



Fig. 1 Nexis[™] SCD-2030 + HS-20

Volatile sulfur compounds in beer can be generated during production and storage. These sulfur compounds give beer their distinct aroma and flavor characteristics and can have a significant impact on product quality.

However, even trace-level concentrations of sulfur compounds can affect the flavor characteristics and quality of beer. Analysis of sulfur compounds with high sensitivity is required for accurate quality control and product development.

We analyzed volatile sulfur compounds in three commercially available beer samples using gas chromatography (GC) with headspace (HS-20) and sulfur chemiluminescence detection (SCD).

Y. Takemori

Reagent Preparation

Three different brands of beer were prepared for this evaluation. Each 5 g beer sample was poured into a 20 mL headspace vial, and 5 µL of 0.1 mL/L of ethyl methyl sulfide aqueous solution was added to the sample as an internal standard at 100 pL/g (ppb).

These vials were placed in the HS-20 headspace sampler and analyzed by an automated GC sequence.

In addition to quantifying sulfur compounds in the beer samples, we used a standard addition by spiking 5 µL of dimethyl sulfide, S-methyl thioacetate and dimethyl disulfide aqueous solution to each sample. Sample concentrations are equivalent to the values shown in Table 1.

Table 1 Concentrations of Sulfur Compounds in Each Beer Sample (pL/g)

Compounds	1	2	3	4
Dimethyl Sulfide	0	100	50	10
S-Methyl Thioacetate	0	10	5	1
Dimethyl Disulfide	0	10	5	1
Ethyl Methyl Sulfide (IS)	100	100	100	100

Table 2 shows the details of instrument configuration and analytical conditions in this evaluation.

Table 2 Instrument Configuration and Analytical Conditions				
Model	: Nexis GC-2030 / SCD-2030 / HS-20			
HS-20				
Mode	: Loop			
Oven Temperature	: 45 ℃			
Sample Line Temperature	: 95 ℃			
Transfer Line Temperature	: 95 ℃			
Vial Pressure	: 150 kPa			
Vial Heat-retention Time	: 40 min			
Vial Pressurization Time	: 1 min			
Vial Pressurization	: 0.1 min			
Equilibrating Time				
Loading Time	: 1 min			
Loading Pressurization Time	: 0.1 min			
Injection Time	: 1 min			
Needle Flush Time	: 5 min			
GC-2030				
Injection Mode	: Split			
Split Ratio	: 1:5			
Carrier Gas	: He			
Carrier Gas Control	: Constant Linear Velocity (45 cm/sec)			
Column	: SH-Rxi™-1 MS			
	(30 m × 0.32 mm l.D. df=4.00 μm)			

Column Temp

SCD-2030

JCD-2030		
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	
	O₃ 25.0 mL/min	

: 35 °C (5 min) - 5 °C/min - 100 °C - 10 °C/min - 230 °C (5 min)

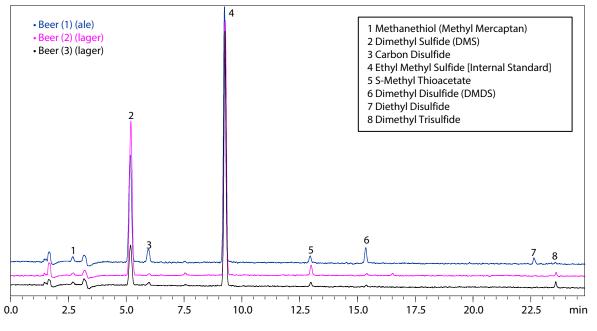


Fig. 2 Chromatogram of Three Commercially Available Beers

Results

Fig. 2 shows the chromatograms of three beer samples. Seven types of sulfur compounds were detected in these samples.

Dimethyl sulfide (Peak No. 2), S-methyl thioacetate (Peak No. 5), and dimethyl disulfide (Peak No. 6) were quantitated using standard addition. Table 3 shows the quantitative results of these three representative sulfur compounds in each beer sample.

Fig. 3 shows an enlarged chromatogram of dimethyl sulfide with different amounts of standard added in beer matrices. These results exhibit the high sensitivity of the detector even at low ppb levels.

Fig. 4 shows the calibration curve for dimethyl sulfide.

Table 3 Quantitative Results of Sulfur Compounds in Each Beer Sample (pL/g)

	Beer ①	Beer 2	Beer ③
Dimethyl Sulfide	66.0	96.0	18.6
S-Methyl Thioacetate	7.23	11.6	3.97
Dimethyl Disulfide	1.93	0.106	0.054

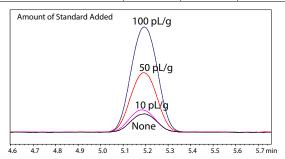


Fig. 3 Chromatograms of Standard Added Dimethyl Sulfide



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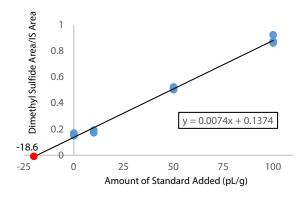


Fig. 4 . Calibration Curve of the Dimethyl Sulfide in Beer

Conclusion

Results show the Nexis SCD-2030 can detect volatile sulfur compounds at trace levels without any concentration or sample pre-preparation steps.

In addition, we confirmed that different types of commercially available beers contain varying amounts and types of sulfur compounds that could affect flavor and aroma.

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