the RESTEK Advantage
Innovators of High Resolution Chromatography Products

Siltek™ Deactivation—The Next Generation

Outstanding Performance for Chlorinated Pesticide Analyses

by Dr. David Smith, R&D Chemist, and Deb Salabsky, Applications Chemist

- Maximizes the inertness of sample pathway.
- Minimizes breakdown.
- Low bleed.
- Thermally stable.
- "Clean and green"—manufactured without the use of harmful organic solvents.

First Restek developed a 100% polymeric, high-temperature silanization process for inlet liners. Restek's polymeric silanization is the deactivation of choice, resulting in low endrin breakdown and inertness for compounds containing active functional groups like phenols, diols, and acids.

Next Restek developed a surface deactivation for handling basic compounds, like those found in drugs, azo-dyes, and amines. Our base-deactivated glass accessories provide excellent recovery of trace-level active basic compounds.

Now Restek Introduces the Next Generation of Deactivation… Siltek™.
The Siltek™ deactivation process (patent pending) produces a highly-inert glass surface, which features high temperature stability, extreme durability, and low bleed. Try Siltek™-deactivated liners, guard columns, wool, and connectors for minimized breakdown and better recovery of sample analytes.

Siltek™-Deactivated Inlet Liners
Gas chromatographic (GC) analysis of chlorinated pesticides presents unique challenges to environmental laboratories because these compounds often are analyzed at trace levels and are susceptible to decomposition caused by reactive sites in the analytical system. Pesticide methods, such as the US Environmental Protection Agency (EPA) Methods 8081 and 608, have stringent breakdown criteria. The two pesticide compounds used to monitor system inertness are notorious for exhibiting breakdown—endrin, which breaks down into endrin aldehyde and endrin ketone, and DDT, which breaks down into DDE and DDD. The breakdown of these compounds most often occurs in the GC injection port. *(cont. on page 2)*

in this issue

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Siltek™ Deactivation—The Next Generation

(continued from pg. 1)

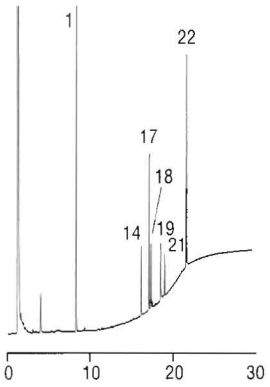
Routine maintenance of the injection port and GC columns is essential to minimize compound breakdown.

To illustrate the importance of proper surface deactivation for endrin and DDT analysis, a 50pg/µL test mix was injected on an undeactivated direct injection glass inlet liner. Endrin breakdown was 62% and DDT breakdown was below detection limits, as shown in Figure 1.

Next, the raw liner was removed and replaced with a Siltek™-deactivated direct injection liner. The results of this injection are shown in Figure 2. Endrin breakdown measured less than 1% and DDT breakdown again was below detection limits. The results not only confirm the necessity for inlet liner deactivation in pesticides analysis, but also show the inherent inertness of Siltek™ deactivation and its ability to improve the accuracy of pesticides analysis.

Figure 1

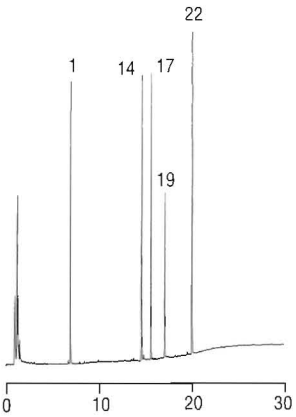
Direct injection Uniliner® without deactivation exhibits 62% endrin breakdown.



30m, 0.53mm ID, 0.42µm Rtx-CLPesticides2 (cat.#11340) with open-top Uniliner® (cat.# 20843-214.1 for Siltek™ deactivation)
Inj.: 1µL of 50pg/µL standard of tetrachloro-meta-xylene (IS), endrin, 4,4'-DDT, methoxychlor, and decachlorobiphenyl (IS)
Oven temp.: 120°C (hold 1 min.) to 300°C @ 9°C/min. (hold 10 min.)
Inj. temp.: 250°C
Det.: ECD, 300°C
Carrier gas: helium

Figure 2

A Siltek™-deactivated liner exhibits approximately 1% endrin breakdown.



Siltek™-Deactivated Guard Columns

Guard columns are commonly used in the analysis of chlorinated pesticides. Many analysts use them as a way to divide a sample equally onto two different analytical columns by way of a Press-Tight® 'Y' connector. This configuration allows a primary and a confirmational analysis using one injection. Guard columns also make routine maintenance easier by allowing removal of the first meter of column. This eliminates non-volatile contamination, without affecting the analytical column(s). Siltek™-deactivated guard columns and Siltek™-deactivated connectors provide an inert sample introduction pathway that is ideal for chlorinated pesticide analysis.

