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Application News

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Gas Chromatography

New Approach to Food Smell Analysis Using Combination of GCMS™ and GC-SCD (1)

Gas chromatography mass spectrometry (GCMS), which has outstanding qualitative analysis capabilities, is used in smell analyses of food products, but because sulfur compounds contribute to the smell of food, even when present in trace amounts, detection by GCMS is difficult in some cases due to insufficient sensitivity and separation of sulfur compounds from other components. In this experiment, we studied a new approach to analysis of food smell by using a combination of GCMS, which is particularly effective for comprehensive qualitative analysis of odor components, and a GC device equipped with a sulfur chemiluminescence detector (GC-SCD), which enables selective and highly sensitive detection of only sulfur compounds.

As the study method, an analysis of the smell released into the outside air from a storage bag was conducted using kimchi (Korean pickles) which has a particular strong smell among food products as the sample.

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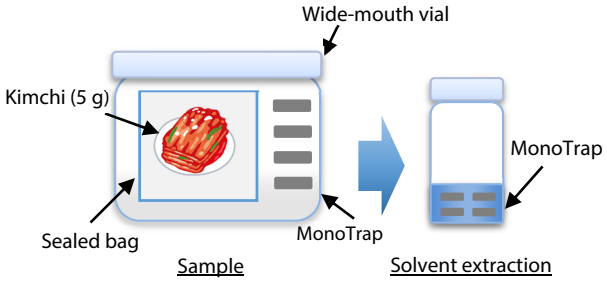
Appearance of GCMS-QP™2020 NX + Nexis™ SCD-2030

Sample and Analysis Method

Using commercially-available kimchi as the sample material, a sample was prepared by the following procedure.

(1) Place 5 g of kimchi in a bag (polyethylene) and seal.
(2) Place the sample prepared in (1) and 4 pieces of MonoTrap (DCC-18, GL Sciences Inc.) in a wide-mouth vial and seal.
(3) Allow to stand for 2 h at room temperature.
(4) Remove the MonoTrap from the wide-mouth vial.
(5) Conduct solvent extraction of the MonoTrap in (4) using 1 mL of a mixed liquid of diethyl ether and n-pentane (1: 1).



Analysis Conditions

Table 1 shows the composition of the GC instrument and the analysis conditions used in this experiment. Table 2 shows the composition of the GCMS instrument and the analysis conditions.

Table 1 Composition of GC Instrument and Analysis Conditions

Model	:	Nexis GC-2030/SCD-2030
Injection Volume	:	1 µL
Injection	:	SPL
Injection Temp.	:	250 °C
Injection Mode	:	Split
Split Ratio	:	1:5
Carrier Gas	:	He
Carrier Gas Control	:	Constant pressure (44.5 kPa)
Column	:	InertCap 5MS/Sil (30 m×0.32 mm I.D., 0.50 µm)
Column Temp.	:	50 °C (5 min) – 10 °C /min – 250 °C (10 min)
Detector	:	Sulfur chemiluminescence detector (SCD)
Interface Temp.	:	200 °C
Electric Furnace Temp.	:	850 °C
Detector Gas	:	H_2 80.0 mL/min N_2 40.0 mL/min O_2 10.0 mL/min O_3 25.0 mL/min

Table 2 Composition of GCMS Instrument and Analysis Conditions

Model	:	GCMS-QP2020NX
GC		
Injection Volume	:	1 µL
Injection	:	SPL
Injection Temp.	:	250 °C
Injection Mode	:	Split
Split Ratio	:	1:5
Carrier Gas	:	He
Carrier Gas Control	:	Constant pressure (44.5 kPa)
Column	:	InertCap 5MS/Sil (30 m×0.32 mm I.D., 0.50 µm)
Column Temp.	:	50 °C (5 min) – 10 °C /min – 250 °C (10 min)
MS (EI method)		
Ion Source Temp.	:	200 °C
Interface Temp.	:	250 °C
Ionization Mode	:	EI
Measurement Mode	:	Scan
Event Time	:	0.3 s

Analysis Results

Fig. 1 shows the GC-SCD chromatogram, and Fig. 2 shows the GCMS total ion chromatogram (TIC). Use of GC-SCD enabled selective and highly sensitive analysis of 8 species of sulfur compounds. The scan analysis by GCMS could detect four species of the sulfur compounds, as well as other compounds such as alcohols and ketones. Table 3 shows the sulfur compounds detected in this experiment. From these results, comprehensive detection of odor components was possible by GCMS, while trace amounts of sulfur compounds could be detected by GC-SCD.

