

A Tool for Selecting an Adsorbent for Thermal Desorption Applications

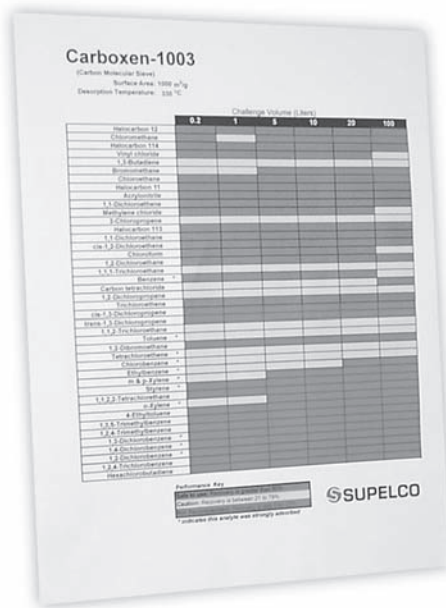
A common question asked by GC users working with thermal desorption is “Which adsorbents trap what analytes?” To assist customers in selecting the appropriate adsorbents for their applications, we embarked on a study to evaluate 24 adsorbents for trapping and releasing a targeted list of 43 analytes. The results of this effort lead to the development of a color-coded selection chart system that simplifies the decision of “Which adsorbents trap what analytes?”

Chart System Development

We selected 24 adsorbents for the study including Carboxen™ and Carbosieve™ carbon molecular sieves, Carbopack™ and Carbotrap™ graphitized carbons, and several porous polymers. Each adsorbent was packed into a tube and spiked with the 43 component gas mix. To assess the analyte breakthrough, we conducted tests using six different sampling volumes ranging from 0.2 to 100 liters for each tube. The collected analytes were desorbed onto an SPB-1 capillary column and we measured the recovered analytes at each challenge volume. We then conducted a second desorption of each tube to observe if any carryover had occurred.

We recorded all the analyte recovery data into spreadsheets. We then applied the analogy of a traffic light to the data with green indicating greater than or equal to 80% recovery, yellow indicating between 21% and 79%, and red for recoveries of 20% or less. With this color scheme, we transformed the data into a color-coded chart system for determining which adsorbents trap what analytes. Figure A shows an example of one of the charts generated in the study.

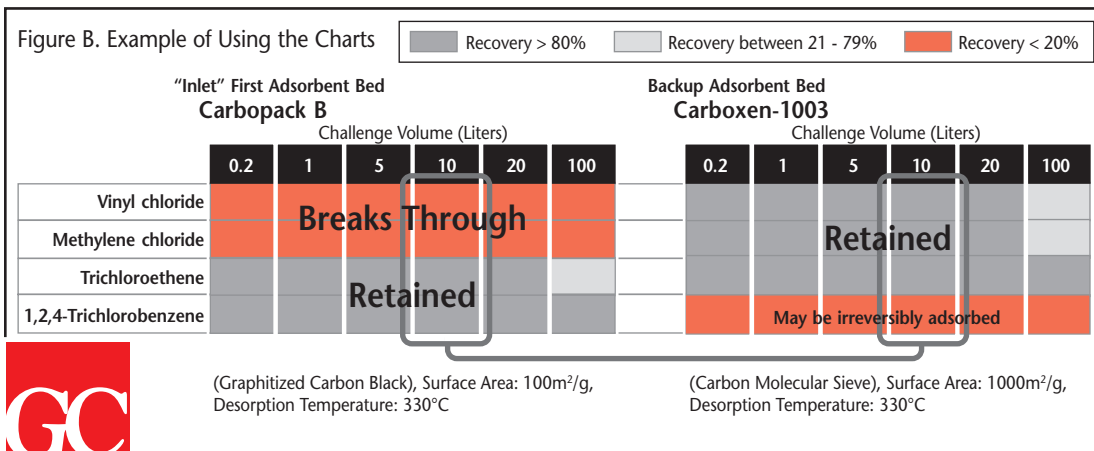
Figure A. Recovery Chart from the Study



Using the Selection Tool

As an illustration of how to work with the chart system, assume you plan to sample 10 liters of air for the presence of trichloroethene. Examining the chart system, you learn recoveries of 80% or greater can be achieved on several adsorbents, including Carbopack B and Carboxen-1003 (Figure B). Your decision here is easy

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Packed GC Columns for
Agilent Technologies



E000910

Thermal Desorption Tubes



9960295

NEW PRODUCTS

Packed GC Columns for Agilent Technologies

Agilent Technologies has made a decision to exit the packed GC column business. In an effort to maintain a continuous supply of product to their customers, Agilent Technologies has named Supelco the authorized supplier of packed GC columns for Agilent Technologies and Agilent Technologies customers.