Siltek™ Deactivation—The Complete Solution

The analysis of US EPA Method 8081 calibration standard is shown in Figure 3. This chromatogram was generated using a Siltek™-deactivated inlet liner and guard column, and an Rtx®-CLPesticides analytical column.

The best protection against endrin and DDT breakdown for chlorinated pesticide analysis is to outfit your GC with Siltek™-treated products. For a highly inert pathway and fast GC cycle times, use Rtx®-CLPesticides and Rtx®-CLPesticides2 analytical columns in combination with Siltek™-deactivated liners and guard columns.

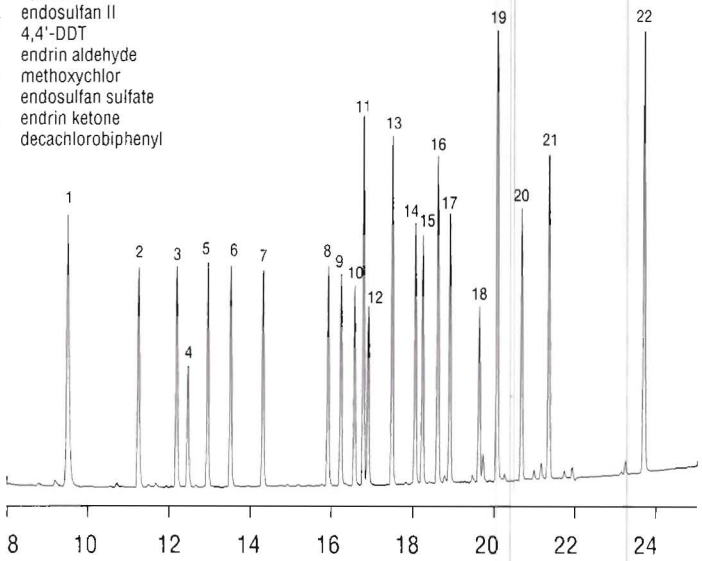
Figure 3

Analysis of US EPA Method 8081 with a Siltek™-deactivated Uniliner® and guard column shows resolution of all 22 chlorinated pesticides.

Peak List for Figures 1, 2, and 3

1. 2,4,5,6-tetrachloro-m-xylene
2. α-BHC
3. γ-BHC
4. β-BHC
5. δ-BHC
6. heptachlor
7. aldrin
8. heptachlor epoxide
9. γ-chlordane
10. α-chlordane
11. 4,4'-DDE
12. endosulfan I
13. dieldrin
14. endrin
15. 4,4'-DDD
16. endosulfan II
17. 4,4'-DDT
18. endrin aldehyde
19. methoxychlor
20. endosulfan sulfate
21. endrin ketone
22. decachlorobiphenyl

30m, 0.32mm ID, 0.5µm (cat.# 11139) Rtx®-CLPesticides with a 5m, 0.32mm ID Siltek™-deactivated guard column (cat.# 10027) and a Siltek™-deactivated gooseneck liner (cat.# 20798-214.1)
On-column conc.: 16-160pg
Oven temp.: 120°C (hold 1 min.) to 300°C @ 9°C/min. (hold 10 min.)
Inj. temp.: 250°C, splitless (hold for 0.75 min.)
Det.: ECD, 300°C with Anode purge
Carrier gas: helium at 31cm/sec. linear velocity



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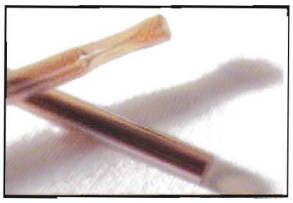
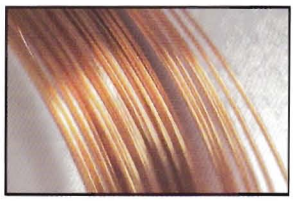
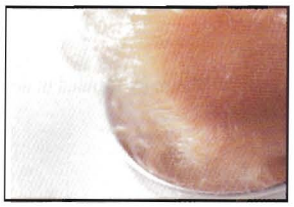
For more information on Siltek™ deactivation, request "**Siltek™ Deactivation Benefits Brochure**" (lit. cat.# 59803). Call 800-356-1688, ext. 5, or contact your local Restek representative.







For Siltek™-deactivated inlet liners, add the corresponding suffix number to your liner catalog number.

Siltek™-Deactivated Inlet Liners			
qty.	Siltek™	Siltek™ with Siltek™-deactivated wool	Siltek™ with CarboFrit™
each	-214.1	-213.1	-216.1
5-pk.	-214.5	-213.5	-216.5

Siltek™-Deactivated Press-Tight™ Connectors*		
type	qty.	cat.#
straight	25-pk.	20449
angled "Y"	3-pk.	20469

Other types of Press-Tight™ connectors can be ordered on a custom basis by adding the suffix -266.

other	each	-266

Siltek™-Deactivated Guard Columns			
nominal ID	nominal OD	5-meter	10-meter
0.25mm	0.37 ±0.04mm	10026	10036
0.32mm	0.45 ±0.04mm	10027	10037
0.53mm	0.69 ±0.04mm	10028	10038

Siltek™-Deactivated Borosilicate Wool	
qty.	cat.#
10 g	21100

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See page 10 for an article on US EPA Method 8081A Chlorinated Pesticide Analysis.

