

Agilent InfinityLab Stay Safe Caps – Reduction of Solvent Evaporation

Technical Overview

Introduction

Mobile phases for HPLC and UHPLC systems are usually provided from solvent bottles with distinct caps (Figure 1). Solvent lines run from the mobile phases, and pass through the bottle caps, before connecting to the LC system. The importance of the solvent bottle caps is often overlooked in laboratory safety and performance of the chromatographic system. This technical overview presents a performance study of InfinityLab Stay Safe caps through the measurement of methanol evaporation over time.



Figure 1. Solvent bottles as used for mobile phases.



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Requirements for Solvent Bottle Caps

The purpose of solvent bottle caps is to close the solvent bottles, to reduce evaporation, and to allow a solvent line to pass through, providing mobile phase to the pump. For proper operation of the LC, venting of the bottles must be possible. Avoiding evaporation is important due to two reasons:

- The organic solvents typically used in LC (that is, acetonitrile, methanol, THF, and so forth) are hazardous substances. Therefore, the concentrations of these solvents within the laboratory air should be reduced to a minimum.
- Variations in the mobile phase are critical to chromatographic performance. Even minor changes to the mobile phase composition due to evaporation can have a major effect on chromatographic performance and repeatability. The impact of these evaporative changes can become even more problematic as the mobile phase is stored over time.

Agilent InfinityLab Stay Safe Caps

The Agilent InfinityLab Stay Safe cap offers a solution that meets all the requirements for an optimum solvent bottle cap (Figure 2). They are compatible with the GL45 industry standard solvent bottle screw threads. There are many models with different numbers and types of connection ports for maximum flexibility. A venting valve allows air to flow into the bottles while it prevents solvents from evaporation, and a membrane in the venting valve prevents impurities getting into the mobile phase. There is a time strip attached to the venting valve indicating the need for replacement.



Figure 2. Agilent InfinityLab Stay Safe cap.

Experimental

The performance of Agilent InfinityLab Stay Safe caps for the prevention of solvent evaporation was investigated by comparing the evaporation rate of methanol from identical solvent bottles, equipped with different caps. Four different cap types were used for the study (Figure 3):

- An open bottle without any cap (A)
- A standard cap with three holes (B), one of which was closed
- An Agilent InfinityLab Stay Safe cap (C) (p/n 5043–1217) equipped with a venting valve including a time strip (p/n 5043–1190), and one port closed
- A closed cap (D)

We used six individual 1 L clear borosilicate glass bottles for each cap type, filled with 500 mL of methanol. To simulate the setup of a chromatographic system in use, a short piece of solvent line was used to plug one of the holes of the standard cap and the Agilent InfinityLab Stay Safe cap. This solvent line was closed with a cable tie on one end (Figures 3B and 3C).

The bottles were stored in a solvent cabinet with tenfold air exchange rate per hour. All the bottles were weighed at the beginning of the experiment, then several times over a period of 30 days. This measured the loss of methanol over time. Temperature was not controlled, but was recorded during the experiment, and it varied between 17 and 21 °C.

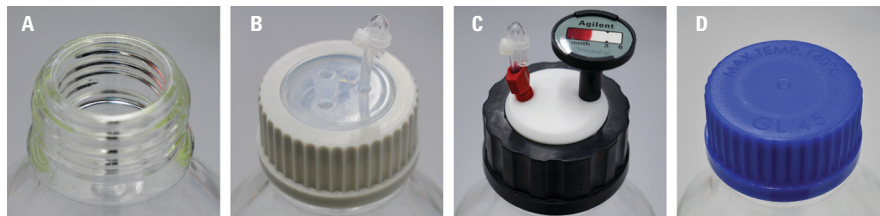


Figure 3. Open bottle (A); standard cap (B); Agilent InfinityLab Stay Safe cap (C); closed cap (D).

Results and Discussion

Figure 4 shows the average (n = 6) methanol evaporation over time resulting from using the different cap types.

Methanol loss from solvent bottles due to evaporation occurs in a linear fashion, with differences in the slope, or rate of loss, depending on the caps used. More than 75 g of methanol evaporated from the uncapped solvent bottles within 30 days. The standard cap also exhibited a significant loss of methanol: approximately 8 g within 30 days.

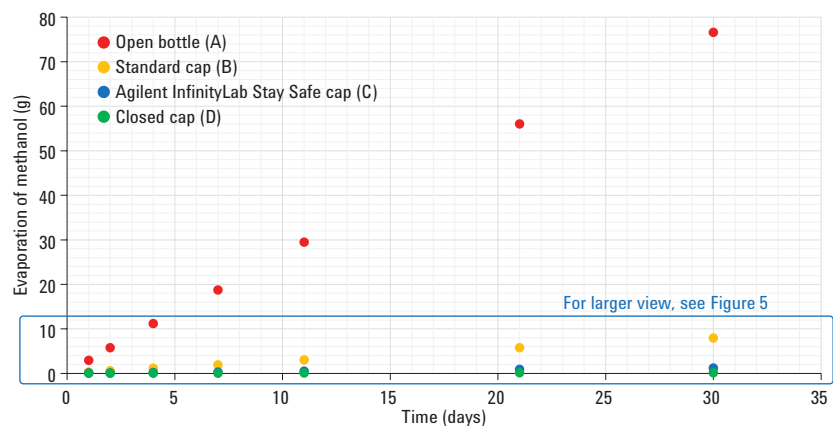


Figure 4. Methanol evaporation over time from solvent bottles equipped with different types of cap.

