C146-E424A

SHIMADZU
Excellence in Science

Multifunctional Autosampler System AOC-6000 Plus

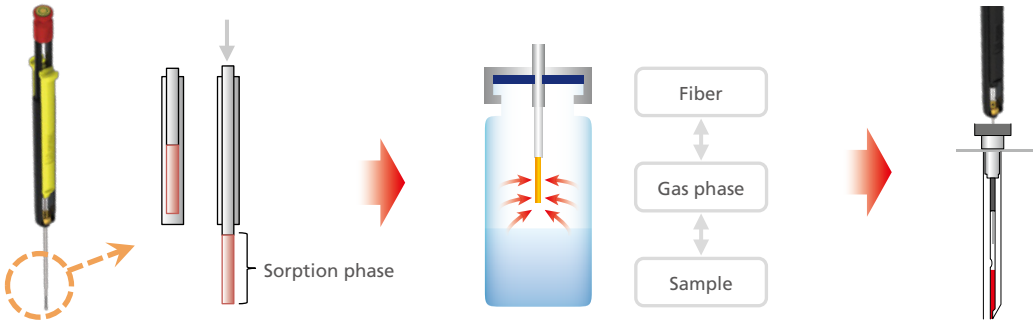
Smart SPME Fibers and Arrow Selection Guide

Solid Phase Micro Extraction (SPME) Method

The solid phase micro extraction (SPME) method concentrates volatile compounds in SPME fibers for sample introduction into GC and GCMS. It is used in a wide variety of fields, including food, environmental, chemistry, and life science. It is faster and more convenient than other sample introduction methods and, furthermore, can concentrate volatile compounds without using solvents. Using the AOC-6000 Plus multifunctional autosampler enables automation of all the processes from sampling to analysis and conditioning, and even management of usage logs for Smart SPME fibers and Smart SPME Arrow.

SPME

In the SPME method, SPME fibers are used for sampling. A fiber coated with a sorption phase is stored inside the needle. When the plunger is lowered, the fiber is exposed, and the volatile compounds from the sample are concentrated in the sorption phase.
Afterward, the concentrated compounds are loaded into the GC column under thermal desorption at the GC injection port.
The principle behind the SPME method is movement of the compounds in the sample to the sorption phase in the fibers via the partition coefficient. Accordingly, in order to increase the amount concentrated in the fibers, the sorption phase must be selected to suit the targeted compounds and the sample must be salted out, increasing the sorption phase partition coefficient. The extraction time, the temperature, and the agitation are also important parameters.



Structure of the SPME Fibers

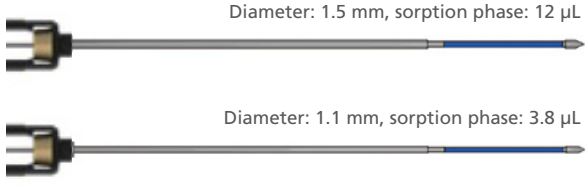
Concentration in the SPME Fibers

Thermal desorption
in the GC Injection Port

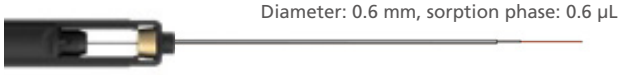
Smart SPME Arrow Provides High Sensitivity and High Durability

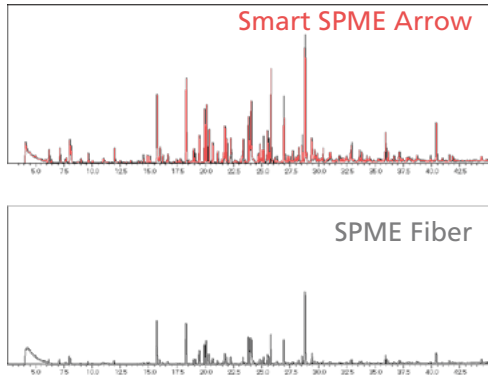
Smart SPME Arrow, cutting-edge SPME technology, is coated with more adsorbent than conventional SPME fibers, enabling high-sensitivity analysis. Further, the thick and sturdy construction provides high durability.