CarboPrep™ SPE Tubes

RESPREP™

For Improved Recovery

by Gary Stidsen, Sample Preparation Product Line Manager

- Excellent for cleanup of pesticide residue extracts.
- Maximum capacity for contaminate cleanup using a minimum bed weight.
- Improved recovery of sulfonylurea herbicides, phenols, carbamates, and triazine herbicides compared to C-18 and C-8 tubes.
- Wide range of selectivity for both analytes and their metabolites or degradents.
- Rapid sampling flow rates up to 20mL/min. without compromising recoveries.

Restek's CarboPrep™ tubes were developed for the sample preparation of nonvolatile and semi-volatile analytes from a variety of matrices. They are useful for diverse applications, from concentration of human estrogen in amniotic fluids to cleanup of environmental pesticides and herbicides in agricultural commodities.[1,2] CarboPrep™ tubes are commercially manufactured from chromatographic-grade, nonporous, graphitized carbon. The manufacturing process is designed to minimize variability and improve performance of recovery and cleanup procedures. Restek's CarboPrep™ tubes provide a carbon with twice the surface area of most commercially available carbons, to give you the maximum capacity for your most difficult samples.

To experience the many benefits of CarboPrep™ tubes for yourself, call 800-356-1688, ext. 3, or contact your local Restek representative for a sample pack and *Get Prepped* today!

cat. #	
CarboPrep™ 3mL, 250mg	
26088	(50-pk.)
CarboPrep™ 6mL, 500mg	
26087	(30-pk.)

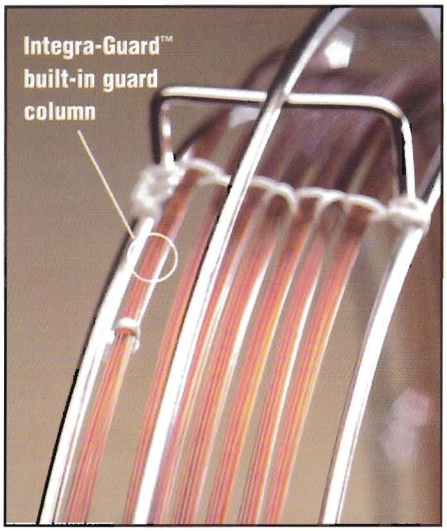
Custom sizes available, please call for details.

References
1. F. Andreolini, C. Borra, F. Caccamo, A. DiCorcia, and R. Samperi., *Analytical Chemistry.* 1987, 59, pp. 1720-1725.
2. J. Fillion and L. Nolan, *Today's Chemist.* 1996, pp. 14-24.

Integra-Guard™ Columns

Get the Protection Without the Connection!

by Rick Crago, Fused Silica Columns Product Line Manager



Some people swear by press-fit connectors, and others swear at them. For many analysts, the art of attaching a guard column to an analytical column is a mystery. Restek's chemists have discovered the solution to this mystery—the most reliable connection is no connection at all! No guard column system is more permanent than one continuous length of tubing containing both the guard column and the analytical column.

Restek pioneered this innvoative approach to guard columns, and our Integra-Guard™ column is engineered to be worry-free for the analyst. The transition area between the guard and analytical column is the point at which the guard column ends and the analytical column begins. High-temperature string is used to tie the guard column in a separate loop, making it easy to distinguish from the analytical column. The entire setup is suspended in Restek's unique "crush-free" cage, which prevents the column from coming in contact with anything that could damage it. We offer Integra-Guard™ columns in a wide variety of phases (Table I).

Guard columns are beneficial because they:

* Increase the lifetime of a column by trapping non-volatile contamination on the first few meters.
* Allow for system maintenance without sacrificing separation.
* Function as "retention gaps," allowing components with different volatilities to be focused in the same band on the analytical column.

Problems that conventional guard columns can create:

* Difficult and time consuming to make a proper connection.
* Leaks may develop during an analysis, destroying the columns.
* Active sites and dead volume from tubing connectors may cause peak tailing and loss of resolution.

Integra-Guard™ Columns provide the solution:

* The most reliable connection between a guard column and an analytical column is pictured at the left NO CONNECTION AT ALL (Figure 1).
* Integra-guard technology eliminates the need for a connector by incorporating the guard column into the actual analytical column.

If you are currently using a guard column or considering one for the future, call Restek today and ask about our Integra-Guard™ columns.

Figure 1
The best connection is no connection at all!

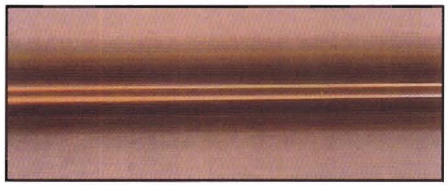


Table I
Phases currently available with an Integra-Guard™ guard column.

