



# Two Methods for Quick Analysis of Polycyclic Aromatic Hydrocarbons (PAHs) Using the Axcend Focus LC<sup>®</sup>

## Abstract

The Axcend Focus LC<sup>®</sup> was used to separate polycyclic aromatic hydrocarbons (PAHs) in ~12 and ~15 minutes, respectively, with separate methods on short (10 cm x 150  $\mu$ m i.d.) capillary columns packed with 1.7  $\mu$ m monomeric and 3.0  $\mu$ m diameter polymeric C18 particles.

As a lightweight, hand-portable, AC- or DC-powered high-performance liquid chromatography system that utilizes capillary columns and on-column UV-absorption detection, the Axcend Focus LC is uniquely suited for both in-the-field or laboratory-based HPLC detection, separation and analysis of a variety of target chemicals, including products and by-products of fossil fuels, pollutants, and agrichemicals, to name a few.

## Introduction

PAHs are ubiquitous environment pollutants typically formed by incomplete combustion of organic matter by nature or humans. As primary pollutants (including many that are carcinogenic), PAHs are regularly monitored by corporate, government, and non-government organizations (NGOs) alike. Because PAHs strongly absorb UV light and many PAHs are also isomers (compounds with identical chemical formulas but different structures), UV-based HPLC is highly effective for separating, detecting, and analyzing PAHs.

The Axcend Focus LC offers laboratory-quality separation in a compact, portable format. This work highlights two methods for rapid PAH analysis: a nine-compound method optimized for speed, and a 16-compound method optimized for resolution.

## Materials and Methods

### Instrumentation

The Axcend Focus LC equipped with an on-column UV-absorption detector at 255 nm was used for this analysis.

## Run Conditions

### Method 1 – 9 PAHs

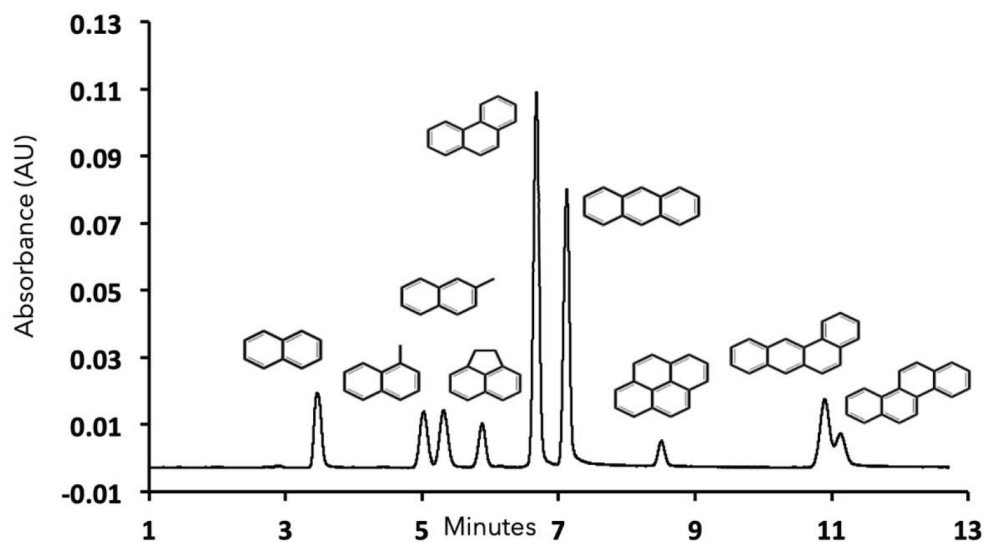
|                      |                                                                                                                                    |
|----------------------|------------------------------------------------------------------------------------------------------------------------------------|
| Column               | 10 cm × 150 µm i.d., 1.7 µm dp, 100 Å monomeric C18                                                                                |
| Mobile Phase A       | Water (H <sub>2</sub> O)                                                                                                           |
| Mobile Phase B       | Acetonitrile (ACN)                                                                                                                 |
| Gradient Program     | 40% to 60% B                                                                                                                       |
| Detection Wavelength | 255 nm                                                                                                                             |
| Flow Rate            | 3.5 µL/min                                                                                                                         |
| Equilibration Time   | 2 min                                                                                                                              |
| Analytes             | Naphthalene, 1-methylnaphthalene, 2-methylnaphthalene, acenaphthene, phenanthrene, anthracene, pyrene, benz[a]anthracene, chrysene |
| Run Time             | ~12 min                                                                                                                            |

