Application Note

No. 820001S-E

Supercritical Fluid Extraction (SFE) of Airborne Particulate Matters as Preparation for HPLC Analysis of Benzo(a)pyrene

Introduction

Among 234 airborne pollutants the polycyclic aromatic hydrocarbon benzo-(a)-pyrene has been assigned as one of the priotrity pollutants by Central Environment Council, Ministry of the Environment, Japan. This material is reported to have carcinogenic and other adverse health effects and the monitoring has been conducted to determine its origins.
The conventional measurement method requires time-consuming Soxhlet extraction of collected particulate matters using benzene and other hazardous organic solvents. We have investigated the applicability of Supercritical Fluid Extraction of benzo(a)pyrene in airborne particulate matters using carbon dioxide as a sample preparation method for HPLC analysis.

Keywords: Benzo(a)pyrene; SFE; Fluorescence detection; Airborne particulate matters; HPLC

Conditions

[SFE]

System:	SCF-201
Extraction vessel:	10 mL (capacity)
CO_2 flow rate:	3.0 mL/min
CH_3OH flow rate:	0.3 mL/min
Extraction Pressure:	30 Mpa
Extraction temp.:	80 °C
Trap column:	SCFpak SIL C1 TP (4.6 mm I.D. x 35 mm)
Extraction time:	55 min with a mixture of CO_2 and CH_3OH and then 10 min with pure CO_2

[HPLC]

Column:	Crestpak PAHs
Column temp.:	40 °C
Eluent:	H_2O/CH_3CN (15/85)
Flow rate:	1.0 mL/min
Wavelengths:	Ex 365 nm, Em 410 nm, Gain x 100
Sample:	the extract of airborne particulate matters
Injection volume:	20 µL

Experimental

Collection of airborne particulate matters and sample preparation :

1. A high volume air sampler equipped with a quartz fiber filter (sampling area 18 x 23 cm) was run at 1000 L/min for 24 hrs (collected air volume 1440 m^3).
2. Fifteen-millimeter diameter pieces were punched out from the filter and a set of 10 pieces were subjected to supercritical fluid extraction and the extract was collected.
3. Components trapped on the trap column was eluted with 27 mL of acetonitrile and the effluent was collected.
4. The extract in 2 and the wash liquid in 3 were made up to 50 mL with acetonitrile.
5. 20 mL was injected into the HPLC.

Results and Discussion

Figure 1 shows the HPLC chromatogram of the extract containing benzo(a)pyrene with a fluorescence detector. In this method, the collection recovery was 95.4 % (in comparison with that by ultrasonic extraction, n=3). The use of carbon dioxide supercritical fluid provides an easy, fast, and highly efficient extraction method.

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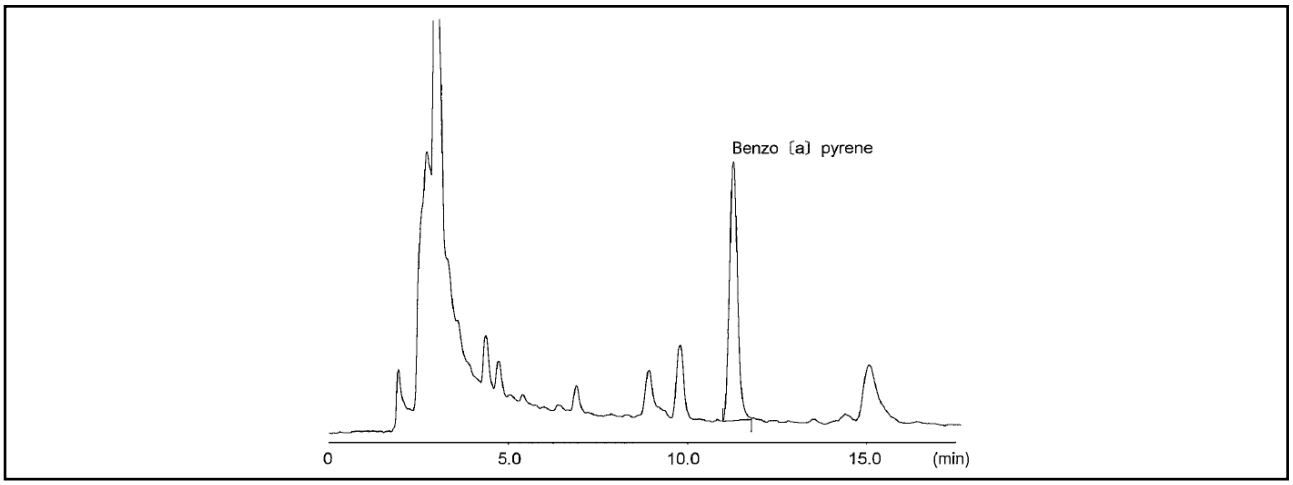

Figure 1 Chromatogram of benzo(a)pyrene in the extract with a fluorescence detector. Column: Crestpak PAHs, Column temp.: 40 °C, Eluent: H_2O/CH_3CN (15/85), Flow rate: 1.0 mL/min, Wavelengths: Ex 365 nm, Em 410 nm, Gain x 100, Sample: the extract of airborne particulate matters, Injection volume: 20 µL

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