Smart SPME Arrow



SPME Fiber





Analysis of Aroma Compounds in Coffee
(The PDMS 100 µm type Smart SPME Arrow and SPME fibers are used.)

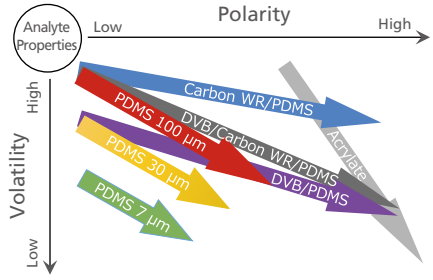
Selection of Smart SPME

Selection of the Sorption Phase

When using SPME fibers and SPME Arrow, the optimal sorption phase for the compounds to be analyzed must be selected.

The Smart SPME fibers and Smart SPME Arrow include various sorption phases, so they can be used in a wide range of analyses.

The following figure and table show the features of each sorption phase corresponding to the targeted compounds. The color of the Smart SPME fibers and Smart SPME Arrow plunger indicates the type of sorption phase, enabling the sorption phase to be ascertained at a glance.



Selection Guide

- PDMS is used for low polarity volatile compounds.
- Carbon WR/PDMS effectively concentrates low molecular weight compounds.
- DVB/PDMS is used for volatile compounds including polar compounds.
- Acrylate is used for high polarity compounds.
- DVB/Carbon WR/PDMS is optimal for a wide range of compounds.

Smart SPME Fibers

	Sorption phase	Target compound	Molecular weight	Polarity	Concentration method
	PDMS, 7 µm	Non-polar, high boiling point compounds	125-600	Non Polar	Absorption
	PDMS, 30 µm	Non-polar, medium boiling point compounds	80-500	Non Polar	Absorption
	PDMS, 100 µm	Non-polar to medium polarity volatile compounds	60-275	Non Polar	Absorption
	Acrylate, 100 µm	Polar, medium boiling point compounds, and phenols	80-300	Polar	Absorption
	Carbon WR/PDMS, 120 µm	Low molecular weight, low boiling point compounds	30-225	Non Polar	Adsorption
	DVB/PDMS, 120 µm	Polar, volatile compounds, amines, and alcohols	60-300	Bipolar	Adsorption
	DVB/Carbon WR/PDMS, 120 µm	A wide range of volatile compounds	30-300	Bipolar	Adsorption

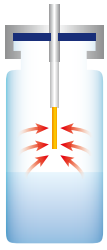
Smart SPME Arrow

	Sorption phase	Diameter	Target compound	Molecular weight	Polarity	Concentration method
	PDMS, 100 µm	1.1 mm/1.5 mm	Non-polar to medium polarity volatile compounds	60-275	Non Polar	Absorption
	Acrylate, 100 µm	1.1 mm	Polar, medium boiling point compounds, and phenols	80-300	Polar	Absorption
	Carbon WR/PDMS, 120 µm	1.1 mm/1.5 mm	Low molecular weight, low boiling point compounds	30-225	Non Polar	Adsorption
	DVB/PDMS, 120 µm	1.1 mm/1.5 mm	Polar, volatile compounds, amines, and alcohols	60-300	Bipolar	Adsorption
	DVB/Carbon WR/PDMS, 120 µm	1.1 mm/1.5 mm	A wide range of volatile compounds	30-300	Bipolar	Adsorption
	PDMS, 250 µm	1.5 mm	Non-polar to medium polarity volatile compounds	60-275	Non Polar	Absorption

Selection of the Extraction Method

With the SPME method, the sensitivity and compounds that can be measured vary with the extraction method. Accordingly, the extraction method must be selected to suit the analysis objective.

