

## JMS-T100GCV Application Data

## Analysis of diesel oil by using GC x GC-HRTOFMS (FI) with 2 different sets of column combinations

### [Introduction]

Comprehensive two-dimensional gas chromatography (GC x GC) is a kind of a continuous hard-cut GC system. Two different types of columns are connected via a modulator in the same GC oven. GC x GC shows a very high separating power compared to single GC.

This report shows the difference of separation result for diesel oil when 2 different sets of combined columns are used with GCxGC-HRTOFMS (FI).

### [Sample and method]

Sample: diesel oil

Method: see Table 1

### [Result and discussion]

Fig.1 shows 2 TIC chromatograms. Upper TIC is the result by using a normal column set (1<sup>st</sup> column: non-polar column, 2<sup>nd</sup> column: polar column) for general GCxGC analysis. Lower TIC is the result by using reverse column set (1<sup>st</sup> column: polar column, 2<sup>nd</sup> column: non-polar column).

Some of components such as n-paraffins, naphthenes and aromatic hydrocarbons could be separated based on a different polarity because 2<sup>nd</sup> column in normal column set was a polar column. However, since the polarity between monocyclic and polycyclic naphthenes is not so different, the separation of these compounds was not enough due to the use of a very short 2<sup>nd</sup> column (ca. 2m).

On the other hand, when the reverse column set was used, some of components such as n-paraffins, monocyclic and polycyclic naphthenes, monocyclic and polycyclic hydrocarbons could be separated by the difference in boiling point because non-polar column was used as 2<sup>nd</sup> column. The reverse column set had a better performance to separate monocyclic and polycyclic naphthenes compared to the normal column set because of the differences in boiling point. This result shows that the normal column set is suitable to separate aromatic compounds and the reverse column set is suitable to separate naphthenes.

Table 1 GC x GC-HRTOFMS measurement conditions.

Instrument	JMS-T100GCV (JEOL Ltd.)
	KT2004 (Zoex Corporation)
Injection mode	Split 100:1
Injection temp.	280°C
Oven temp. program	50°C (2min) → 3°C/min → 300°C
Injection volume	0.2µL
Normal column set	1st: BPX-5 (30m × 0.25mm, 0.25µm)
	2nd: BPX-50 (2m × 0.1mm, 0.1µm)
Reverse column set	1st: DB-WAXETR (30m × 0.25mm, 0.1µm)
	2nd: DB-1 (1m × 0.1mm, 0.1µm)
Modulation period	6sec
Ionization mode	FI+ (cathode voltage: -10kV)
Ion source temp.	Heater OFF
m/z range	m/z 35-500
Data acquisition speed	0.04 sec(25 Hz)

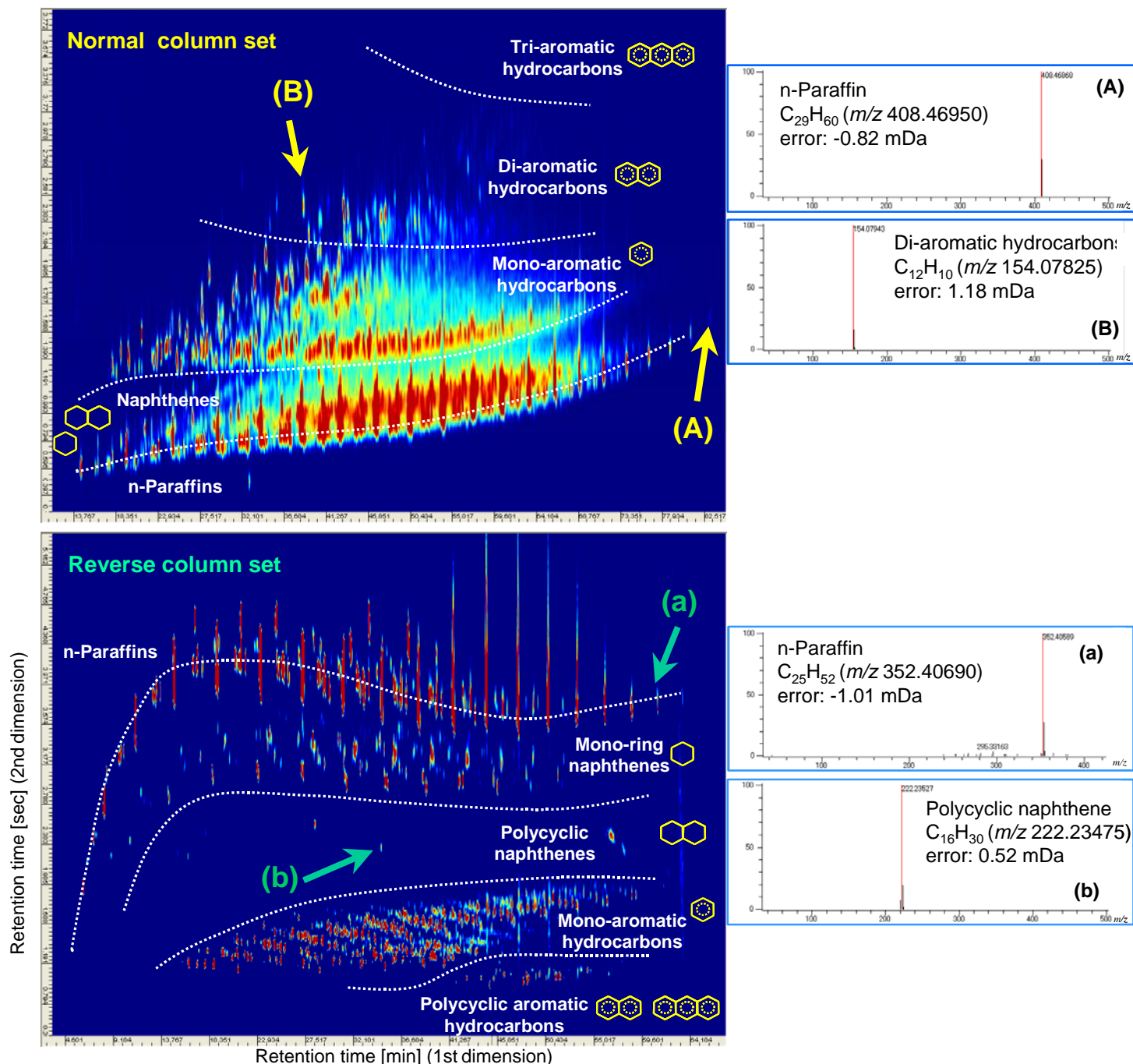


Fig.1 2-dimensional TIC chromatograms and FI mass spectra

In addition, only molecular ions were observed in mass spectra due to use of FI. It is sometimes difficult to confirm molecular ions of hydrocarbons by EI. But, it was very easy to confirm molecular ions of hydrocarbons with FI. The mass accuracy of molecular ions was less than 1.2 mDa.

As this report shows, FI could be used with the GC x GC method on the JMS-T100GCV due to both high sensitivity and high speed acquisition. Also, it is possible to do highly-detailed qualitative analysis by using high mass accuracy with GC x GC separation.

### [Acknowledgement]

This analysis was supported by Ms. T. Ieda of GERSTEL K.K., Japan.

Zoex's GC x GC system is provided and supported through Zoex's sales and support network and may not be available in your territory. Contact your local JEOL representative for detail.