Agilent Model 355 Sulfur Chemiluminescence Detector (SCD): Volatile Sulfur Compounds in Beer

Technical Overview

Introduction

Sulfur compounds play a major role in determining the flavor and odor characteristics of beer. The selective determination of sulfur compounds by headspace gas chromatography and sulfur chemiluminescence detection provides a sensitive and rapid analysis method for the volatile sulfur compounds commonly found in beer.

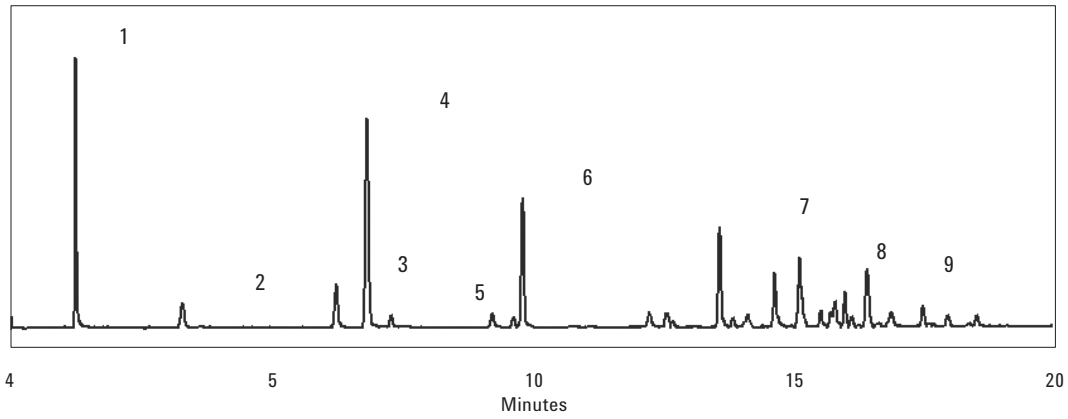
Determination of volatile sulfur compounds is of considerable interest in the brewing industry, since many sulfur compounds are known to affect both the flavor and odor of beer. These compounds represent a wide range of sulfur types and volatilities. They include such species as mercaptans, sulfides, disulfides, and hydrogen sulfide. These compounds are typically present at low levels (ppb-ppm); however, they characteristically possess extremely low odor and taste thresholds as well. Presence of certain sulfur species may also be useful as indicators of fermentation problems. Until recently, gas chromatography with the flame photometric detector (FPD) has been used for sulfur analysis. The FPD suffers from a number of inherent problems including quenching, nonlinear response, and poor selectivity. Gas chromatography with sulfur chemiluminescence detection (SCD) provides a rapid means to identify and quantify various sulfur compounds that may be present in beer. [1] Advantages of this technique include more sensitive and selective detection, no quenching, and a linear and equimolar response to sulfur.

Various sulfur compounds are identified in the chromatogram of the headspace of a beer shown in Figure 1. These sulfur compounds include:
1. Hydrogen sulfide; 2. Methyl mercaptan; 3. Ethyl mercaptan; 4. Dimethyl sulfide; 5. Carbon disulfide; 6. Ethyl methyl sulfide (added as internal standard); 7. Dimethyl disulfide; 8. Ethyl methyl disulfide; and 9. Diethyl disulfide.

Conditions are as follows: Model 355 SCD operated according to standard conditions; column: 30 m, 0.32 mm id, 4 µm methyl silicone WCOT fused silica; temperature program: –10° C for 3 minutes to the final required temperature at a rate of 10° C/minute; 1 mL static headspace injection; split ratio 1:10.

Reference

1. M. Burmeister, C. Drummond, D. Pfisterer, and D. Hysert, *Amer. Soc. Brewing Chemists J.* 1992, 50, p 53.



1 Hydrogen sulfide
2 Methyl mercaptan
3 Ethyl mercaptan
4 Dimethyl sulfide
5 Carbon disulfide
6 Ethyl methyl sulfide (added as internal standard)
7 Dimethyl disulfide
8 Ethyl methyl disulfide
9 Diethyl disulfide

Figure 1. Gas chromatogram of beer headspace.

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Printed in the USA
May 23, 2007
5989-6781EN

Agilent Technologies