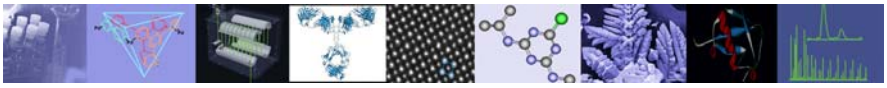

Applications Note

AccuTOF-GCv Series

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×GC) is a kind of continuous heart-cut GC system. Two different types of columns are connected via a modulator in the same GC oven. By using the two columns together, this technique provides very high separation capabilities when compared to one-dimensional GC analysis.

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

Method

Sample: diesel oil

The instrument conditions are shown in Table 1. All of the GC×GC chromatograms were created by using the Zoex GC Image software.

Table 1. GC×GC-HRTOFMS measurement

Instrument	JMS-T100GCV (JEOL Ltd.)
	KT2004 (Zoex Corporation)
Injection mode	Split 100:1
Injection temp.	280℃
Oven temp. program	50℃ (2min)→3℃/min→300℃
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)

Results and Discussion

Fig.1 shows two different TIC chromatograms. The upper TICC shows the results obtained by using the normal column set (1st column: non-polar column, 2nd column: polar column) that is generally used for GC×GC analysis. The lower TICC shows the results obtained by using the reverse column set (1st column: polar column, 2nd column: non-polar column). Several components such as n-paraffins, naphthenes and aromatic hydrocarbons were reasonably separated based on their polarity differences because the 2nd column in the normal column set was a polar column. However, since the monocyclic and polycyclic naphthenes have very similar polarities, their separation was not sufficient as a result of the very short 2nd 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 were separated by their differences in boiling point even though the non-polar column was used as the shorter 2nd column (ca. 1m). Additionally, the reverse column set had a better performance in separating monocyclic and polycyclic naphthenes compared to the normal column set. These results clearly show that the normal column set is suitable for separating the aromatic compounds while the reverse column set is suitable for separating the naphthenes.

In addition, only molecular ions were observed in the FI mass spectra. It is sometimes difficult to confirm molecular ions for hydrocarbons when using electron ionization (EI) as it is a very hard ionization technique. However, FI provides a soft ionization alternative that produces mass spectra that are typically dominated by the hydrocarbon molecular ions. In each case, the mass accuracy for each molecular ion was less than 1.2 mDa.

MS Tips #154

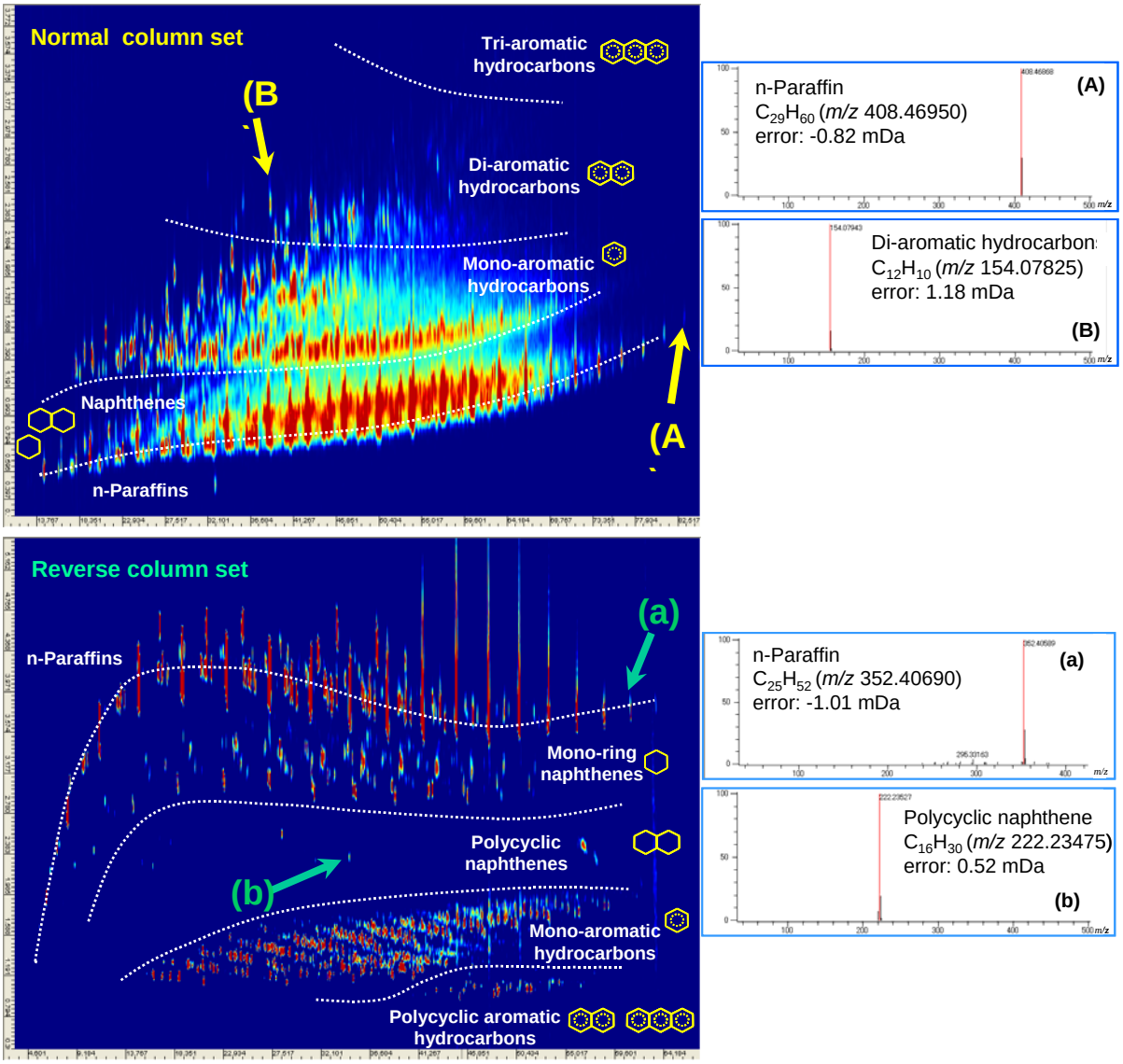

Fig 1. 2-dimensional TIC chromatograms and FI mass spectra

Conclusions

As this report shows, the FI technique can be used with the GC×GC method on the AccuTOF-GCv due to the system's ability to provide both high sensitivity and high speed data acquisition. Also, it is possible to do highly-detailed qualitative analysis by using high mass accuracy with GC×GC separation.

Acknowledgement

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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.