AUTOSAMPLER
VIALS AND CAPS

Screw and Snap Cap

Evaporation Studies

Extended Application Note

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Introduction

When analyzing typical samples for HPLC using autosampler vials, you want to be sure the cap and septa provide a proper seal. If not, solvent in the sample can evaporate and alter the concentrations of your analytes. This may affect your analytical results and can prompt a time-consuming QC investigation. Some solvents are more volatile than others and may be more susceptible to this phenomenon. Likewise, not all caps and septa provide the same sealing capabilities.

The MicroSolv autosampler vials were tested in this manner with a variety of caps and solvents. It was of interest to determine which combinations of vials, caps, and solvents would be optimal in terms of minimizing evaporative loss. These results can help the analyst in selection of the right products and conditions for a given application.

Plotting percent solvent loss over the course of several days is a good way to study these effects. The data traces obtained for each set of experimental conditions can be visually compared in a graph to determine the extent each variable has on percent loss. For example, if evaporation is observed to be a problem under a certain set of conditions, would switching to a different cap or a different solvent be better?

The variables studied in this work were as follows: Vials (screw, snap, and RSA™ brand screw), caps (screw, snap), septa (pre-slit, non-slit), and solvent (methanol, 1:1 acetonitrile: DI water). Evaporation under each of these conditions was studied over several days.

Vials:

- screw, MicroSolv
- screw, RSA™, MicroSolv
- snap, MicroSolv

Caps:

- snap cap, brand A
- snap cap, brand B
- snap cap, MicroSolv™, non-slit
- snap cap, MicroSolv™, pre-slit
- screw cap, MicroSolv™, non-slit
- screw cap, MicroSolv™, pre-slit

Solvents:

- methanol
- 1:1 acetonitrile: DI water

Experimental

Materials

Deionized water (DI H_2O) was prepared on a Milli-Q™ purification system from Millipore (Bedford, MA, USA). Acetonitrile and methanol (HPLC grades) were obtained from GFS Chemicals, Inc. (Powell, OH, USA). A Sartorius (Göttingen, Germany) Handy H51 analytical balance was used to record mass readings.

Sample Preparation and Data Analysis

Approximately 1 mL of solvent was added to each vial by pipet. The vial was then capped and set on the lab bench at room temperature (25 °C). The vial, cap, and solvent total mass was recorded once a day for 8–10 days. Percent loss was then calculated and averaged for each set of replicate experimental conditions (up to 15 replicates per vial/cap/solvent combination). The average percent loss as a function of time was graphed for each set of experimental conditions. Comparison of the percent loss for each of these data traces led to conclusions as to which combinations were best and which variables had the most significant effect on the rate of evaporation. Data analysis (tables and figures) were compiled using Microsoft Excel™ (Redmond, WA, USA) software.

Results and Discussion

Using the MicroSolv™ vials, three snap caps and two solvents were compared (**Fig. 1**). The results shown here are averages of multiple sample replicates.