For your convenience, you may reference an Agilent Technologies part number with your first order. In most cases, your Sigma-Aldrich/Supelco representative will provide you with a corresponding Supelco part number for future orders.

☎ For more information call 800-247-6628 or 814-359-3441, fax 800-325-5052 or email techservice@sial.com.

FEATURED PRODUCTS

Thermal Desorption Tubes for
GERSTEL®, PerkinElmer, Tekmar, and
CDS/Dynatherm Instruments

Tube	Qty.	Stainless Steel Cat. No.	Glass Cat. No.
PerkinElmer (3.5" long x 0.25" OD)			
Carbotrap 300	10	25050	25085
Carbotrap 349	10	25057-U	25092-U
Air Toxic TM	10	25051	25086
Carbopack B	10	25052	25087
Carbosieve S-III ¹	10	25053	25088
Tenax GR	10	25054	25089
Tenax TA	10	25055	25090-U
Chromosorb 106	10	25056-U	25091
Empty Tube ²	1	25049	25084
Tekmar (7" long)			
Carbotrap 100 ³	1	20241	—
Carbotrap 300 ³	1	20370-U	20912-U
Carbotrap 300 ⁴	1	—	20983
Tenax TA ³	1	20913-U	20970-U
Tenax TA ⁴	1	20984	20988
Empty Tube ³	1	20920-U	20918
Empty Tube ⁴	1	20924	20922
GERSTEL (7" long x 6mm OD)			
Tenax TA	1	28271-U	28281-U
Tenax GR	1	28272-U	28282-U
Carbotrap 300	1	28273-U	28283-U
Carbosieve S-III	1	28274-U	28284-U
Chromosorb 106	1	28275-U	28285-U
Empty Tube with Frit	1	—	28286-U
Empty Tube, no Frit	1	28276-U	28287-U

CDS/Dynatherm Model 850/890, ACEM 900/901 - FF
(4.5" long x 6mm OD)

Carbotrap 100	1	—	20872
Carbotrap 300	1	—	20875
Carbotrap 349	1	—	20243
Tenax TA	1	—	20896-U
Empty tube w/frit	3	—	20380-U
Empty tube no frit	5	—	20235-U

¹ German Patent No. 1935500. Patent holder: Badische Anilin-& Soda-Fabrik Aktiengesellschaft.

² Stainless steel tube supplied with retaining gauge & clip.

³ 1/4" OD

⁴ 1/2" OD

☎ For more information request T401093 and T401028.

MORE FEATURED PRODUCTS

Thermal Desorption Tube Accessories for
PerkinElmer Equipment

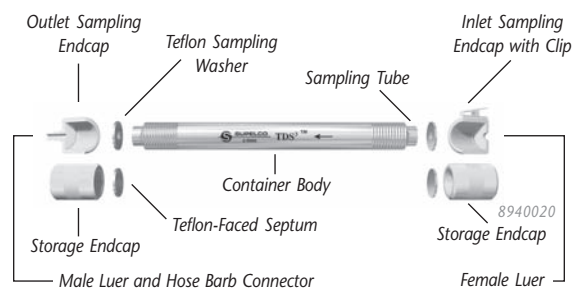
TurboMatrix Tube Accessories	Qty.	Cat. No.
Brass Caps	20	28011-U
Replacement Teflon® PFE Ferrules for Caps	20	28012-U
Pen Clips for Tubes	10	28016-U
Diffusion Caps, Standard	10	28017-U
Diffusion Caps with Membrane	10	28018-U
Empty Glass Tube with Brass Caps	10	28013-U
Empty SS Tube with Brass Caps	10	28014-U
Empty SS Tube with Brass Caps	50	28015-U

ATD Model 50 and 400 Accessories	Qty.	Cat. No.
PTFE Storage Caps	20	28019-U
Empty Tube Stainless Steel	1	25049
Empty Tube Glass	1	25084

☎ For more information on accessories available for PerkinElmer thermal desorption equipment, request T401093.

