

Application News

No. 277A

Gas Chromatography Mass Spectrometry

High Sensitivity Analysis of Coffee Aroma Components Using the SPME Arrow

Gas chromatograph mass spectrometers (GC-MS) capable of excellent qualitative measurements are used in the analysis of aroma components in foods and beverages. The convenient sampling methods of SPME (solid-phase microextraction) and HS (headspace extraction) are increasingly used for sample introduction. However, sample introduction methods such as these can suffer from insufficient sensitivity when analyzing some aroma components.

The SPME Arrow method was developed as a new sample introduction option for the AOC-6000 Multifunctional Autosampler to address this shortcoming. The larger sorption phase volume compared to conventional SPME fibers allows the SPME Arrow to achieve high enrichment of volatile components and serve as a solution for applications where sensitivity was previously lacking.

This article presents the results of analyzing coffee aroma components using the SPME Arrow.

K. Kawamura

Sample Introduction Using the SPME Arrow

The SPME Arrow enables analysis at high sensitivities due to approximately 5 to 20 times more sorption phase than conventional SPME fibers (Fig. 1).

The thick and robust structure of the SPME Arrow also provides higher durability over conventional SPME fibers.

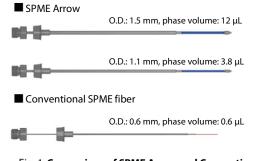


Fig. 1 Comparison of SPME Arrow and Conventional SPME Fibers

Sample and Analysis Conditions

A sample of 2 g of commercially-available ground coffee beans were weighed out, placed into a 20 mL vial, and set in the AOC-6000. Table 1 lists the analysis conditions. For comparison, analysis was also performed using the conventional SPME method.

Table 1 Analysis Conditions			
GCMS	: GCMS-QP2020		
Autosampler	: AOC-6000		
Column	: DB-WAXetr (length: 60 m, 0.25 mm l.D., df = 0.25 μ	μm)	
SPME Arrow conditions		SPME conditions	
SPME Arrow	: PDMS (O.D.: 1.1 mm, film thickness: 100 μm, length: 20 mm)	SPME fiber Conditioning Temp.	: PDMS (film thickness: 100 µm, length: 10 mm) : 270 °C
Conditioning Temp.	: 270 °C	Pre Conditioning Time	: 5 min
Pre Conditioning Time	: 270 C	Incubation Temp.	: 60 °C
Incubation Temp.	: 60 °C	Incubation Time	: 8 min
Incubation Time	: 8 min	Agitator Speed	: 250 rpm
Stirrer Speed	: 250 rpm	Sample Extract Time	: 30 min
Sample Extract Time	: 30 min	Sample Desorb Time	: 2 min
Sample Desorb Time	: 2 min (250 °C: GC vaporizing chamber temperature)	Sumple Desorts mille	(250 °C: GC vaporizing chamber temperature)
GC conditions		MS conditions	
Vaporizing chamber	: 250 °C	Interface temperature	: 230 °C
temperature		lon source temperature	e : 200 °C
Injection mode	: Splitless	Ionization method	: El
Purge flow rate	: 5.0 mL/min	Measurement mode	: Scan
Control mode	: Linear Velocity (25,5 cm/sec)	Event time	: 0.3 sec
Column oven temperature	: 40 °C (3 min) \rightarrow 10 °C/min \rightarrow 250 °C (10 min)		

Analysis Results

Fig. 2 shows the analysis results for the SPME Arrow and SPME fibers. Known aroma components of coffee that were detected include short-chain aldehydes, phenols, pyridines, and pyrazines in addition to multiple sulfurbased compounds. Compared to the conventional SPME fiber, the SPME Arrow enabled high enrichment and analysis of the aroma components. Fig. 3 shows a comparison of the mass chromatogram peak area of several aroma components.

Conclusion

In contrast to conventional SPME fibers, analysis of trace components that prove difficult with SPME can be achieved using the SPME Arrow, which is coated with a larger volume of sorption phase.

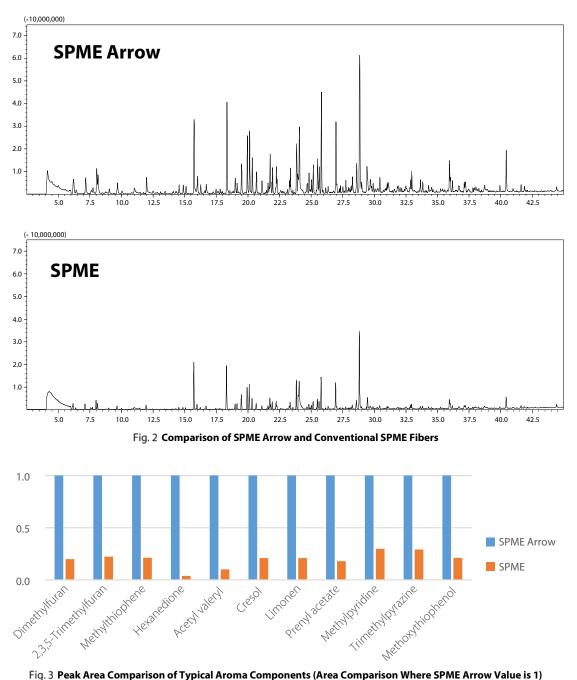


Fig. 3 Peak Area Comparison of Typical Aroma Components (Area Comparison Where SPME Arrow Value is 1)

First Edition: Jan 2019 Second Edition: Oct. 2019



Shimadzu Corporation www.shimadzu.com/an/

For Research Use Only. Not for use in diagnostic procedure.

This publication may contain references to products that are not available in your country. Please contact us to check the availability of these products in your country.

The content of this publication shall not be reproduced, altered or sold for any commercial purpose without the written approval of Shimadzu. Shimadzu disclaims any proprietary interest in trademarks and trade names used in this publication other than its own. See http://www.shimadzu.com/about/trademarks/index.html for details.

The information contained herein is provided to you "as is" without warranty of any kind including without limitation warranties as to its accuracy or completeness. Shimadzu does not assume any responsibility or liability for any damage, whether direct or indirect, relating to the use of this publication. This publication is based upon the information available to Shimadzu on or before the date of publication, and subject to change without notice.