JMS-T2000GC AccuTOF™ GC-Alpha
Sensitivity in nitrogen carrier gas ① - EI / PI ion source

Related products: Mass spectrometer (MS)

Introduction

Due to the global shortage of helium gas supply, the demand for alternative gas for GC-MS carrier gas is increasing. Nitrogen gas is the most suitable gas due to its availability and high safety, but it is known that the influence of nitrogen ions generated by the MS ion source causes a decrease in sensitivity. So we have checked the influences of nitrogen carrier gas on JMS-T2000 GC AccuTOF ™ GC-Alpha, and report on MS Tips No. 374-376. This report shows the results of the EI (Electron Ionization) / PI (Photo Ionization) combination ion source, which is one of the characteristic multi-ionization ion sources of JMS-T2000 GC AccuTOF ™ GC-Alpha.

Measurement

Table 1 shows the details of the measurement conditions in this experiment. In the EI method, 1 µL of OFN (octafluoronaphthalene) 100 pg / µL was injected. In the PI method, 1 µL of benzophenone 10 ng / µL was injected. Helium and nitrogen were used as carrier gases, and the S/N sensitivity, the similarity to the library spectrum (M.F.), and the mass accuracy (error) of molecular ions were compared. The carrier gas flow rate was set to 1.0 mL / min in helium and 0.55 mL / min in nitrogen based on the optimum linear velocity of each carrier gas. The ionization energy in the EI method was measured at 70eV and 20 eV, which is expected to suppress the ionization of nitrogen.

Table 1. Measurement conditions

GC : 8890GC (Agilent Technologies, Inc.)		**TOFMS : JMS-T2000GC AccuTOF™ GC-Alpha**	
Injection volume	1 µL	Ion source	EI/PI combination ion source
Mode	Splitless	Ionization	①EI, ②PI
Column	DB-5MS UI	EI Ionization energy	70eV (300µA), 20eV (200µA)
	(Agilent Technologies, Inc.)	(filament current)	
	30m x 0.25mm, 0.25µm	Mass Range	*m/z* 35-600
Oven temperature	40°C(1min)-30°C/min	Detector voltage	①2600V, ②2800V
	-250°C(2min)		
Carrier flow	He : 1.0 mL/min		
	N_2 : 0.55 mL/min		

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Results ① EI method

Figure 1 shows the extracted ion chromatograms (*m/z* 272.98 ± 0.10) of the OFN measurement results in the EI method. The sensitivity was greatly decreased to about 1/30 in nitrogen (70 eV). In the nitrogen (20 eV), the sensitivity was slightly decreased to about 1/3. It was confirmed that the decrease in sensitivity was suppressed by changing the ionization energy.

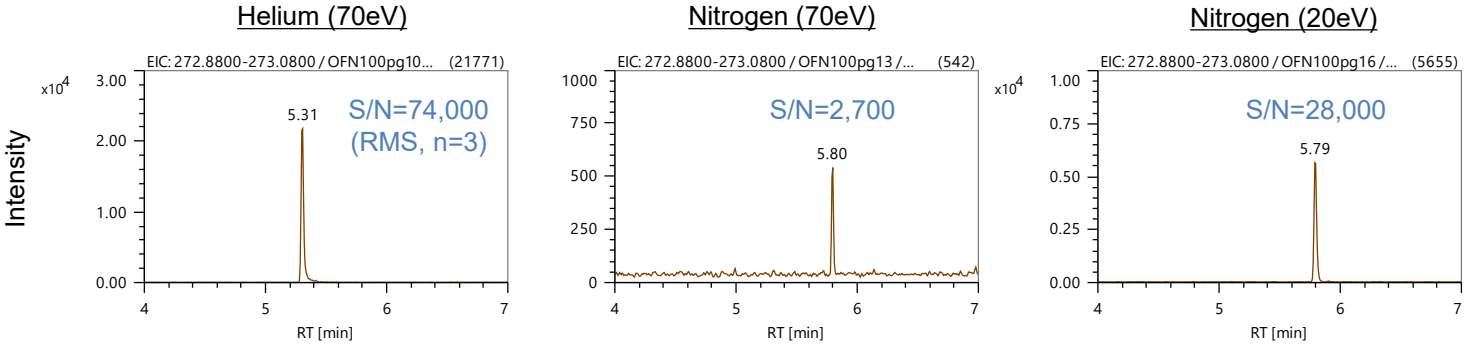

Figure 1. EICs of OFN（EI method)

