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Rapid HPLC Analysis of PAH Compounds, Using Porous 3 μ m Particles

T. Ascah, E. Kraft, *Liquid Separations, Supelco, Bellefonte, PA, USA*

Polynuclear aromatic hydrocarbons (PAHs) are a severe environmental hazard with a variety of sources. Airborne particles, combustion products, and fossil fuels all contain these toxic aromatic substances. Analysis by gas chromatography (GC) has been problematic because GC phases do not meet the need for shape selectivity in separating PAHs (1). Conversely, high-density C18 octadecylsilane (ODS) phases for liquid chromatography (LC) have the proper bonded structure to allow this type of separation. The SUPELCOSIL™ LC-PAH column rapidly and economically separates PAH compounds.

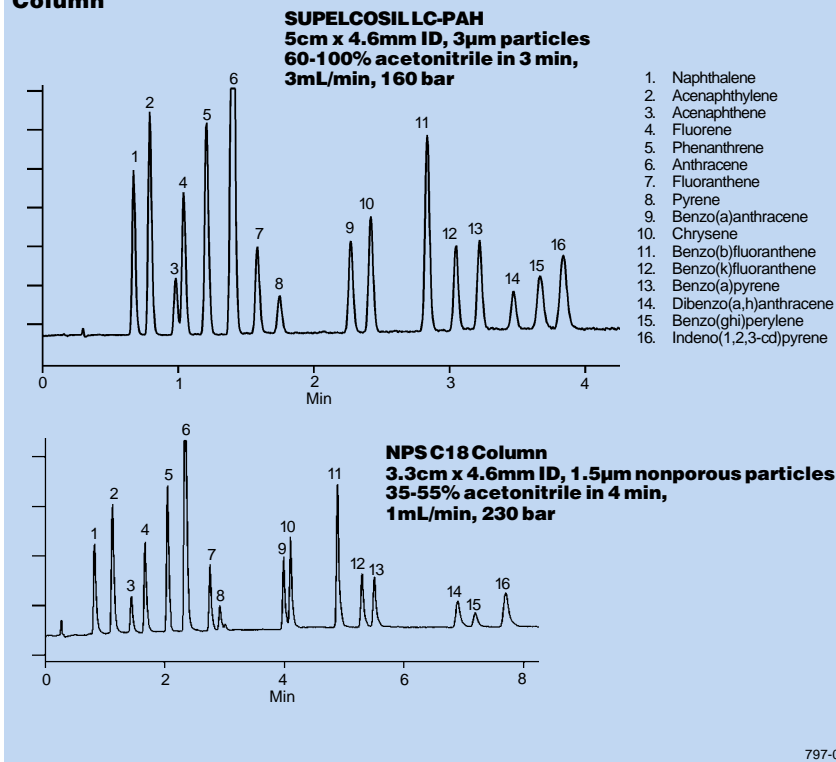
One theory states that shape selectivity is caused by slots in the bonded phase that selectively capture PAHs. Compounds containing a high degree of planar structure are held in these slots and are retained longer than compounds with a nonplanar structure. A selective ODS phase, like that in the LC-PAH column, retains compounds in order of planarity, with the more planar molecules eluting after the nonplanar compounds.

A 3 μ m SUPELCOSIL LC-PAH column was compared to a nonporous 1.5 μ m NPS-C18 column to determine the effect of particle size. Typically, decreasing the particle size of the LC packing can increase the efficiency of the column, because both the A and C term in the van Deemter equation are proportional to particle diameter. However there are problems associated with using the smaller, nonporous 1.5 μ m particles. The main problem is increased back pressure. Back pressure for the 1.5 μ m NPS-C18 column is more than 4000psi, at a flow rate of only 2mL/min, while the 3 μ m particles in the LC-PAH column allow flow rates greater than 3mL/min.

Other problems associated with using nonporous particles are low capacity and shorter retention. Because the particles do not have pores, total bonded phase surface area accessible to the analytes is very low. Much lower concentrations of organic component in the mobile phase are needed to significantly retain ethylbenzene on the 1.5 μ m particles, but these low percentages cause problems with sample solubility in sample preparation and during separation.

A mixture of 16 PAHs was injected onto the two columns, using conditions

Figure A. Fast PAH Separation Using a 3 μ m SUPELCOSIL LC-PAH Column



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recommended by the manufacturers. The 3 μ m LC-PAH column performs the separation in half the time of the 1.5 μ m NPS C18 column, with better resolution of most components (Figure A).

The 3 μ m LC-PAH column has higher capacity, lower back pressure, and can function with a range of organic modifier in which satisfactory k' values are achieved. A cost comparison shows that the LC-PAH column also is a much better value, both in the initial cost of the column and cost per analysis.

Increasing resolution by using extremely small particles may not be the practical answer to difficult separations. The real need for good separations is met in developing phases that exhibit the proper selectivity for the desired separation, such as the high-density ODS phase we use in the 3 μ m SUPELCOSIL LC-PAH column.

Ordering Information:

Description	Cat. No.
SUPELCOSIL LC-PAH Columns	
5cm x 4.6mm ID, 3 μ m particles	59133
10cm x 4.6mm ID, 3 μ m particles	59134
25cm x 2.1mm ID, 5 μ m particles	57945
25cm x 3.0mm ID, 5 μ m particles	59187
15cm x 4.6mm ID, 5 μ m particles	58318
25cm x 4.6mm ID, 5 μ m particles	58229
PAH Standard	
16 analytes in Figure A, in acetonitrile/methanol	49156

Reference

1. Wise, S.A., L.C. Sander, *Chromatographia*, 25: 6 (June 1988).

Reference not available from Supelco.

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