Rtx®-1
Rtx®-1MS
Rtx®-5
Rtx®-5MS
XTI®-5
Rtx®-1301
Rtx®-624
Rtx®-1701
Rtx®-Volatiles
Rtx®-20
Rtx®-35
Rtx®-BAC 1
Rtx®-BAC 2
Stabilwax®
Stabilwax®-DA
Stabilwax®-DB

Integra-Guard™ Guard Columns*		
mm ID	**length**	**suffix#**
0.25	5m	-124
	10m	-127
0.32	5m	-125
	10m	-128
0.53	5m	-126
	10m	-129

*Add suffix # and price to the order of your column.

Allure™ Acidix HPLC Column

Specialized Columns for LC/MS Analysis of Acids and Amino Acids

by Keith Duff, Dave Bell, and Vernon Bartlett

- Improved LC/MS sensitivity.
- Maximum retention of acidic compounds.
- High selectivity and reproducibility.
- Analysis of amino acids without derivatization.

Restek's Allure™ phases are engineered to provide maximum sensitivity for liquid chromatography/mass spectrometry (LC/MS) separations. The Allure™ Acidix phase retains and exhibits good peak shape for compounds that contain carboxylic acid, sulfonic acid, phosphoric acid, or other acidic functional groups. Maximum retention occurs at high percentages of organic modifier, which results in a desirable increase in the signal-to-noise ratio for LC/MS analyses.

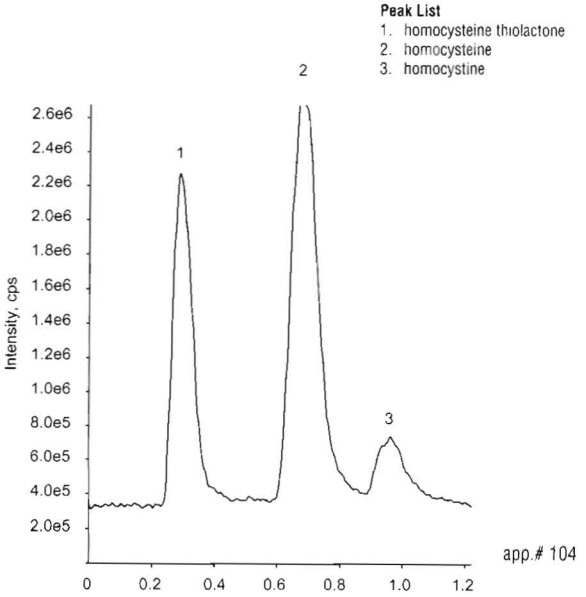
Use of the Allure™ Acidix column allows chromatographers to generate high-throughput acid and amino acid analyses by eliminating the need for derivatization of these analytes. Typically, amino acids require derivatization prior to separation by HPLC. This adds much cost and time to the method, and should be avoided whenever possible. In addition, incomplete derivatization can distort quantitative measurements. This is a problem particularly when more than one moiety on an amino acid can be derivatized. Until now, underivatized amino acids only could be run using ion exchange, but many of the buffers required in these methods are not LC/MS compatible. The Allure™ Acidix column retains and separates amino acids, achieving good peak shape using simple isocratic mobile phases (Figure 1). Volatile buffers and high organic content can be used in the mobile phase to assist in the LC/MS ionization process for good MS sensitivity.

However, most of the advantages exhibited by the Allure™ Acidix are not limited to LC/MS separations. Fast analyses, excellent peak shape and retention, high reproducibility, and the elimination of the need for derivatization apply to other HPLC systems as well. Polar acids (e.g., ascorbic acid) that are difficult to retain by traditional C18 columns are easily retained by the Allure™ Acidix phase (Figure 2). Larger molecular weight acidic compounds such as pharmaceuticals also show excellent retention and peak shape (Figure 3). Additionally, salicylic acid and aspirin are cleanly and easily separated on the Allure™ Acidix column (Figure 4).

The Allure™ Acidix column is a breakthrough in HPLC stationary phase development that permits the analysis of amino acids without derivatization. Furthermore, it provides the highest sensitivity available for LC/MS detection of acidic compounds, and it retains most acids that C18 phases cannot. For samples with solubility limitations, the Allure™ Acidix column can be used at both the high and the low end of percent organic in the mobile phase. Most importantly, it displays the reproducibility and reliability chromatographers have come to expect from Restek chromatography products.

Figure 1

Allure™ Acidix column retains and separates un-derivitized amino acids, achieving good peak shape using isocratic mobile phases and LC/MS.