Figure 2 shows the mass spectra of the OFN measurement results in the EI method. The similarities to the library spectra (M.F.) were good at 800 or more in helium (70eV) and nitrogen (70eV). It was slightly decreased to about 760 in nitrogen (20eV), since the low energy ionization suppressed the fragments and changed the spectrum. The mass errors of the molecular ions $M^{+\cdot}$ (*m/z* 271.9867) were as good as 1 mDa or less in all results.

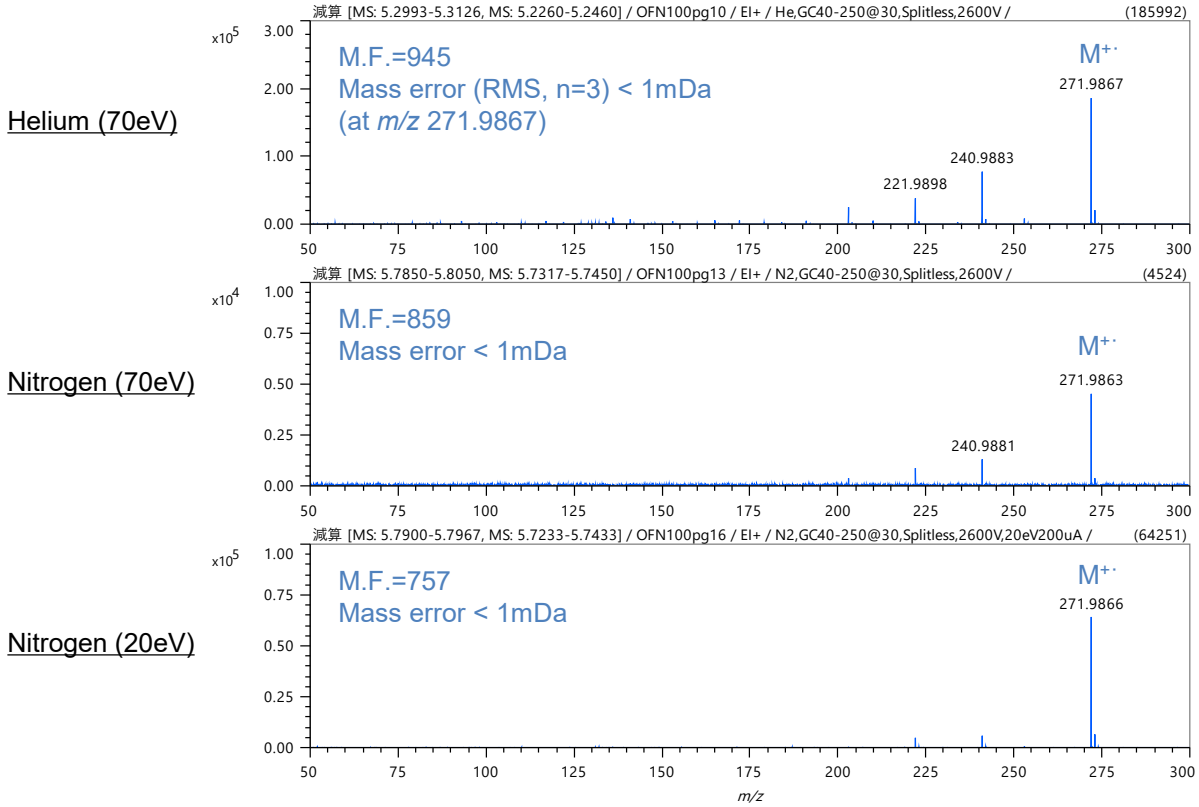

Figure 2. Mass spectra of OFN（EI method)

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Results ② PI method

Figure 3 shows the extracted ion chromatograms (*m/z* 182.07 ± 0.10) of the benzophenone in the PI method. The sensitivity was slightly decreased to about 1/3. In the PI method, which is soft ionization, nitrogen is hardly ionized, but the sensitivity is slightly reduced due to the influence of a large amount of nitrogen molecules.