Thermal Desorption Accessories for
GERSTEL Tubes

Accessories	Qty.	Cat. No.
Empty Stainless Steel Tube with Stainless Steel Screen	1	28276-U
Empty Glass Tube with Glass Frit	1	28286-U
Empty Glass Tube, no Frit	1	28287-U
Replacement Screens, Stainless Steel	10	28277-U
Replacement TDS ³ ™ Storage Container	1	25095-U
Replacement Seal for TDS ³	50	25073
Sampling Cap Set	1	25069



☎ For more information request T401028.

All literature mentioned in this issue can be obtained from the website, sigma-aldrich.com/TheReporter, by completing the Literature Request section on the reply card, or by calling our Technical Service Dept.

LITERATURE

A Tool for Selecting an Adsorbent for Thermal Desorption Applications

There are a variety of adsorbents used in the field of thermal desorption. Often choosing the right adsorbent can be difficult. The goal in selecting the proper adsorbent is to choose one that can retain a specific or group of analytes for a specified sample volume. However, just as important, the adsorbent must also be able to release the analytes during the desorption process. This report sheds some light on choosing the right adsorbent by demonstrating the relative differences between those most commonly used. Supelco investigated 24 adsorbents in the study and generated easy to use color-coded charts for each of the adsorbents.

For more information visit sigma-aldrich.com/thereporter and open the link for T402025.

Thermal Desorption Accessories for PerkinElmer Equipment

Supelco now offers the complete line of PerkinElmer accessories for the ATD-50 and ATD-400 and TurboMatrix thermal desorption instruments. We have all the products you will need for the new TurboMatrix (TMX) instrument including the new brass storage end caps, replacement ferrules, pen clip holders, diffusion caps with and without membranes, empty glass, and stainless steel tubes.

For more information request T401093.

Thermal Desorption Tubes for GERSTEL Analytical Equipment

Supelco thermal desorption tubes are available for the GERSTEL model TDS 2/TDS A instrument. These tubes offer superior performance for trapping and thermally desorbing organic compounds. They retain compounds effectively, and release them efficiently. Supelco manufactures these tubes to within close tolerances. This ensures even lot-to-lot performance. Many adsorbents are available nowhere else. Tubes are available in glass or stainless steel.

For more information request T401028.



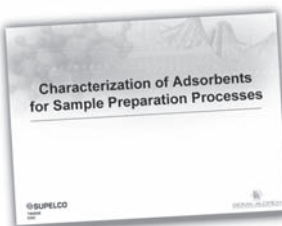
SEMINARS

Characterization of Adsorbents for Sample Preparation Processes

Adsorbent technology has been a core business at Supelco for over a decade. The use of adsorbents in sample preparation processes, specifically gas phase processes, has been one of the major focuses of this core technology. The roots of this technology are founded in gas-solid chromatography (GSC), and this chromatographic technique led to the initial generation of several families of adsorbents and subsequent adsorbent products. Additional studies focus-

ing on the thermodynamic, kinetic and physical properties of the adsorbents have led to a better understanding of the performance characteristics of the adsorbents. The history of these studies at Supelco, the adsorbents which have evolved from these studies, and the current efforts at Supelco are presented.

For more information visit sigma-aldrich.com/thereporter and open the link for T402026.



GAS CHROMATOGRAPHY PERFORMANCE TIP

Conditioning Thermal Desorption Tubes

Thermal desorption tubes have an advantage over solvent desorption tubes since they are reusable. However, after using a thermal desorption tube, it is necessary to properly recondition the tube. You must heat the tube and completely remove the sample from the previous application before using the adsorbent tube again.