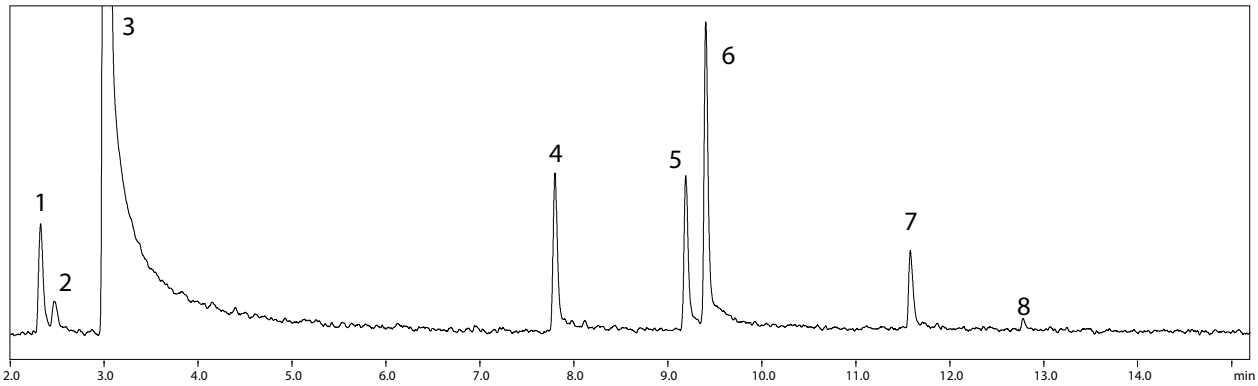


Fig. 1 GC-SCD Chromatogram

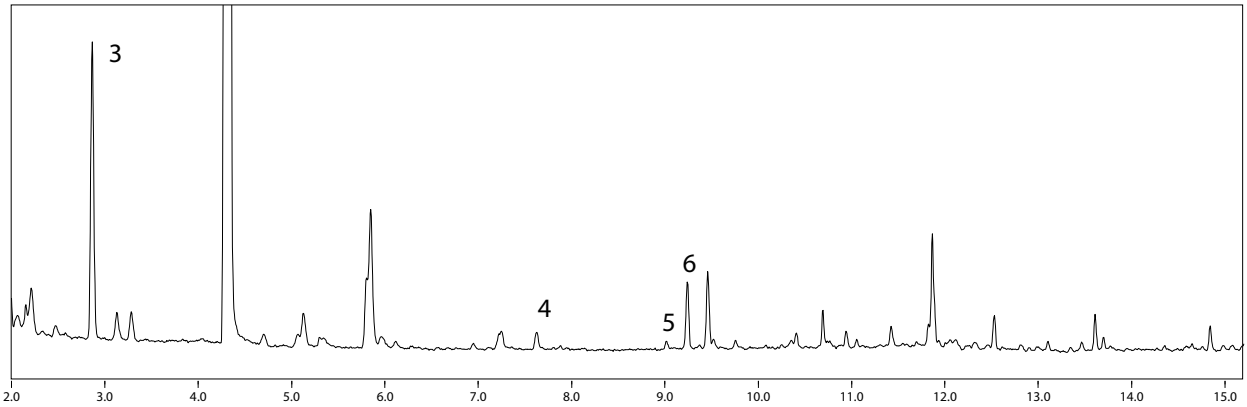


Fig. 2 GCMS Total Ion Chromatogram

Table 3 Sulfur Compounds Detected in Experiment

ID	Compound Name
1	Allyl Methyl Sulfide
2	S-methyltioacetate
3	Dimethyl disulfide
4	Allyl Methyl Disulfide

ID	Compound Name
5	Dimethyl trisulfide
6	4-Isothiocyanato-1-butene
7	Diallyl disulfide
8	Trisulfide, methyl 2-propeny

Conclusion

An analysis of the odor leaked into the outside air from a bag in which kimchi was stored was carried out using a GC-SCD and GCMS. Eight species of sulfur compounds could be detected. The combination of GC-SCD and GCMS enabled easy identification of sulfur compounds, and also made it possible to detect sulfur components present only in trace amounts.

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