Performance of Miniature Parylene Gas Chromatographic Column

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There is a tremendous interest in miniaturizing chemical analytical systems for field analysis. This research contributes to worldwide efforts to miniaturize one of the most powerful and versatile analytical tools, gas chromatography (GC). If a rapid, sensitive and selective hand-held GC system is realized, it would have a wide range of applications in biomedical and environmental research, food and health industry, and anti-terrorism efforts. The most important component of a GC system is the separation column. Recently, parylene separation column was developed for a miniature GC system.

This paper describes the performance of the parylene GC columns. The column has been installed and tested in a conventional GC system (HP 6850, *Agilent Inc.*) replacing a commercial fused-silica column as shown in Figure 1. The column is 1 m long and has a rectangular cross-section (86 µm x 260 µm). The most common non-polar polydimethylsiloxane type stationary phase (OV-1, *Ohio Valley*) was coated inside the column using conventional injection coating technique. Diverse aliphatic and aromatic hydrocarbons have been analyzed in the GCsystem.

The column performance (retention time and column efficiency) of the parylene column has been measured and compared with the theoretical values. The actual column performance was less than 5% of the theoretical values. However, the separations of some volatile chemical mixtures have been successfully achieved within 1 min as shown in Figure 2. Column temperature was ramped from 30 ^{o}C to 100 ^{o}C during the analyses.

Figure 1. Miniature parylene GC column installed in conventional GC (HP 6850).

1st peak: Benzene
2nd peak: Toluene
3rd peak: Ethylbenzene, 3 xylenes
4th peak: 1,3,5-trimethyl-benzene
        4-ethyltoluene
5th peak: 1,2,3-trimethyl-benzene
        p-cymene
        cyclopropyl-benzene
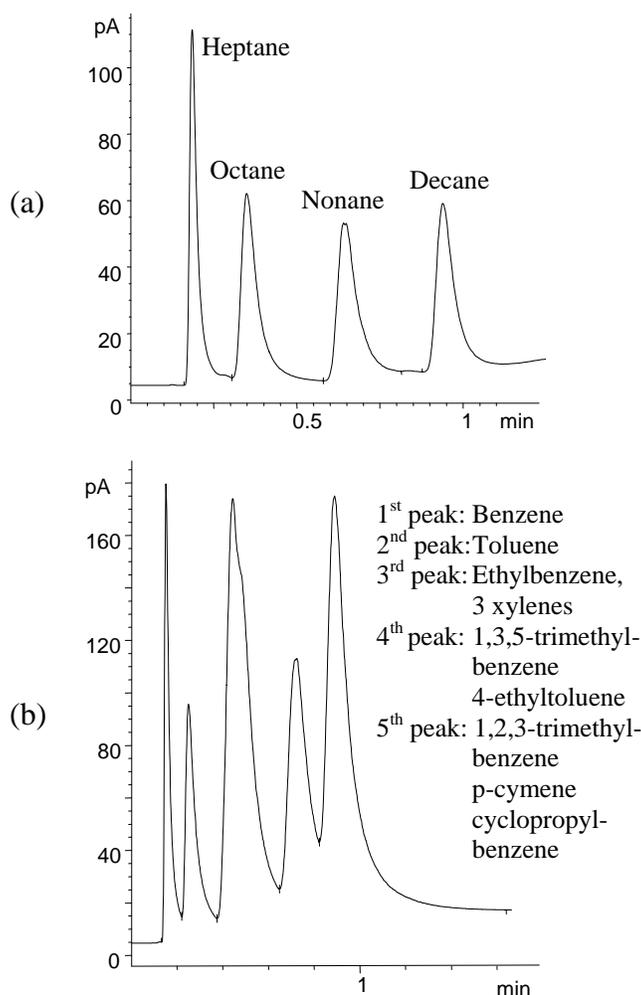
Figure 2. Chromatograms using flame ionization detector for: (a) aliphatic carbon mixture, (b) aromatic carbon mixture.