We recommend that you condition the tube at 10 to 20°C above the desorption temperature you use to analyze the tube. When conditioning, make sure that you do not exceed the recommended maximum temperature limit of the adsorbent. Use clean nitrogen or helium at a flow rate of 50cc/minute for at least thirty minutes. More time may be necessary depending on how you use the tubes.

If you are sampling in the parts per billion or parts per trillion range you may need to condition your tubes for two or three hours. Longer conditioning times are also required after too much sample is adsorbed onto the tube.

When you are conditioning a multi-bed tube, you want to make certain that the direction of the gas flow during conditioning is correct. The direction of the flow should go from the strongest bed of adsorbent through the weakest. This removes high molecular weight analytes that collect on the inlet of the tube. Otherwise, these analytes are irreversibly adsorbed on the other beds.

For more information visit sigma-aldrich.com/thereporter and open the link for T402025.



Jamie Brown -
R&D

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Air Toxics, PerkinElmer - PerkinElmer
Agilent Technologies - Agilent Technologies
Carbopack, Carbosieve, Carbotrap, Carboxen, SPB, Supelco, TDS³ - Sigma-Aldrich Co.
GERSTEL - GERSTEL GmbH
Tekmar - Tekmar Co.
Teflon - E. I. du Pont de Nemours & Co., Inc.

A Tool for Selecting an Adsorbent...

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since either of these adsorbents will provide good trichloroethene results at 10 liters.

However, what if your sampling needs change? Now assume you must monitor for vinyl chloride, methylene chloride, and 1,2,4-trichlorobenzene in addition to trichloroethene. The color coding for each adsorbent found in Figure B tells us neither the Carbopack B nor the Carboxen-1003 adsorbents can be used alone for sampling. None of the adsorbents will effectively retain all the compounds of interest. If you want to use a single tube, you must design a multiple adsorbent bed tube. Based on the chart information, you can achieve good results by combining two adsorbents, Carbopack B and Carboxen-1003. The Carbopack B bed must be the first adsorbent the sample

encounters. This is because the trichloroethene and 1,2,4-trichlorobenzene are trapped on the Carbopack B, while the vinyl chloride and methylene chloride pass through to the Carboxen-1003 bed, where they are collected. The data shows that the 1,2,4-trichlorobenzene may be irreversibly adsorbed on the Carboxen-1003 if it were first.

The decision process used here to determine which adsorbents trap what analytes can be applied to scenarios that are more complex by using the color-coded chart system we developed. The entire study with associated adsorbent charts and the detailed experimental conditions can be accessed on our web site.

For more information visit sigma-aldrich.com/thereporter and open the link for T402025.

CASE STUDY 1

Multi-Bed Adsorbent Tube Provides Better Results

The Problem

A customer who was interested in sampling for methylene chloride in an indoor air quality application called our Technical Service department recently. To determine what adsorbent tube would be required, we asked the customer what other compounds could be included in the sample. We learned that he was going to do the sampling in an environment that contained aromatic hydrocarbons (BTEX) in addition to methylene chloride.

The customer inquired about a thermal desorption tube to do this analysis. He was interested in a TDU tube that would be packed with a single bed of Carboxen-1000 material to do the analysis. He knew from published literature that this material would trap organic compounds with carbon chain lengths in the C2-C5 range.

The Solution

Our Technical Service representative informed the customer that the Carboxen-1000 custom TDU tube would not be a good choice for the analysis. Some of the BTEX compounds could be too strongly retained on the Carboxen-1000 material.

He suggested that the customer use our Carbotrap 317 TDU tubes which contains three adsorbent beds: Carbopack C, Carbopack B, and Carboxen-1000. The Carbopack C will trap organic compounds with carbon chain lengths in the C12-C20 range. The Carbopack B will trap compounds in the C5-C12 range. The Carboxen-1000 will trap compounds in the C2-C5 range. The first two beds will retain the BTEX compounds and serve to protect the bed of Carboxen-1000 material, which will collect the methylene chloride.

By using a multiple adsorbent bed tube, the customer was able to isolate the target compound of interest and effectively deal with the interfering aromatic hydrocarbons.

For more information visit sigma-aldrich.com/thereporter and open the link for T402025.

Figure C. Thermal Desorption Unit Tubes



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