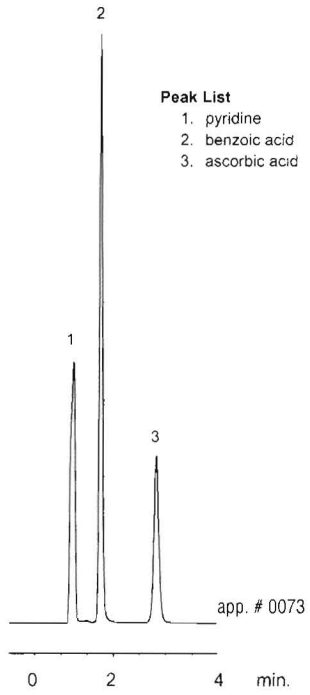
Column:	**Allure™ Acidix**
Catalog#:	9162552
Dimensions:	50 x 2.1mm
Particle Size:	5µm
Pore Size:	60Å
Conditions:	
Mobile Phase:	water pH to 3.0 with formic acid:acetonitrile (40:60)
Flow:	0.2mL/min.
Temperature:	ambient
Detection:	PE/SCIEX API 150 EX, TURBO IONSPRAY©
Ionspray voltage:	+3000V
Temperature:	350°C
Orafice:	10V
Ring:	90V
Auxillary gas:	6000cc/min.
Sample:	
Inj.:	5µL
Conc.:	10µg/mL
Solvent:	mobile phase

Allure™ Acidix HPLC Column

(continued from pg. 5)

Figure 2

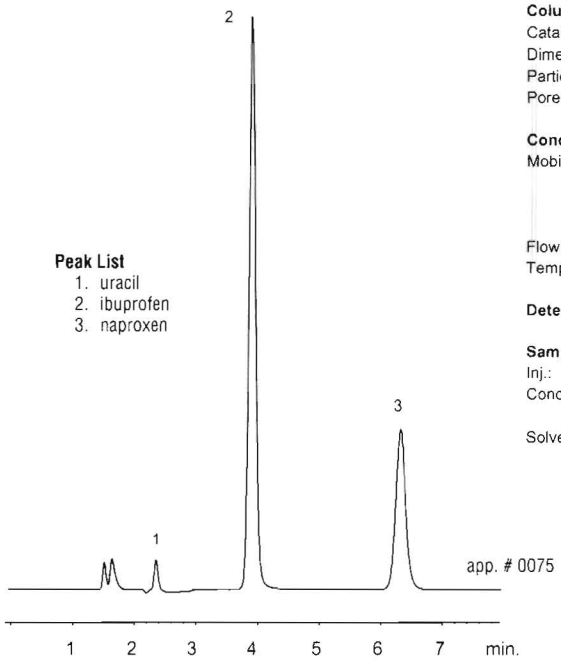
Polar acids that are difficult to retain on traditional C18 columns are easily retained on the Allure™ Acidix column.



Column:	**Allure™ Acidix**
Catalog#:	9162565
Dimensions:	150 x 4.6mm
Partical Size:	5µm
Pore Size:	60Å
Conditions:	
Mobile Phase:	10mM potassium phosphate pH 2.6: acetonitrile (60:40 v/v)
Flow:	1.2mL/min.
Temperature:	27°C
Detection:	UV @ 230nm
Sample:	
Inj.:	25µL
Conc. (acids):	250µg/mL
Solvent:	water:acetonitrile (99:1, v/v)

Figure 3

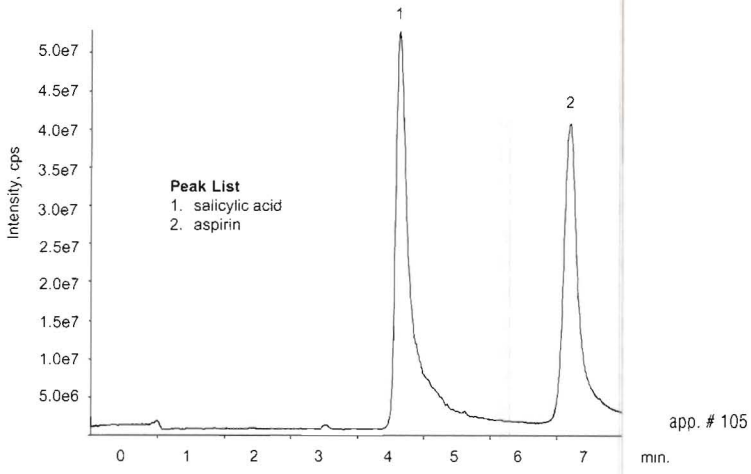
Pharmaceuticals show excellent retention and peak shape on the Allure™ Acidix column.



Column:	**Allure™ Acidix**
Catalog#:	9162565
Dimensions:	150 x 4.6mm
Particle Size:	5µm
Pore Size:	60Å
Conditions:	
Mobile Phase:	20mM ammonium acetate pH 4.5: acetonitrile (30:70, v/v)
Flow:	1.0mL/min.
Temp.:	ambient
Detection:	UV@220nm
Sample:	
Inj.:	10µL
Conc.:	100µg/mL (ibuprofen and naproxen)
Solvent:	ammonium acetate buffer:acetonitrile (1:1, v/v)

Figure 4

Salicylic acid and aspirin are cleanly and easily separated on the Allure™ Acidix column.