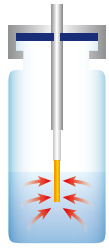
Headspace sampling is the most often used SPME extraction method. It can accommodate a wide range of volatile sample compounds including liquids, solids, and highly viscous samples. In contrast, with direct immersion sampling, the SPME fibers are dipped directly into the liquid sample. This method can accommodate high polarity, high boiling point compounds, which are difficult to collect using headspace sampling. Smart SPME Arrow is particularly durable and optimal for direct immersion sampling. In direct immersion sampling, when the sample contains a solvent that causes PDMS swelling, use of the wide sleeve type is recommended to prevent peeling off of the sorption phase. Additionally, inclusion of the washing step with the recommended solvent is recommended when salting out and for samples containing large matrix quantities.



SPME Method

Headspace Sampling

- Accommodates samples with a wide range of forms and matrices
- Compatible with volatile compounds
- Smart SPME fibers and Smart SPME Arrow can be used.

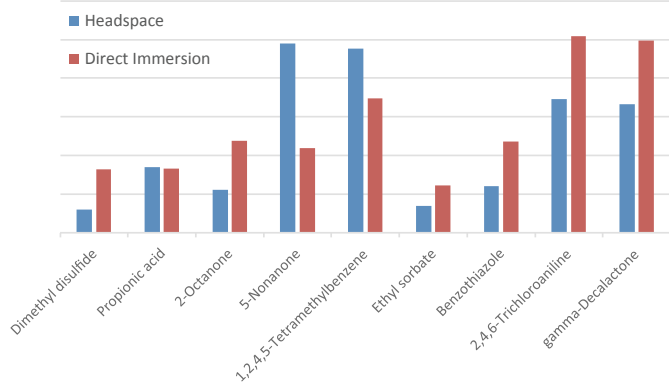


SPME Method

Direct Immersion Sampling

- Suitable for liquid samples
- Can concentrate high polarity, high boiling point compounds, which are hard to vaporize
- If there is PDMS swelling, use the wide sleeve Smart SPME Arrow.

The figure at right shows a comparison of the response of headspace sampling and direct immersion sampling using Smart SPME Arrow (PDMS, 250 µm). Low vapor pressure compounds are collected very efficiently with headspace sampling. Highly polar, high boiling point components tend to be collected very efficiently with direct immersion sampling.



Selection of Glass Inserts

Favorably shaped peaks can be obtained by selecting the optimal GC glass insert for the Smart SPME fibers or Smart SPME Arrow. When using Smart SPME fibers, if glass inserts for liquid injection are used, the bandwidth for low boiling point compounds will widen, resulting in broadly shaped peaks. For this reason, with the SPME method, sharp peaks can be obtained by using glass inserts with as narrow an inner diameter as possible.

- When using Smart SPME fibers, select a glass insert with a narrow 0.8 mm inner diameter for SPME.
- When using Smart SPME Arrow with an outer diameter of 1.1 mm, use glass inserts for SPME Arrow with an inner diameter of 1.3 or 1.7 mm.
- When using Smart SPME Arrow with an outer diameter of 1.5 mm, use glass inserts for SPME Arrow with an inner diameter of 1.7 mm.

Ordering Guide

Smart SPME Fiber

No.	Sorption phase	Phase thickness	Color code	P/N (1 pc)	P/N (3 pcs)	P/N (5 pcs)
1	Polydimethylsiloxane (PDMS)	7 µm	Green	227-35342-01	227-35342-03	227-35342-05
2	Polydimethylsiloxane (PDMS)	30 µm	Golden	227-35343-01	227-35343-03	227-35343-05
3	Polydimethylsiloxane (PDMS)	100 µm	Red	227-35344-01	227-35344-03	227-35344-05
4	Acrylate	85 µm	Grey	227-35348-01	227-35348-03	227-35348-05
5	Carbon Wide Range (WR)/PDMS	95 µm	Dark Blue	227-35347-01	227-35347-03	227-35347-05
6	Divinylbenzene (DVB)/PDMS	65 µm	Violet	227-35346-01	227-35346-03	227-35346-05
7	DVB/Carbon WR/PDMS	80 µm	Dark Grey	227-35345-01	227-35345-03	227-35345-05
	Smart SPME fiber for method developing 1 (No. 1, 2, 3, 4 and 5)					227-35349-01
	Smart SPME fiber for method developing 2 (No. 3, 4, 5, 6 and 7)					227-35350-01

