



Wide Dynamic Range Analysis of PAHs by SIFI GC/MS

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Polycyclic aromatic hydrocarbons (PAHs) are a group of chemicals formed by the incomplete combustion of many materials including coal, oil, gas, wood, garbage, and are also present in other substances such as tobacco and asphalt. The widespread presence, high rate of human and the risk of health effects have prompted a number of worldwide regulations and warnings concerning the use and disposal of PAHs. The European Union (EU) and the U.S. Environmental Protection Agency (EPA), among others, have set standards for the levels of PAHs in consumer goods and for environmental testing of soil and water. Both the World Health Organization (WHO) and Occupation Safety and Health Administration (OSHA) have set exposure levels as guidelines for human health and workplace safety.

The regulation of PAHs has created the need to determine the concentration of PAHs in a wide range of materials. Each type

of material requires its own sample preparation technique and will not be discussed here; the concentrations mentioned in this note reflect the actual concentration of the solution injected into the GC/MS system. This method, utilizing a PerkinElmer® Clarus® GC/MS, will quantitate 16 PAHs across a very wide range (5 ppb to 100 ppm) in a single run using single ion and full ion (SIFI) scanning technology. Another important element to successfully analyzing PAHs is achieving the key chromatographic separations (Benzo (B) & Benzo (K) Fluoranthene).

Experimental Conditions

The Clarus GC/MS used in this technique was configured with a liquid autosampler, a capillary injector port, and TurboMass™ 5.2 GC/MS software. Inside the injector port a 4-mm liner with wool interfaced with a 30 m × 0.25 mm × 0.25 μm Elite-5MS column. A 5-μL autosampler syringe was used to make a 1-μL injection into a 300 °C injector port. During injection, the column flow rate of helium was increased from 1 mL/min to 2 mL/min; this achieved a pressure-pulsed injection to help control the solvent expansion. The injection was splitless for 0.75 minutes, after which the flow rate was reduced and the split vent open to 50 mL/min (the split ratio was reduced to 20 mL/min after 5 additional minutes to save gas). The GC oven began at 45 °C and was ramped at 25 °C/min to 260 °C, then ramped at 6 °C /min until the elution of Benzo(B) & Benzo(K)fluoranthene. The oven was finally ramped at the maximum rate to 330 °C. The mass spectrometer method scanned from 75 to 300 u, with a scan time of 0.1 seconds and an inter-scan delay 0.05 seconds. Nine single ion monitoring functions were set with a dwell time of 0.08 seconds per ion. The functions were limited to 3 ions each aside from function 9, which had 5 ions as a result of the co-elution of Indeno(1,2,3-cd)pyrene and Dibenz(a,h)anthracene.

Conclusion

The fast cycle time, low-level sensitivity with a large dynamic range and the SIFI capabilities of the PerkinElmer Clarus GC/MS allows laboratories to quickly and reliably separate, identify and quantitate a wide range of PAHs at both low and high levels.

References

- (1) <http://www.atsdr.cdc.gov/toxprofiles/phs69.html>

Compound	5 ppb–100 ppm (R ² value)
Fluoranthene	0.9991
Pyrene	0.9992
Benzo(a)anthracene	0.9990
Chrysene	0.9997
Benzo(b)fluoranthene	0.9998
Benzo(k)fluoranthene	0.9997
Benzo(a)pyrene	0.9992
Indeno(1,2,3-cd)pyrene	0.9988
Dibenzo(a,h)anthracene	0.9999

Resolution of Benzo(b) and Benzo(k)fluoranthene

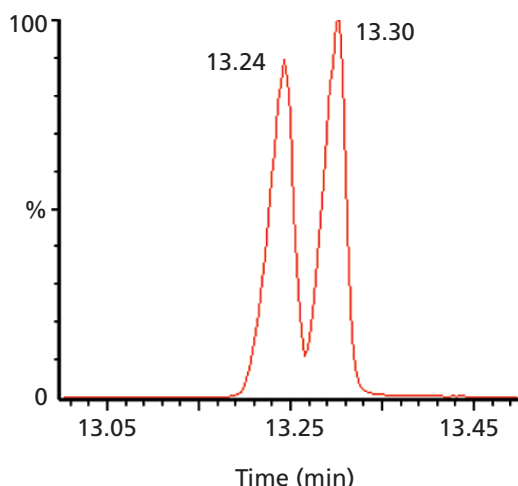


Figure 1: Example of calibration linearity and chromatographic separation.

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