Column:	**Allure™ Acidix**
Catalog#:	9162565
Dimensions:	150 x 4.6mm
Partical Size:	5µm
Pore Size:	60Å
Conditions:	
Mobile Phase:	20mM ammonium formate, pH 4.5: acetonitrile (20:80, v/v)
Flow:	1mL/min
Temperature:	ambient
Detection:	PE/SCIEX API 150 EX, Heated Nebulizer interface in negative ion mode
Needle current:	3µA
Temperature:	350°C
Orafice:	-5V
Ring:	-30V
Auxillary gas:	6000cc/min.
Sample:	
Inj.:	5µL
Conc.:	50µg/mL
Solvent:	water:methanol (1:1, v/v)

Restek Survival Kit for HPLC

The Restek Survival Kit is an invaluable analytical spare-parts kit that contains the essential tools and supplies to maintain and set-up your solvent delivery system.

cat.# 25322

Product Listing

Allure™ Acidix Columns				
Particle Size: 5µm	1.0mm ID cat.#	2.1mm ID cat.#	3.2mm ID cat.#	4.6mm ID cat.#
30mm length	9162531	9162532	9162533	9162535
50mm length	9162551	9162552	9162553	9162555
100mm length	9162511	9162512	9162513	9162515
150mm length	9162561	9162562	9162563	9162565
200mm length	9162521	9162522	9162523	9162525
250mm length	9162571	9162572	9162573	9162575

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For more information on Allure™ HPLC columns, request the **LC/MS Columns Flyer** (lit. cat.# 59735).

Free HPLC wall chart and LC/MS Catalog

To receive your free wall chart (lit. cat.# 59894) and catalog (lit. cat.# 59607) call our Literature Request Hotline at **800-356-1688, ext. 5**; or visit us online at **www.restekcorp.com**.

Silcosteel®-Treated Sample Cylinders

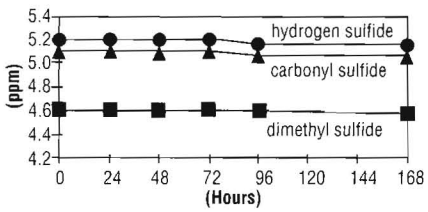
New SCAQMD Standard for Sulfur Analyses

by Gary Barone, MPG Product Line Manager, and Dave Shelow, Air Monitoring Products Product Line Manager

visit us at Gulf Coast Conference booth #223

Figure 1

Sulfur compound (~5.0ppm) storage in a Silcosteel®-treated stainless steel cylinder over seven days shows no significant compound loss.



Results of a recent study by South Coast Air Quality Management District (Rule 1118 Ad Hoc Working Group) determined that Silcosteel®-treated sample cylinders are accepted for Method 307-91, *Determination of Sulfur in a Gaseous Mixture.*

The use of stainless steel high-pressure cylinders has greatly increased the accuracy and efficiency of gas sampling. Tedlar® bags, which previously had been recommended, required a large pressure reduction and possible loss of sample through the permeable wall. Silcosteel® treatment is a thin-film passivation treatment for stainless steel, resulting in a rugged and inert coating that decreases sample loss, and the stainless steel cylinder reduces pressure problems.

During the last 12 years, Silcosteel® treatment has been used for many applications in analytical chemistry. Most recently, Silcosteel® sample cylinders have become the standard for gas sampling in the petroleum industry.

This Silcosteel® coating is ideal for applications involving the transfer of extremely low-level organics and corrosives (see Figure 1). Unlike fluoropolymer surface coverings, Silcosteel® coating is incorporated into the lattice of the steel, which results in very high stability and durability—to maintain the integrity of your sample. Always use Silcosteel®-treated sample pathways when peak performance is required for sulfur-related work.

Silcosteel®-Treated Sample Canisters			
size	cat.#	size	cat.#
75cc	24271	500cc	24274
150cc	24272	1000cc	24275
300cc	24273		

Silcosteel®-Treated Hoke Sample Cylinder Valves		
description	metal stem tip cat.#	Kel-F stem tip cat.#
1/4" male NPT exit	24276	24278
1/4" compression exit	24277	24279

Restek Survival Kit for HPLC

For start-up and standard use in all HPLC-systems

The Restek Survival Kit is an invaluable analytical spare part kit that contains the essential tools and supplies for your solvent delivery needs.

cat.# 25322

Restek HPLC Survival Kit Contents:

