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APPLICATION NOTE

The Separation of Aromatics from Olefins in Petroleum Samples using *forte* BPX90

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Introduction

Regardless of the method used for sample preparation, the separation of aromatic and aliphatic components during the analysis of petroleum and related products remains an important application for gas chromatography. SGE's BPX90 GC capillary column is a highly polar phase that offers unique selectivity and the opportunity to speciate petroleum based products on the basis of degree of unsaturation.

While the aromatic content of petroleum products is important to their function, the aromatic components are of particular concern because they pose a toxicological threat and so are legitimate targets in many gas chromatographic applications. Successful speciation of aromatic and saturate groups is made difficult because of the need to use columns with sufficient polarity that separation is not based only on boiling point (vapor pressure) but that also have sufficient thermal stability to allow the elution of higher boiling hydrocarbons.

Experimental Conditions

A petroleum sample for analysis was obtained for analysis from a domestic automotive fuel supply. Gas chromatography-mass spectrometry analysis was performed using an Agilent 6890 GC - 5973 MSD (Palo Alta, CA, USA) fitted with a BPX90 capillary column (30 m x 0.25 mm ID, film thickness 250 micron, P/N 054580), a No-Vent II (SGE International) and an ETP 14616 electron multiplier (Sydney, Australia). The column temperature settings were 40°C for 5 min then the GC oven was heated at 30°C/min to 230°C with a final holding time of 5 minutes. Injector and detector temperatures were at 240°C and 230°C, respectively. Cold-needle injection of 0.3°µl of sample was split at the rate of 60:1 with a nominal pressure pulse of 25.7 psi to give a helium flowrate of 1.8 ml/min in constant flowrate mode. Electron Impact (EI)-MS was conducted under standard conditions using an unskewed automatic tune over the range of 45 to 450 Da with a data acquisition rate of 2 s/scan.

Results

Analysis of the petroleum sample on BPX90 allowed the elution of hydrocarbons up to C10 before benzene and other aromatics (see Figure 1). Mechanistically, the BPX90 has negligible non-polar characteristics and so saturates are eluted on the basis of their vapor pressure only. The comparatively strong retention of the aromatics is evidence of a very strong π-bonding phase that is generally useful for the speciation of compounds containing isolated double and triple bonds. Unlike the PEG phases in which the n-bonding moieties are fixed to the phase backbone, the BPX90 has mobile isolated π-bonding functional groups that do not provide complete resolution of the meta- and para-xylenes. However, this characteristic of the phase separation on the basis of π-density in sterically hindered fused ring systems that are not well resolved on alternative phases.

Conclusion

The BPX90 column is effective at separating aliphatic and aromatic components in petroleum based products. A maximum operating temperature of 280°C and the selectivity of the phase towards aromatic species is attributable to the very high π-bonding capacity of the phase that allows retention of suitable analytes in the absence of a significant non-polar capacity.

The very high selectivity towards higher aromatics (naphthalenes and higher) also provide a phase with exquisite resolution that is also completely orthogonal to non-polar phases for 2-dimentional GC applications.

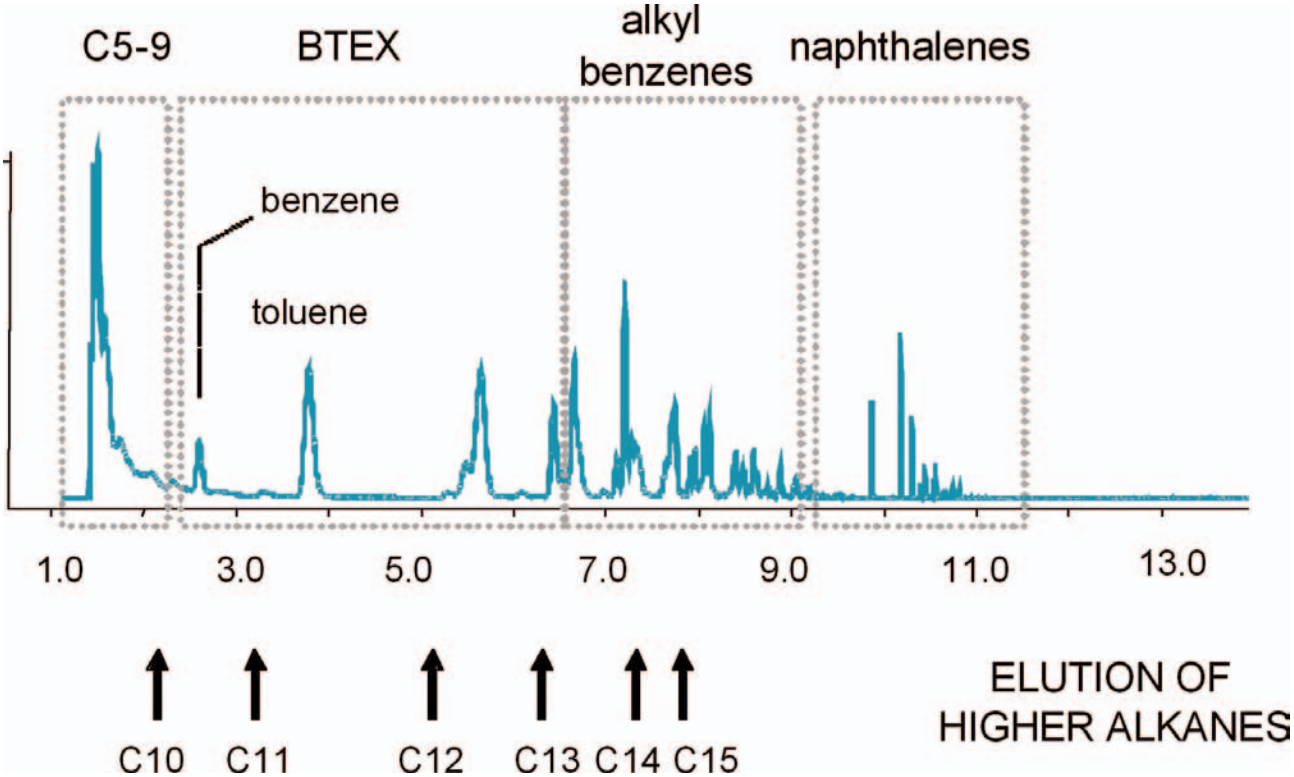

Figure 1: The separation of a petroleum sample using a BPX90 column (30m x 0.25mm, 250 micron film) showing the resolution of aromatic families and the separation from more abundant alkanes.

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