

Application Data Sheet

No.5

GCMS

Gas Chromatograph Mass Spectrometer

Analysis of Gasoline Utilizing a GC × GC-MS System

When petrochemical products such as gasoline are analyzed using a GC-MS, a number of paraffin hydrocarbons and aromatic hydrocarbons are detected. Since their peaks overlap, qualitative and quantitative analysis of the respective components can be difficult. Analysis of such samples using a GC × GC-MS system, on the other hand, results in comprehensive 2-dimensional separation, simplifying qualitative and quantitative analysis.

GC×GC-MS

GC × GC-MS refers to a GC-MS system equipped with a ZX1-GC × GC modulator (Zoex), a unit capable of comprehensive 2-dimensional chromatographic data sampling. GC × GC systems use the latest chromatographic technology to achieve high-level separation through direct connection of 2 different types of columns. As a result, 2-dimensional images are obtained with, for example, boiling point and polarity as the axes. Target substances can be separated from complicated matrices, and analysis by type can be performed from the resulting 2-dimensional chromatogram patterns. The effectiveness of this system is demonstrated in the analysis of natural substances in complex matrices, which are difficult to analyze with conventional GC and GC-MS systems. Accordingly, its usefulness can be anticipated in a variety of fields, including foodstuffs, fragrances, environmental science, and petro-chemistry.

With GC × GC systems, since extremely sharp peaks result when modulation is applied, the MS scanning speed is an important factor. The GCMS-QP2010 Ultra features ASSP (Advanced Scanning Speed Protocol) technology, which enables analysis at a scan speed of 20,000 u/sec, leading to consistently sharp peaks.



Analysis Conditions

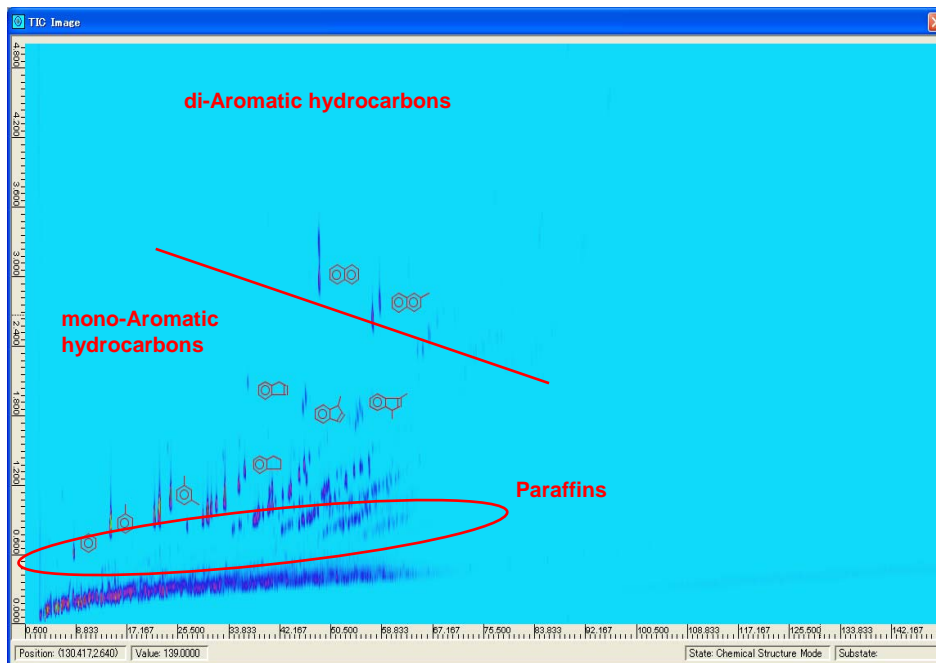
Table 1: Analysis Conditions

GC × GC modulator	: ZX1-GC × GC modulator		
GC-MS	: GCMS-QP2010 Ultra		
[GC × GC]			
Column	: 1st DB-1 (15 mL × 0.25 mm I.D., 1.0 μm) 2nd Rtx-WAX (2.5 mL × 0.1 mm I.D., 0.1 μm)	[MS]	
Injection quantity	: 0.5 μL	Interface temperature	: 240°C
Injection quantity	: Split (split ratio 50)	Ion source temperature	: 200°C
Vaporization chamber temperature	: 275°C	Solvent elution time	: 0.3 min
Column oven temperature	: 40 °C → (1.8 °C /min) → 240 °C (40 min)	Data sampling time	: 0.5 min to 150 min
Control mode	: Pressure (150 kPa → (1.4 kPa/min) → 300 kPa (40 min))	Measurement mode	: Scan
Modulation time	: 5 sec	Mass range	: m/z 35-500
Hot pulse time	: 0.35 sec (300 °C)	Scan speed	: 20,000 u/sec

Results

Fig. 1 shows a 2-dimensional image of the data obtained from analyzing regular gasoline and high-octane gasoline with a GC × GC-MS system. The image was created using GC Image, special GC × GC-MS software. By using a high-polarity column as the second column, it is possible to separate the paraffin and aromatic series, thereby obtaining a blob distribution pattern reflecting the compound structure. In addition, the difference between the regular and high-octane gasoline can be confirmed from the 2-dimensional image.

Regular Gasoline



High-Octane Gasoline

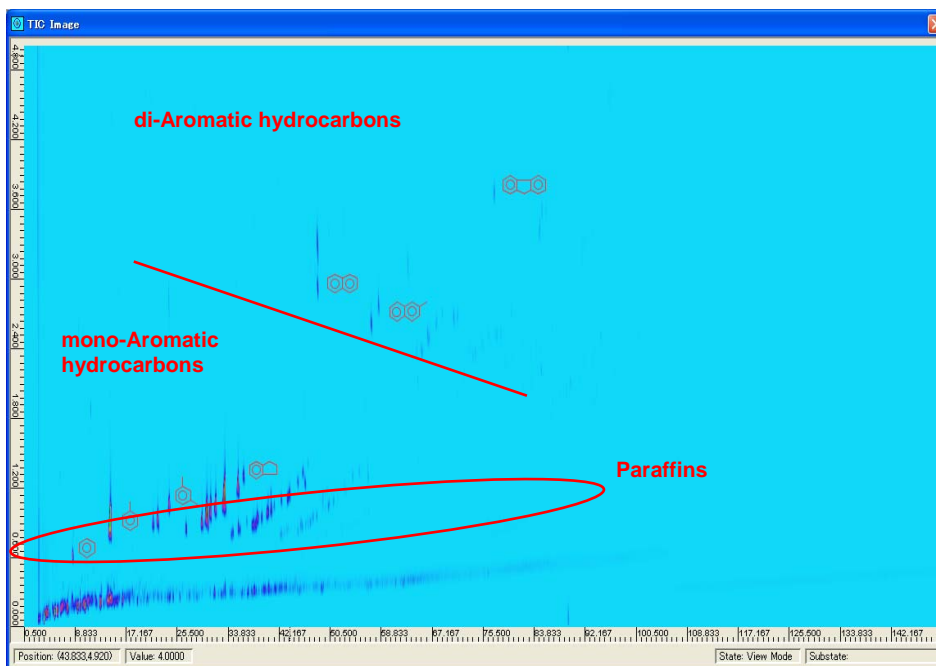


Fig. 1: 2-Dimensional Image of the GC × GC-MS Analysis Results for Regular Gasoline and High-Octane Gasoline

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First Edition: September 2011



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