

Application News

No. G291

Gas Chromatograph

Analysis of Thiophene in Benzene using Nexis GC-2030

Thiophene and other sulfur compounds are known to be linked to sulfur oxide generation during combustion, and as compounds associated with catalyst poisoning. Even very small quantities can have adverse effects, so the quality control of petroleum products requires trace analysis of sulfur compounds.

In the petroleum refinement process, thiophene is eluted together with benzene. ASTM D 7011 specifies standards for the analysis of thiophene impurities in benzene.

The FPD-2030 flame photometric detector, which is installed in Nexis GC-2030 gas chromatograph, has the world's highest level of sensitivity*, thanks to the optimized nozzle shape and the advanced dual focus system. In the analysis of sulfur content in petroleum products, this detector provides high sensitivity and high stability.

In this Application News, we describe the analysis of thiophene in benzene using Nexis GC-2030 gas chromatograph equipped with the FPD-2030.

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* As of May 2017

Instrument Used and Analytical Conditions

Table 1 GC analytical condition

Model	: Nexis GC-2030 / AOC-20i
Software	: LabSolutions LC/GC
Injection Unit	: WBI direct injection unit
Injection Volume	: 1 µL
Injection Temperature	: 200 °C
Column	: SH-Stabiliwax (0.53 mm I.D. × 30 m, d.f. = 2.0 µm)
Column Temperature	: 75 °C (7 min) Total 7 min
Purge Gas	: 3 mL/min (He)
Carrier Gas	: He (99.999%)
Carrier Gas Control	: Constant flowrate Total flowrate: 10 mL/min(He)
Detector	: FPD-2030 (S)
Detector Temperature	: 230 °C
Detector Gas	: H ₂ : 40 mL/min, Air: 60 mL/min

Analysis Results

The results of analyzing 0.1 to 10 ppm of thiophene (in a benzene solution) via the capillary column GC-FPD method are shown below.

0.1 ppm of thiophene in benzene was detected (S/N=16), and favorable linearity was obtained in the range from 0.1 to 10 ppm. (Fig. 2)

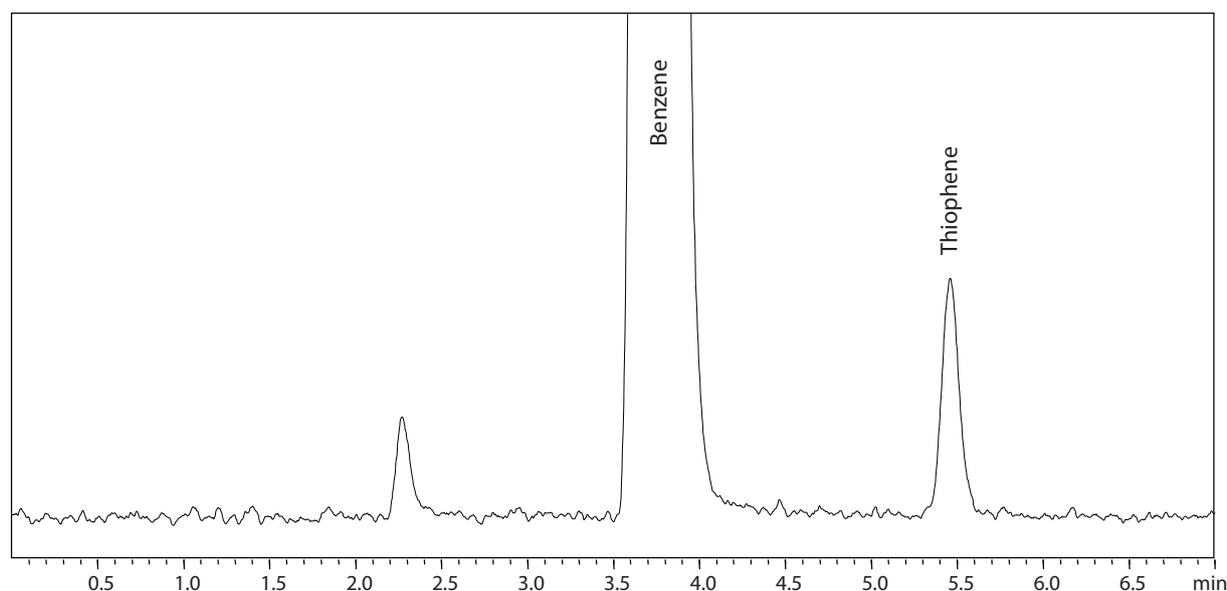
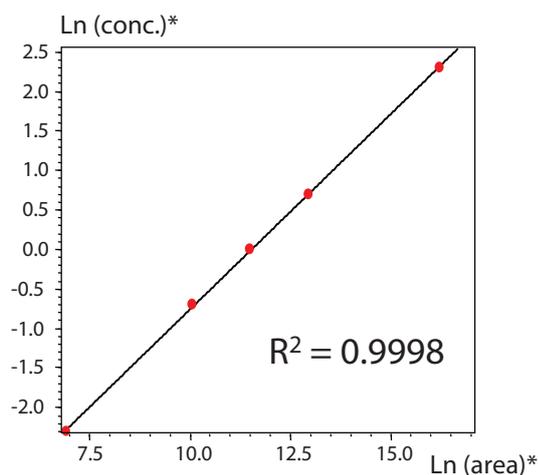


Fig. 1 Chromatogram of 0.1 ppm Thiophene in Benzene



* In the analysis of sulfur compounds using an FPD detector, the output is proportional to the square of the sulfur concentration. Thus the natural logarithm for both concentration and area should be plotted.

Fig. 2 Linearity of Thiophene in Benzene

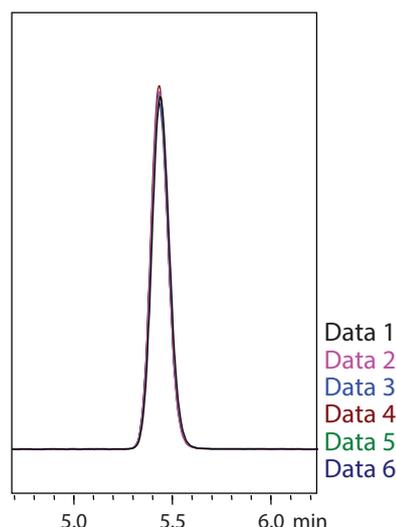


Fig. 3 Chromatogram (Overlap of Six Consecutive Analyses) from the Repeated Analyses of 1 ppm Thiophene in Benzene

Table 2 Repeatability of Area Values ($\mu\text{V} \times \text{sec}$) for 1 ppm

	1	2	3	4	5	6	Ave.	RSD%
Thiophene	97646	98126	97901	99524	97693	96797	97948	0.91

Note: The above are reference values, not guaranteed values.