### Method 2 – 16 PAHs

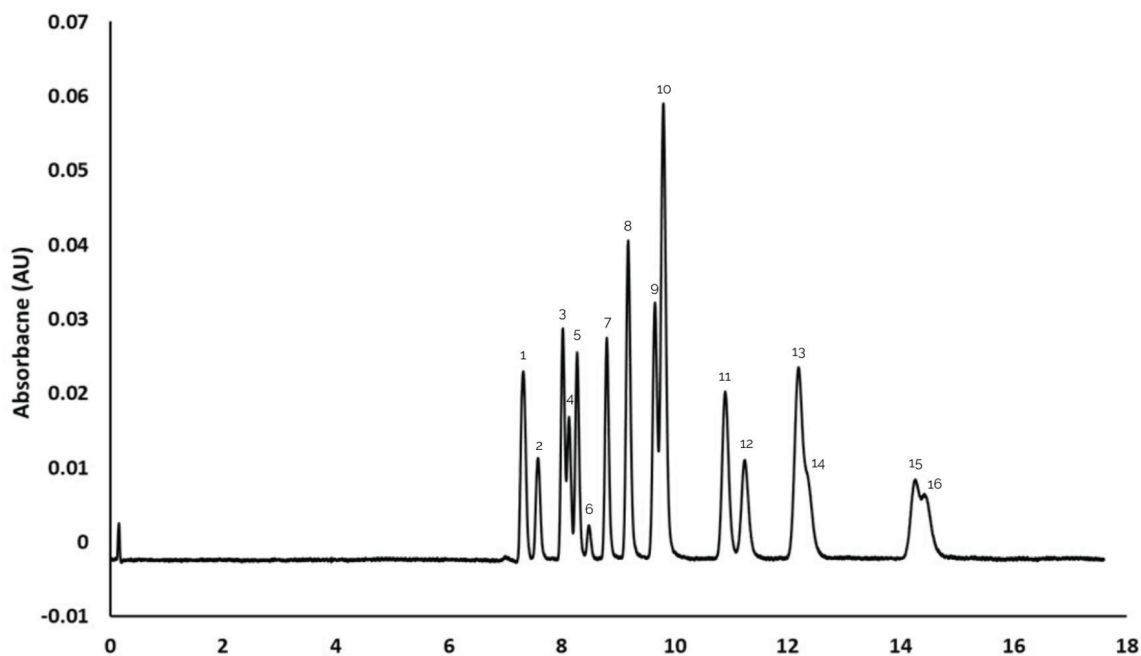
|                      |                                                                                                                                                                                                                                                                 |
|----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Column               | 10 cm × 150 µm i.d., 3.0 µm dp, 100 Å polymeric C18                                                                                                                                                                                                             |
| Mobile Phase A       | Water (H <sub>2</sub> O)                                                                                                                                                                                                                                        |
| Mobile Phase B       | Acetonitrile (ACN)                                                                                                                                                                                                                                              |
| Gradient Program     | 55% to 100% B                                                                                                                                                                                                                                                   |
| Detection Wavelength | 255 nm                                                                                                                                                                                                                                                          |
| Flow Rate            | 0.64 µL/min                                                                                                                                                                                                                                                     |
| Equilibration Time   | 5 min                                                                                                                                                                                                                                                           |
| Analytes             | Naphthalene, acenaphthylene, acenaphthene, fluorene, phenanthrene, anthracene, fluoranthene, pyrene, benz[a]anthracene, chrysene, benzo[b]fluoranthene, benzo[k]fluoranthene, benzo[a]pyrene, dibenz[a,h]anthracene, benzo[ghi]perylene, indeno[1,2,3-cd]pyrene |
| Run Time             | ~15 min                                                                                                                                                                                                                                                         |

## Results

Both methods produced well-resolved chromatograms of target PAHs in under 20 minutes a sample. The nine-PAH method provided fast separation suitable for high-throughput applications, while the 16-PAH method delivered improved resolution for more complex mixtures. The UV detection at 255 nm yielded clear peaks for all analytes, with even closely eluting compounds distinguishable.



**Figure 1.** Separation and UV-absorption detection of nine PAHs of interest. Elution order: naphthalene, 1-methylnaphthalene, 2-methylnaphthalene, acenaphthene, phenanthrene, anthracene, pyrene, benz[a]anthracene, and chrysene (only slightly resolved).



**Figure 2.** Separation and UV-absorption detection of sixteen PAHs of interest. Elution order: naphthalene, acenaphthylene, acenaphthene, fluorene, phenanthrene, anthracene, fluoranthene, pyrene, benz[a]anthracene, chrysene, benzo[b]fluoranthene, benzo[k]fluoranthene, benzo[a]pyrene, dibenz[a,h]anthracene, benzo[ghi]perylene, and indeno[1,2,3-cd]pyrene.

## Conclusion

The Axcend Focus LC enables rapid and effective analysis of PAHs in both laboratory and field environments. Because of its relatively low cost, minimal solvent consumption, and minimal waste production, the Axcend Focus LC offers a significant reduction in the Total Cost of Ownership (TCO) for organizations that use HPLCs to separate and analyze samples to detect the presence and concentrations of PAHs. An added bonus is that this approach clearly qualifies as "green" analytical chemistry.