocarbons (PAHs). The upper one was obtained by using a 50 mm long column, while the lower one was by a 150 mm long column. Peak resolutions (Rs) between benzo[b]fluoranthene, benzo[k]fluoranthene and benzo[a]pyrene, which are known to be difficult to separate among the 16 types of components, are calculated to be Rs=1.2(Peak 1&2), Rs=1.3(Peak 2&3) for a 50 mm column, and Rs=2.0 (peak 1&2) Rs=3.1(peak 2&3) for a 150 mm column, respectively. It is apparent that a 150 mm long column offers significantly better resolutions than a 50 mm long column.

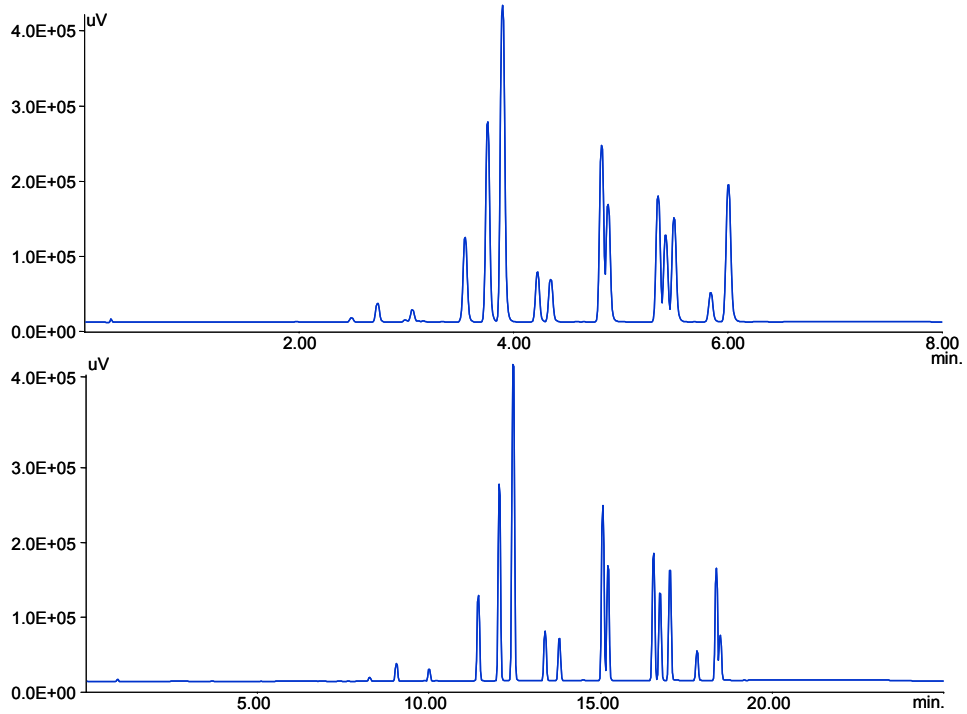

Fig. 1. Chromatograms of PAH standard mixture (Upper: column length = 50 mm, Lower: column length = 150 mm).
1: Benzo[b]fluoranthene, 2:Benzo[k]fluoranthene, 3: Benzo[a]pyrene

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Fig. 2 shows the chromatograms of components in diesel particulate matters. Seventy-nine (79) peaks were detected by using a 50 mm long column, while one-hundred and forty-three (143) peaks were detected by using a 150 mm long column. Although the analysis time is about 3 times longer, the use of a 150 mm long column gives better results for a multi-component sample in such a case as this.

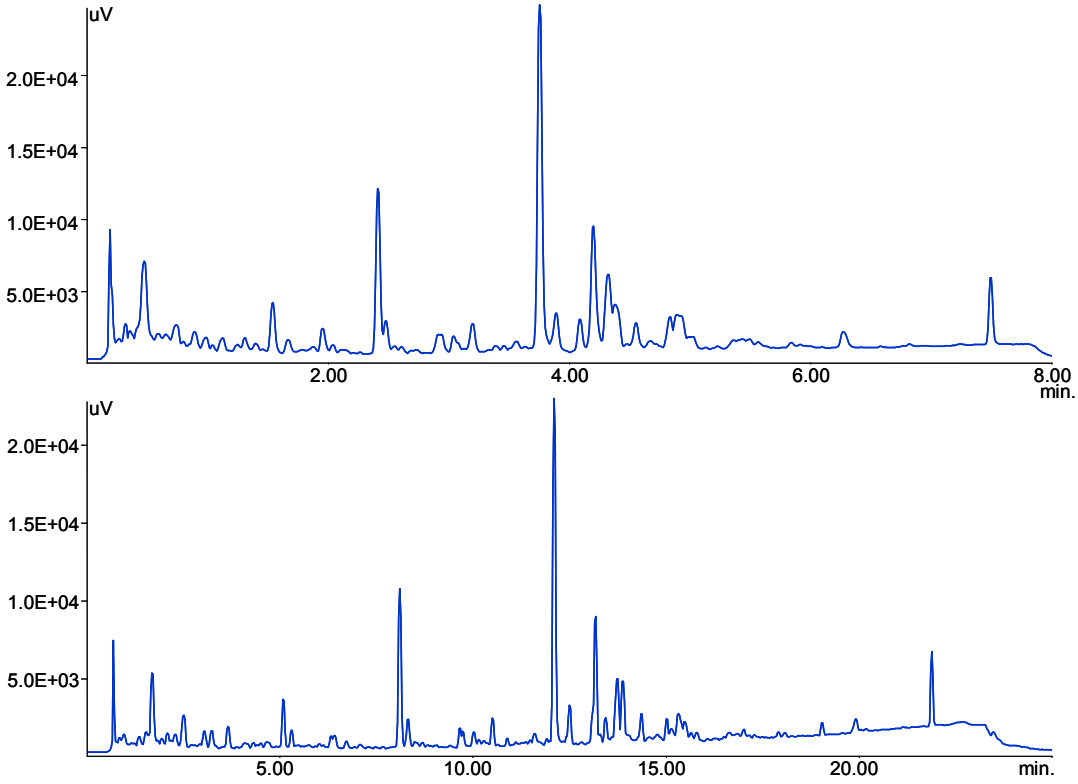

Fig. 2. Chromatograms of components in diesel particulate matters (Upper: column length = 50 mm, Lower: column length = 150 mm)

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