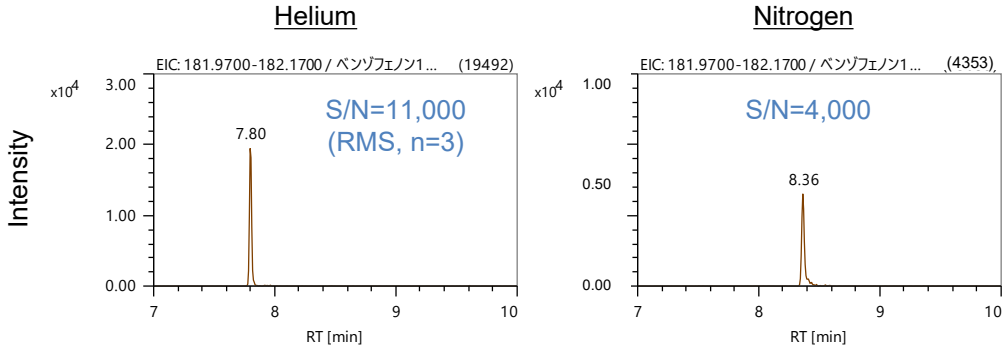

Figure 3. EICs of benzophenone（PI method)

Figure 4 shows the mass spectra of the benzophenone in the PI method. The mass errors of the molecular ions $M^{+\cdot}$ (*m/z* 182.0726) were as good as 1 mDa or less in both results.

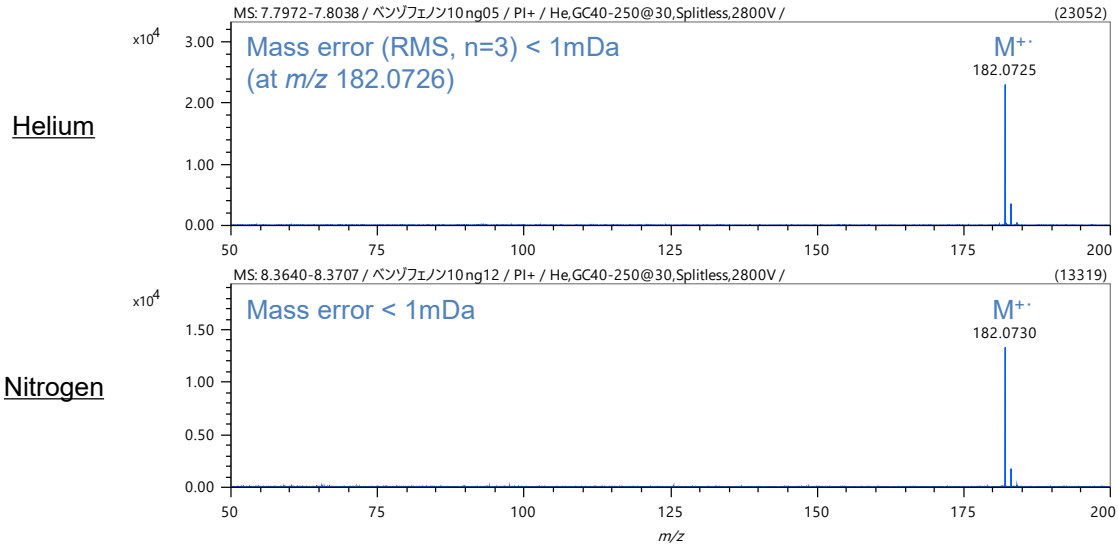

Figure 4. Mass spectra of benzophenone（PI method)

Conclusion

The influences of nitrogen carrier on the EI / PI combination ion source of JMS-T2000GC AccuTOF ™ GC-Alpha were checked. In the EI method, the sensitivity was greatly decreased to about 1/30, but it could be suppressed by changing the ionization energy. In the PI method, the sensitivity was slightly decreased to about 1/3. The mass errors of the molecular ions were as good as 1 mDa or less in both EI method and PI method.

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