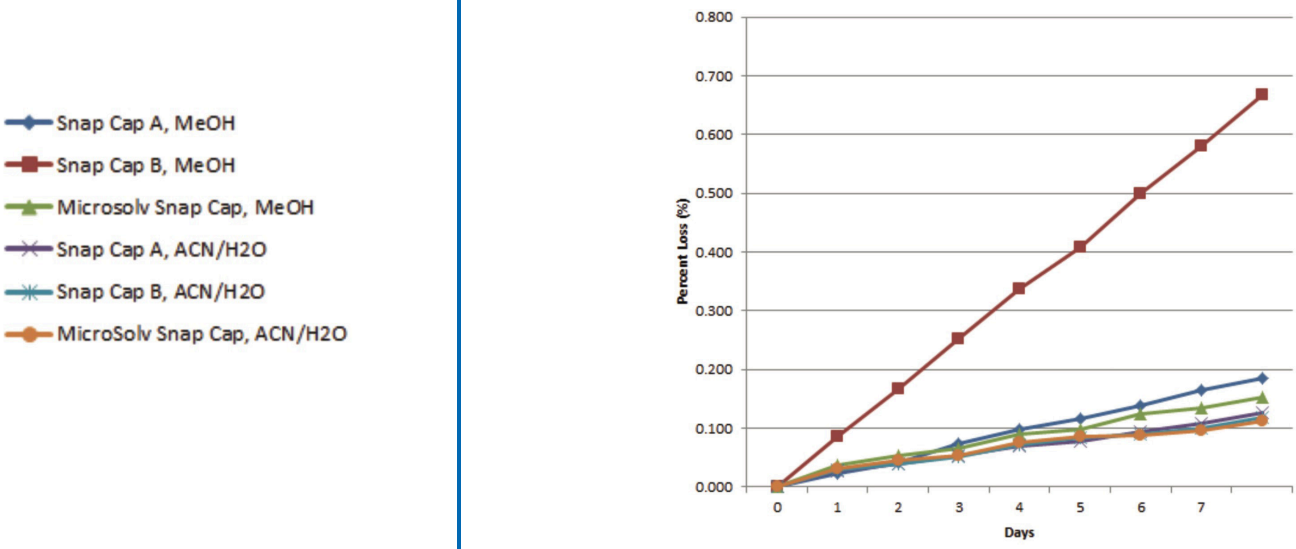

Figure 1

Evaporative loss was notably higher when using the more volatile solvent, methanol. The other solvent, 1:1 acetonitrile: DI water, was chosen because it may be often used in typical HPLC diluents and therefore would be of practical significance to the analyst. The three percent loss traces using this solvent system were the lowest of the six and did not differ significantly based on cap type. On the other hand, the data traces corresponding to methanol were more far apart, suggesting that selection of the snap cap plays a more critical role in situations where volatile solvents are used. The snap caps A and B had the highest loss in this case, while the MicroSolv caps were almost as low as the three traces using the acetonitrile/water solvent.

As an additional investigation, methanol was used to study evaporation rates using screw vs. snap top vials and pre-slit vs. non-slit septa (**Fig. 2**).

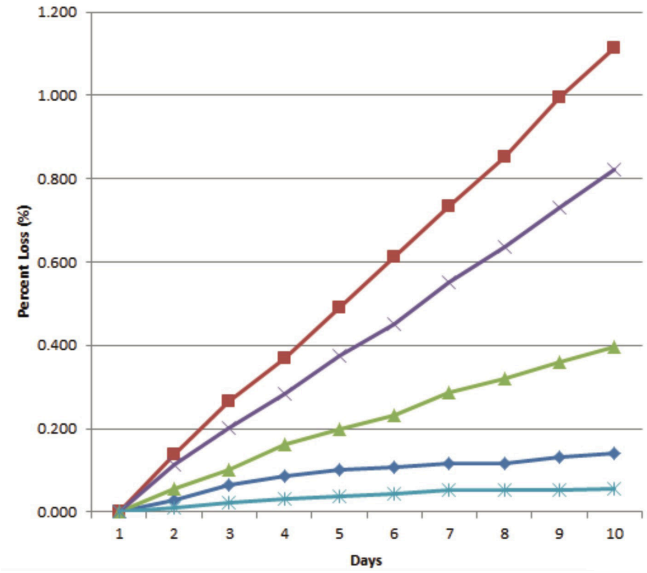

Figure 2

The results showed that the pre-slit septa had the most pronounced effect. Here, the highest loss was observed with the two experimental conditions that used pre-slit septa. Hence, the analyst may want to keep this factor in mind in selection of cap type. In comparing screw vs. snap caps, the screw caps mostly gave the lowest percent loss, and here the use of RSA™ screw vials gave a slight edge over regular screw vials.

Conclusion

The following tables summarize the relative importance of each variable on evaporative loss. Using the data from the two figures, the conditions could be ranked by comparing the slopes of their evaporative loss, with 1 being the lowest rate of loss and 5 or 6 being the highest.

First Study (Comparing Methanol vs. ACN/H2O and MicroSolv, "A," & "B" Brands)

Rank	Cap	Solvent	Vial	Septum Type
1	Snap (MicroSolv Brand)	1/1 ACN/H^2O	Snap	Non-Slit
2	Snap (Brand B)	1/1 ACN/H^2O	Snap	Non-Slit
3	Snap (Brand A)	1/1 ACN/H^2O	Snap	Non-Slit
4	Snap (MicroSolv Brand)	Methanol	Snap	Non-Slit
5	Snap (Brand A)	Methanol	Snap	Non-Slit
6	Snap (Brand B)	Methanol	Snap	Non-Slit

Second Study (Comparing Screw vs. Snap and Pre-Slit vs. Non-Slit)

Rank	Cap	Solvent	Vial	Septum Type
1	Screw	Methanol	Screw, RSA™	Non-Slit
2	Screw	Methanol	Screw	Non-Slit
3	Snap	Methanol	Snap	Non-Slit
4	Snap	Methanol	Snap	Pre-Slit
5	Screw	Methanol	Screw	Pre-Slit

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