

High-Speed Analysis of Polycyclic Aromatic Hydrocarbons in Diesel Exhaust Particulate Matters by Ultra High-performance Liquid Chromatography with Photodiode Array Detection

Introduction

Polycyclic aromatic hydrocarbons (PAHs) are chemicals generated when fuels are incompletely combusted, which are contained in industrial and car exhaust and are known as the main source of air pollution. Some of them are categorized as carcinogens and these compounds are subjected to the regulations of governmental agencies such as EPA (Environmental Protection Agency) of U.S.A.

In this paper, PAHs in diesel exhaust particulate matters are measured by Ultra High-performance Liquid Chromatography (UHPLC) with PDA detection which enables ultra high-speed data acquisition rate at 100 spectra/sec. and the analysis results are reported.

Keyword: UHPLC, diesel exhaust, polycyclic aromatic hydrocarbon, PAHs, 1.8 μm packing material, C18 column, PDA detector

Experimental

Equipment

Pump: X-LC 3185PU x 2
 Degasser: X-LC 3080DG
 Mixer: X-LC 3180MX
 Column oven: X-LC 3067CO
 Autosampler: X-LC 3159AS
 Detector: X-LC 3110MD

Conditions

Column: ZORBAX Eclipse PAH (2.0 mmID x 50 mmL, 1.8 μm)
 Eluent A: Water
 Eluent B: Acetonitrile
 Gradient condition: (A/B), 0 min (60/40) \rightarrow 5.0 min (0/100) \rightarrow 6.5 min (0/100) \rightarrow 6.55 min (60/40) 1 cycle; 9.0 min
 Flow rate: 0.6 mL/min
 Column temp.: 30°C
 Wavelength: 200-500 nm
 Injection volume: 1 μL
 Standard sample: PAH mixture (EPA 610 16 Mix Solution 20 ppm each in acetonitrile)

Results and Discussion

Fig. 1 shows the chromatogram of PAH standard mixture (EPA 610) and contour plot. 16 compounds were clearly separated within 6 minutes.

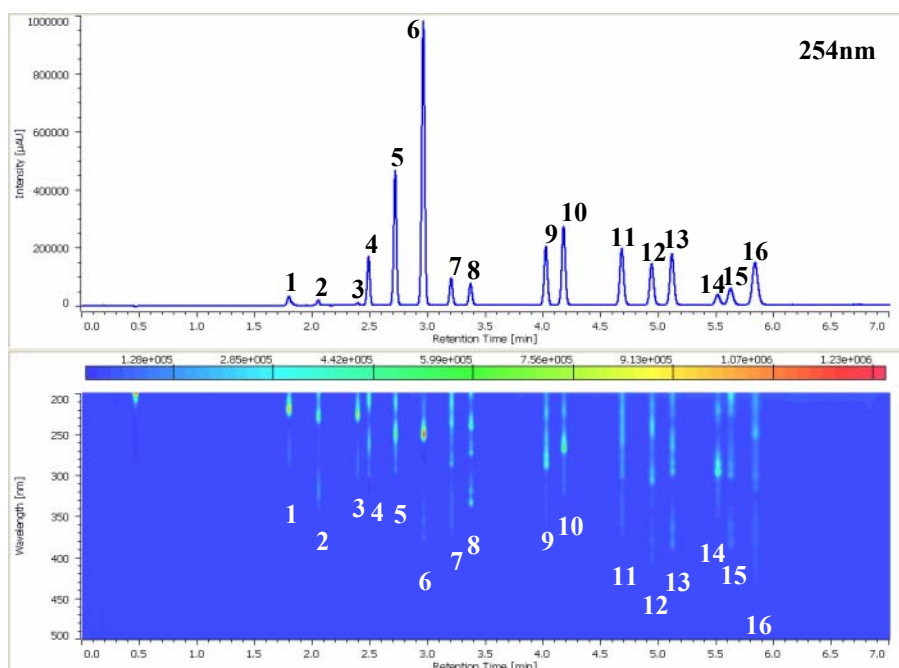


Fig. 1. Chromatogram of PAH standard mixture. 1: Naphthalene, 2: Acenaphthylene, 3: Acenaphthene, 4: Fluorene, 5: Phenanthrene, 6: Anthracene, 7: Fluoranthene, 8: Pyrene, 9: Benzo[a]anthracene, 10: Chrysene, 11: Benzo[b]fluoranthene, 12: Benzo[k]fluoranthene, 13: Benzo[a]pyrene, 14: Dibenzo[ah]anthracene, 15: Benzo[ghi]perylene, 16: Indeno[123-cd]pyrene

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Fig. 2 shows the Chromatogram and contour plot of the sample solution that is extracted from diesel exhaust particulate matters with Soxhlet extraction. It was confirmed from the spectral information that some PAHs were detected.

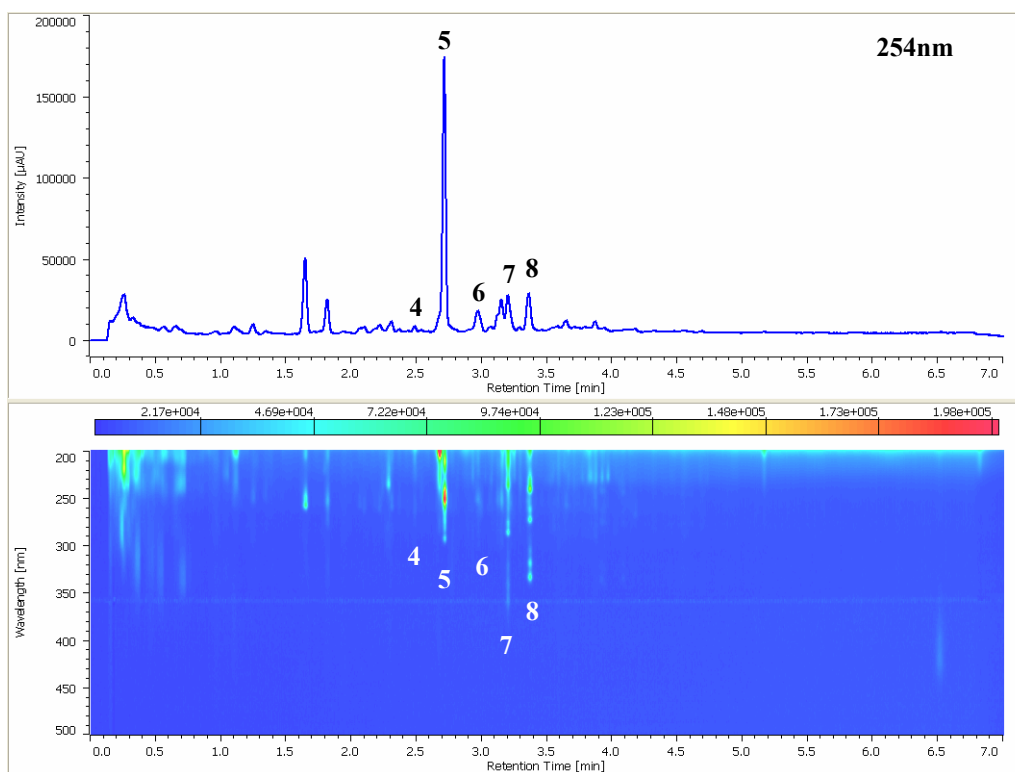


Fig. 2. Chromatogram of extract from diesel exhaust particulate matters. The peak numbers and corresponding compounds are the same as in Fig. 2.

Sample preparation.

Sample solution was filtrated using 0.2 um membrane filter after Soxhlet extraction.