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Performance Comparison of TDS³ Storage Containers to Swagelok Fittings and Glass Storage Containers

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Introduction

The typical analytical process for air sampling using thermal desorption tubes almost always involves shipping and storing the sampling tube before and after sampling prior to analysis. The most common approach to preventing contamination of the tube during shipment and storage has been to attach Swagelok end-cap fittings, using PTFE ferrules to both ends of the tubes before and after sampling. Another common technique is to place the sampling tube in a glass vial-like container, constructed to seal at one end with a Teflon®-faced screw cap.

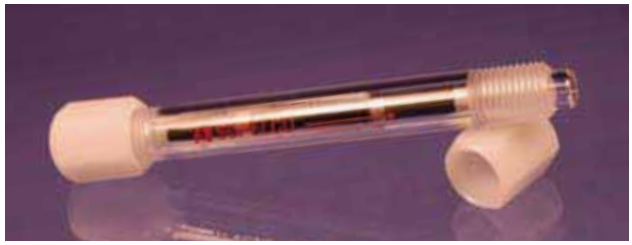
The TDS³ (Thermal Desorption Storage & Sampling System) offers advantages over both the Swagelok end-cap fittings and glass storage containers because it is designed to eliminate internal dead volume, minimize the area of migration of the sample from the adsorbent during the storage period, and eliminate breakage risks when shipping and handling in contrast to glass storage containers bearing this same risk. The TDS³ storage container holds the tube in its hard polycarbonate shell and seals with inert end-caps fitted with Teflon-faced silicone septa that are easily replaced. This eliminates the need for extensive cleaning or thermal conditioning of the device before it can be used for storing another tube.

Experimental

The performance of the TDS³ storage container was measured by its effectiveness for storing a collected sample relative to Swagelok end-cap fittings and glass storage containers.

A mix of twelve analytes were spiked onto twelve Carbotrap™ 300 thermal desorption tubes (6 mm O.D x 4 mm ID x 11.5 cm L), containing three carbonaceous adsorbents: Carbotrap C, Carbotrap B, and Carbosieve™ S-III. The sampling tubes were spiked with 40 ng of each analyte in 0.2 µL of methanol, using flash vaporization and 0.5 liters of inert nitrogen (50 mL/min for 10 min) to transfer the vaporized analytes onto the sampling tube.

Figure 1. TDS³ Container with Carbotrap 300 Glass-Fritted TD Tube



The clear body of the TDS³ is shorter than the actual tube (as shown), so the septa seals on the end of the thermal desorption tube, creating an air-tight seal.

The twelve tubes were assigned to three sets, each stored in a different storage device. Tubes in Set One were stored in TDS³ storage containers, Set Two were fitted with brass Swagelok nut and end-cap fittings, using PTFE ferrules; and Set Three were stored in a threaded glass vial-type container which seals with a Teflon screw cap at one end.

After spiking, the tubes were quickly sealed and placed in a paint can (all tubes in the same can) containing a small amount of activated charcoal and placed in a laboratory freezer for 14 days at -24 °C. After 14 days, the samples were removed from the paint can and thermally desorbed to a gas chromatograph.

Results

Percent recoveries in Table 1 were calculated by comparing peak areas for the desorbed analytes to those for calibration standards spiked onto the Carbotrap 300 tubes in the same manner on the day of analysis. Values shown are means for the three samples. Area counts for the first six

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Table 1. Recovery of Analytes Stored for 14 Days

	Set One	Set Two	Set Three
Analyte	TDS³ Storage Container	Swagelok Fittings with PTFE Ferrules	Glass Storage Container
Chloroform	97.7 ± 6.8	97.9 ± 2.3	99.2 ± 3.5
1,1,1-Trichloroethane	102.4 ± 1.7	102.6 ± 1.5	104.4 ± 1.4
Carbon tetrachloride	98.7 ± 2.8	95.8 ± 1.3	98.8 ± 2.6
1,2-Dichloroethane	98.6 ± 3.0	95.8 ± 1.7	98.6 ± 1.0
Trichloroethylene	100.7 ± 2.8	96.7 ± 0.7	105.0 ± 2.0
1,2-Dichloropropane	99.3 ± 2.5	97.5 ± 1.4	102.9 ± 2.7
1,3-Dichloropropane	101.3 ± 6.0	94.4 ± 9.2	87.8 ± 9.4
Tetrachloroethylene	99.5 ± 5.3	101.7 ± 4.4	93.8 ± 6.6
Ethylene dibromide	114.2 ± 6.2	97.1 ± 18.3	76.2 ± 8.7
Chlorobenzene	95.4 ± 4.4	95.9 ± 6.9	95.0 ± 5.7
Bromoform	107.7 ± 11.3	98.9 ± 5.5	91.7 ± 10.4
Bromobenzene	96.0 ± 4.8	95.4 ± 8.4	91.1 ± 6.8

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listed compounds were normalized to an internal standard, bromodichloromethane; the last six compounds were normalized to 1,3-dichlorobenzene.

Conclusion

The results in Table 1 demonstrate that the TDS^3 storage containers are equivalent to both Swagelok end-cap fittings and glass storage containers in terms of sample stability during storage.

Did you know…?

In addition to its ability to maintain sample integrity, the TDS^3 storage container offers the user versatility during the sampling process. It can be converted to a sampling device by installing optional sampling caps that allow the user to easily connect the tube in the TDS^3 to a sampling pump. An optional tube holder is also available.

Figure 2. Carbotrap 300 TD Tubes with Escort Elf Pump and Twin Port Sampler

Featured Products

Description	Pk.	Cat. No.
TDS^3 Storage Container by Instrument Manufacturer/Model		
Supelco, DANI, Markes, PerkinElmer, Shimadzu	1	25097-U
CDS/Dynatherm Standard Tubes	1	25096-U
Chrompack TD Tubes	1	25098-U
Gerstel TDS/TDS2/TDSA Tubes	1	25095-U
Gerstel 60 mm Tubes	1	28307-U
Teledyne/Tekmar AEROTtrap 6000 Tubes	1	25099-U
Envirochem, 810 Tubes	1	25100-U
TDS^3 Storage Container Accessories		
Sampling caps w/washers for ¼ in. OD Tubes	10	25069
Replacement Septa for all TDS^3 containers	50	25073
Male Luer Plug	12	504351
Female Luer Cap	12	57098
Tubing Adapter for Use With:		
1/8 in. tubing to male luer	20	21016
3/16 in. tubing to male luer	20	23364
¼ in. tubing to male luer	10	24856
Tubing Coupler		
For use with male to male luer	20	25064-U

Related Products

Description	Qty.	Cat. No.
Equipment		
Escort Elf Sampling Pump	1	28160-U
Gemini Twin Port Sampler	1	28118-U
12 Volt Battery Charger	1	28155-U
110 Volt Battery Charger	1	28158-U
240 Volt Battery Charger	1	28159-U
Chemical Standards		
Chloroform	5 mL	02487
1,1,1-Trichloroethane	1 mL, 5 mL	02669
Carbon tetrachloride	1 mL, 5 mL	02671
1,2-Dlchloroethane	1 mL, 5 mL	02562
Trichloroethylene	5 mL	46267
1,2-Dichloropropane	1 mL	02577
1,3-Dichloropropane	250 mg	45439
Tetrachloroethylene	1 mL, 5 mL	02666
Ethylene dibromide	1 g	31040
Chlorobenzene	5 mL, 25 mL	08650
Bromoform	1 g	36972
Bromobenzene	500 mg	442495