

Analysis of Polycyclic Aromatic Hydrocarbons (PAHs) Using a Core Enhanced Technology Accucore HPLC Column

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Abstract

This application note demonstrates the use of the Thermo Scientific Accucore RP-MS HPLC column for the separation of sixteen PAHs.

Introduction

Accucore™ HPLC columns use Core Enhanced Technology™ to facilitate fast and high efficiency separations. The 2.6 µm diameter particles are not totally porous, but rather have a solid core and a porous outer layer. The optimized phase bonding creates a series of high coverage, robust phases. Accucore RP-MS uses an optimized alkyl chain length for more effective coverage of the silica surface. This coverage results in a significant reduction in secondary interactions and thus highly efficient peaks with very low tailing. The tightly controlled 2.6 µm diameter of Accucore particles results in much lower backpressures than typically seen with sub-2 µm materials.

This group of sixteen PAHs are targeted by the United States Environmental Protection Agency (EPA Method 610) as priority pollutants. They are often found in soil and sediment and are known to be carcinogenic, mutagenic and teratogenic. Natural sources of PAHs include volcanic activity and forest fires. Man-made sources of PAHs include incomplete combustion of fossil fuels, waste incineration, tobacco smoke and barbequed meat.

The separation of these sixteen PAHs is demonstrated in this application.



Experimental details

| Chemicals and Reagents | Part Number |
|--|----------------|
| Fisher Scientific HPLC grade water | W/0106/17 |
| Fisher Scientific HPLC grade acetonitrile | A/0626/17 |
| Fisher Scientific HPLC grade methanol | M/4056/17 |
| NSC Mass Spec Certified 2 mL clear vial with blue bonded PTFE silicone cap | MSCERT4000-34W |

Sample Preparation

PAH calibration mix bought in from Sigma Aldrich contained 10 µg/mL of each of the following components in acetonitrile: naphthalene, acenaphthylene, acenaphthene, fluorene, phenanthrene, anthracene, fluoranthene, pyrene, benzo(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, dibenzo(a,h)anthracene, benzo(ghi)perylene, indeno(1,2,3-cd)pyrene.

| Separation Conditions | Part Number | | |
|-----------------------|--|-----------|-----------|
| Instrumentation: | Thermo Scientific Accela UHPLC System | | |
| Column: | Accucore RP-MS 2.6 µm, 150 mm x 2.1 mm 17626-152130 | | |
| Measured pressure: | 460 bar | | |
| Column temperature: | 25 °C | | |
| Injection volume: | 2 µL | | |
| Flow rate: | 0.4 mL/min | | |
| UV detection: | 254 nm | | |
| Mobile phase A: | water | | |
| Mobile phase B: | methanol | | |
| Mobile phase C: | acetonitrile | | |
| Gradient: | | | |
| Time | A% | B% | C% |
| 0.00 | 40 | 40 | 20 |
| 0.50 | 40 | 40 | 20 |
| 20.00 | 0 | 0 | 100 |

Key Words

- Polycyclic aromatic hydrocarbons (PAHs)
- Accucore RP-MS
- Fused core
- Superficially porous
- Core enhanced technology
- Environmental

Results

The analysis was carried out on an Accucore RP-MS 2.6 μm , 150 x 2.1 mm column. The sixteen PAHs eluted in approximately sixteen minutes (Figure 1). Replicate injections of the PAH mix showed that Accucore RP-MS produced stable and reproducible results (Table 2).

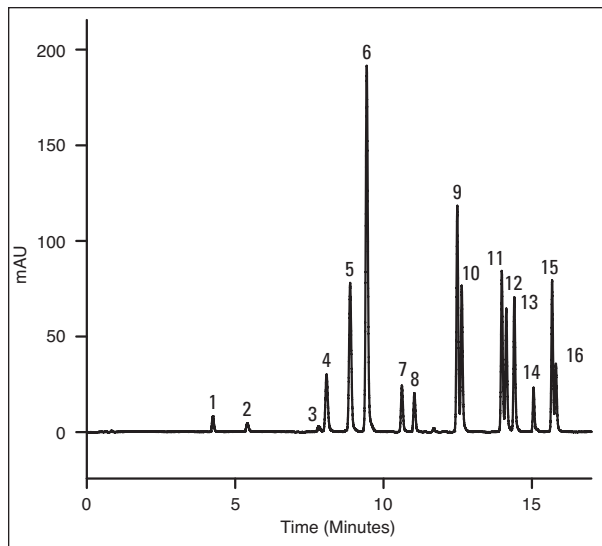


Figure 1: Separation of sixteen PAHs on an Accucore RP-MS 2.6 μm , 150 mm x 2.1 mm column

Conclusions

The Accucore RP-MS column successfully separated sixteen PAHs in approximately sixteen minutes. Accucore RP-MS columns are therefore an excellent choice for the analysis of PAHs.

| Analyte | Analyte Name | Retention Time (minutes) | % RSD on Retention Time |
|---------|------------------------|--------------------------|-------------------------|
| 1 | Naphthalene | 4.26 | 0.59 |
| 2 | Acenaphthylene | 5.43 | 0.58 |
| 3 | Acenaphthene | 7.83 | 0.38 |
| 4 | Fluorene | 8.10 | 0.37 |
| 5 | Phenanthrene | 8.89 | 0.32 |
| 6 | Anthracene | 9.45 | 0.28 |
| 7 | Fluoranthene | 10.63 | 0.21 |
| 8 | Pyrene | 11.05 | 0.20 |
| 9 | Chrysene | 12.49 | 0.17 |
| 10 | Benzo(a)anthracene | 12.65 | 0.17 |
| 11 | Benzo(b)fluoranthene | 14.00 | 0.15 |
| 12 | Benzo(k)fluoranthene | 14.15 | 0.14 |
| 13 | Benzo(a)pyrene | 14.41 | 0.13 |
| 14 | Dibenzo(a,h)anthracene | 15.06 | 0.12 |
| 15 | Indeno(1,2,3-cd)pyrene | 15.69 | 0.11 |
| 16 | Benzo(ghi)perylene | 15.81 | 0.11 |

Table 2: Method precision (%RSD) for sixteen PAHs (data calculated from six replicate injections)

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