Item	Qty.
PEEK Column Connector	10
PEEK Tubing, 1/16" OD x 0.005" ID	3 m
PEEK Tubing, 1/16" OD x 0.007" ID	3 m
PEEK Tubing, 1/16" OD x 0.010" ID	3 m
PEEK Tubing, Elbow 90	5
PEEK Tubing, Elbow 180	5
Teflon Tubing, 1/8" OD x 0.063"	3 m
Teflon Tubing, 1/8" OD x 0.094"	3 m
Tubing Clip	5
Rheotool Wrench	1
1/4" x 5/16" Open-End Wrench	1
Clean-Cut™ Tubing Cutter	1
Replacement Blades for Cutter	1
PEEK Union 1/16"	2
Inlet Filter, 2µm	1
Inlet Filter, 10µm	1

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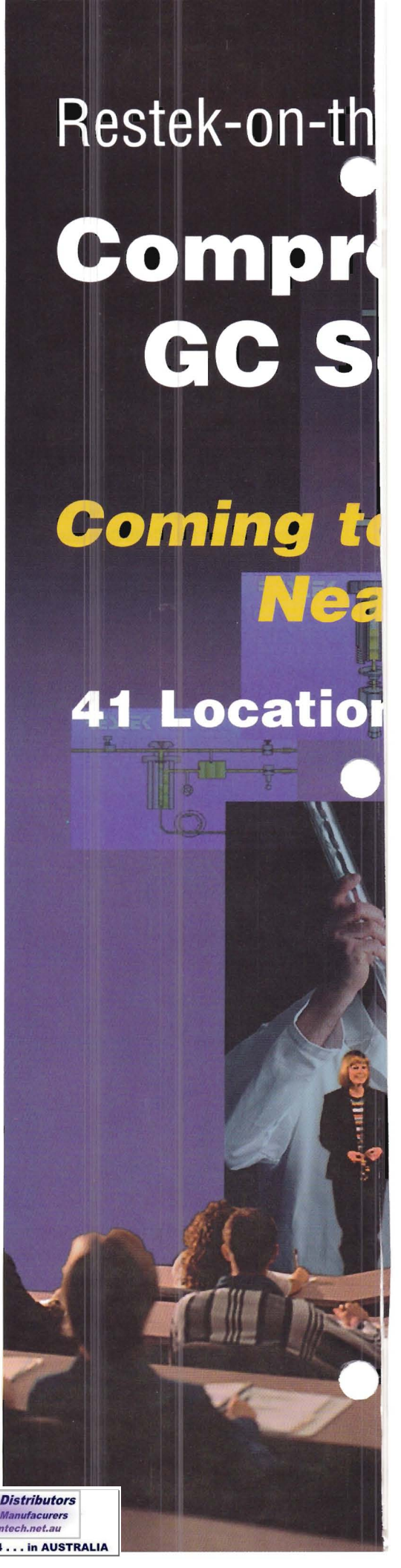
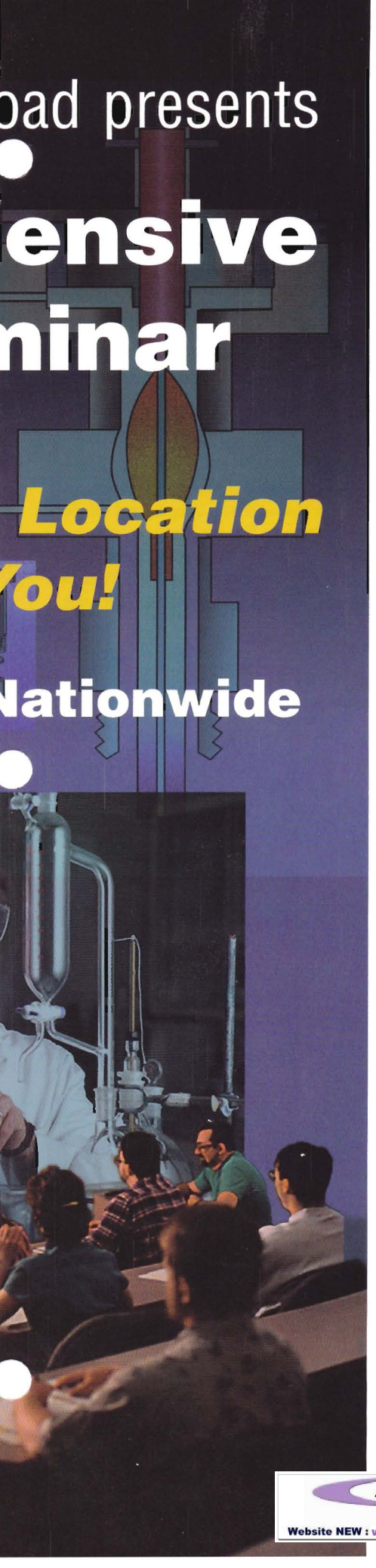
For more information on the HPLC Survival Kit and other HPLC accessories, request the flyer "**HPLC Mobile Phase Accessories**" (lit. cat.# 59728-INT).





Restek offers expert, hands-on training in many aspects of chromatography. For information on training topics or to discuss bringing training to your facility or area, call 800-356-1688, ext. 2174, or contact your local Restek representative.

Register Today!