The methanol vapor retention performance of the InfinityLab Stay Safe caps was excellent. The InfinityLab Stay Safe caps reduced solvent loss to a minimum, with less than 1.5 g lost over 30 days (Figure 5).

Table 1 shows a comparison of the results from all cap types after 30 days.

With InfinityLab Stay Safe caps, the evaporation of methanol was reduced by 85 % compared to a standard cap, and by 98 % compared to an open bottle.

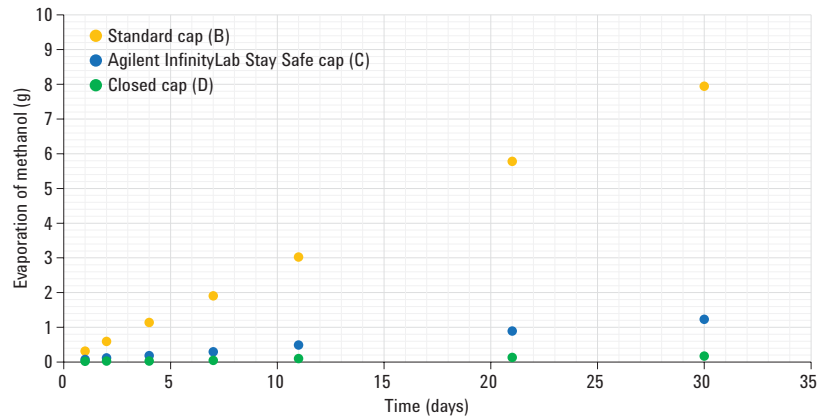


Figure 5. Methanol evaporation over time from solvent bottles equipped with specified caps.

Table 1. Loss of methanol after 30 days.

Cap type	Loss of methanol	
	g	%
Open bottle	76.6	19.1
Standard cap	7.9	2.0
Agilent InfinityLab Stay Safe cap	1.2	0.3
Closed bottle	0.2	0.0

-98% (Arrow from Open bottle to Agilent InfinityLab Stay Safe cap)
-85% (Arrow from Standard cap to Agilent InfinityLab Stay Safe cap)

Conclusion

Gain value from the Agilent InfinityLab Stay Safe caps:

- Limit the evaporation of hazardous solvents within the laboratory.
- Ensure optimum LC performance through mobile phase consistency.

Ordering Information

Agilent InfinityLab Stay Safe caps

Part no.	Description	Ports			
		Fittings	Vent	Filter	Waste
5043-1217	GL45 with 1 port 1 vent valve with time strip (5043-1190)	1 × 3.2 mm	1		
5043-1218	GL45 with 2 ports 1 vent valve with time strip (5043-1190)	2 × 3.2 mm	1		
5043-1219	GL45 with 3 ports 1 vent valve with time strip (5043-1190)	3 × 3.2 mm	1		
5043-1220	GL45 with 3 ports 1 leak hose	4 (2 × 3.2 mm, 1 × 2.3 mm, 1 × 1.6 mm)		1	1

Kits

Part no.	Description
5043-1221	Waste can, 6 L (5043-1196) Stay Safe cap GL45, with 4 ports (5043-1220)
5043-1222	Agilent InfinityLab Stay Safe cap kit, containing: 4 Caps • 3x 5043-1217 • 1x 5043-1218 4 Venting valves, with time strip (5043-1190) 4 Fittings, 3.2 mm (5043-1216)

For fitting ports

Part no.	Description
5043-1216	Fitting, for 3.2 mm tubing, PFA, 2/pk
5043-1215	Fitting, for 2.3 mm tubing, PFA, 2/pk
5043-1214	Fitting, for 1.6 mm tubing, PFA, 2/pk
5043-1198	Screw plug, 0.12 inch, PTFE, 2/pk

For vent port

Part no.	Description
5043-1190	Venting valve, with time strip, PTFE, 1 µm

For filter port

Part no.	Description
5043-1193	Charcoal filter, with time strip (58 g), for waste container

For waste port

Part no.	Description
5043-1207	2-ports waste collector, PTFE
5043-1195	Screw plug, 0.25 inch, PTFE

Miscellaneous

Part no.	Description
5043-1191	Thread adapter, PTFE, GL45 (M) - GL40 (F)
5043-1192	Thread adapter, PTFE, GL45 (M) - GPI 38-430 (F)
5043-1196	Waste can, 6 L, GL45

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