Smart SPME Arrow

No.	Diameter	Sorption phase	Phase thickness	Color code	P/N (1 pc)	P/N (3 pcs)	P/N (5 pcs)
1	1.1 mm	Polydimethylsiloxane (PDMS)	100 µm	Red	227-35334-01	227-35334-03	227-35334-05
2*	1.5 mm	Polydimethylsiloxane (PDMS)	100 µm	Red	227-35338-01	227-35338-03	227-35338-05
3	1.1 mm	Acrylate	100 µm	Grey	227-35330-01	227-35330-03	227-35330-05
4	1.1 mm	Carbon Wide Range (WR)/PDMS	120 µm	Light Blue	227-35331-01	227-35331-03	227-35331-05
5*	1.5 mm	Carbon Wide Range (WR)/PDMS	120 µm	Light Blue	227-35335-01	227-35335-03	227-35335-05
6	1.1 mm	Divinylbenzene (DVB)/PDMS	120 µm	Violet	227-35332-01	227-35332-03	227-35332-05
7*	1.5 mm	Divinylbenzene (DVB)/PDMS	120 µm	Violet	227-35337-01	227-35337-03	227-35337-05
8	1.1 mm	DVB/Carbon WR/PDMS	120 µm	Dark Grey	227-35333-01	227-35333-03	227-35333-05
9*	1.5 mm	DVB/Carbon WR/PDMS	120 µm	Dark Grey	227-35336-01	227-35336-03	227-35336-05
10	1.5 mm	Polydimethylsiloxane (PDMS)	250 µm	Black	227-35339-01	227-35339-03	227-35339-05
	Smart SPME Arrow for method development 2 (No. 1, 3, 4, 6 and 8)						227-35341-01

*Use the SPME Arrow wide sleeve type for applications in which the PDMS layer might swell due to the solvent.

Glass Inserts

Part Name	P/N	Remarks
Smart SPME Inserts, 5 pc.	221-75196	
Smart SPME Arrow Inserts, Inner Diameter 1.3 mm, 3 pc.	227-35327-03	For Smart SPME Arrow with an outer diameter of 1.1 mm
Smart SPME Arrow Inserts, Inner Diameter 1.7 mm, 3 pc.	227-35328-03	For Smart SPME Arrow with an outer diameter of 1.1 mm or 1.5 mm

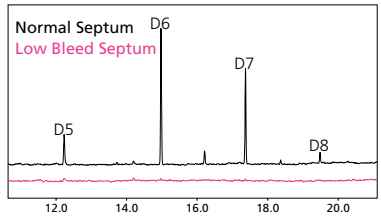
Vials

Part Name	P/N	Quantity
20 mL Screw Vial, Transparent	227-34141-01	100
Magnetic Screw Cap and Septum for 10-20 mL, Silicone (white)/PTFE (blue)	227-34152-01	100
Low Bleed Septum for SPME, Magnetic Screw Cap and Septum for 10-20 mL, Silicone (reddish brown)/PTFE (dark reddish-brown)	225-47192-91	100

Low Bleed Septum for SPME

SPME analyses often detect peaks of cyclic siloxanes from septums, which can interfere with the analytes. The newly developed low bleed septum for SPME minimizes the bleed of siloxanes derived from the septum.

Low Bleed Septum for SPME



Evaluation by blank analysis, vial heating condition 80 °C
(Normal Septum vs Low Bleed Septum)