Call us at 800-356-1688, ext. 3

Fax this form to 814-353-1309

Mail this form to Attn: Seminar Coordinator, 110 Benner Circle, Bellefonte, PA 16823

Register **electronically** at www.restekcorp.com/semiars/register.htm

Registration Form

Seminar Location: _____

Seminar Date: _____ Seminar# _____

Company: _____

Names of attendees:

Attendee #1 _____

Attendee #2 _____

Attendee #3 _____

Attendee #4 _____

Attendee #5 _____

only $199 per person, Lunch included

Method of Payment: ❑ Check ❑ PO ❑ Visa ❑ American Express ❑ MasterCard

Name on Card _____

Account Number _____ Exp. Date _____

Company _____

E-mail _____

Billing Address _____

City _____ State _____ Zip _____

Phone ( ) _____ Fax ( ) _____

The seminar confirmation letter(s) will be sent to the billing address unless otherwise indicated below:

Address _____

City _____ State _____ Zip _____

What is your application area? _____

What type of injection do you use? [e.g., split, direct]

_____

What detectors do you commonly use? _____

How many years of GC experience do you have? _____

What's your toughest chromatography challenge? _____

_____

Referred by / Salesperson: _____

US EPA Method 8081A

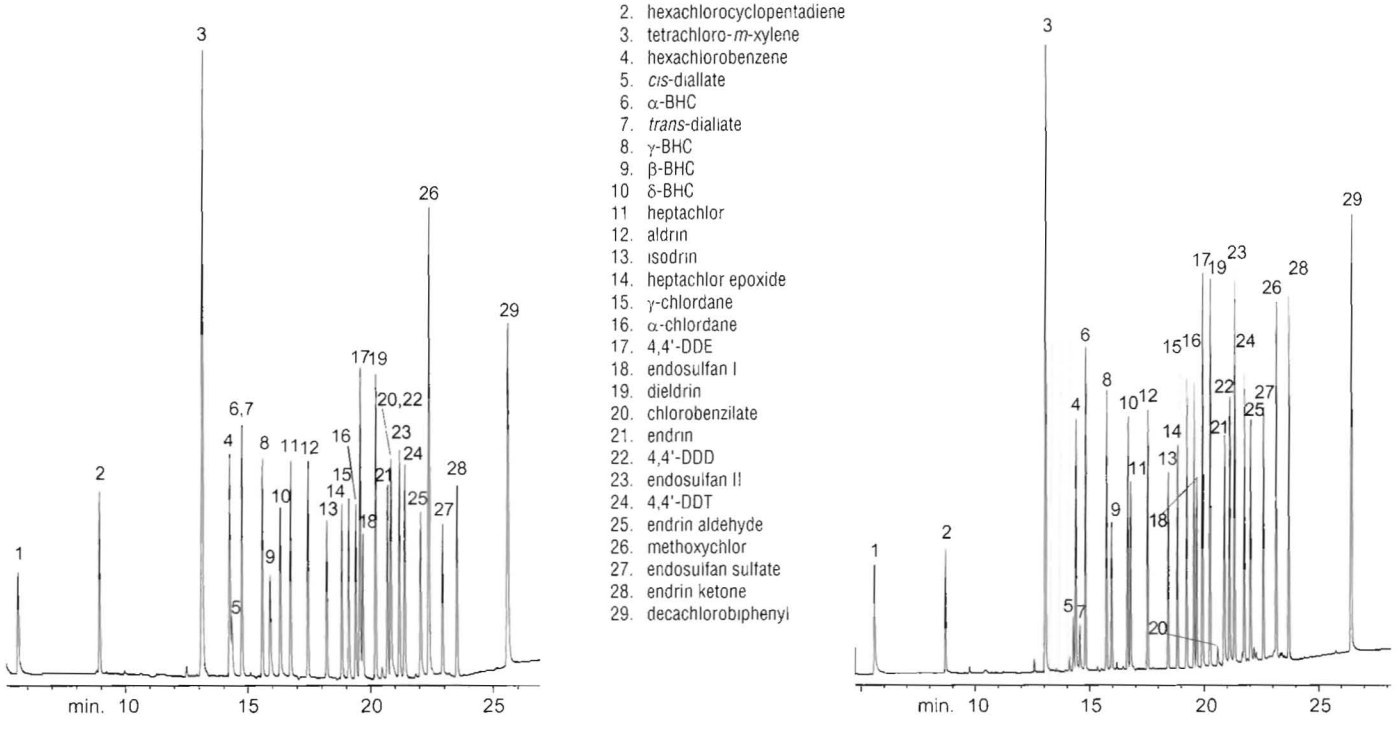
Excellent Separation of Chlorinated Pesticides Using Rtx®-CLPesticides and Rtx®-CLPesticides2 Columns

by Dr. Frank Dorman, Applications Group Leader

For environmental laboratories, the methods to analyze chlorinated pesticides often are the most challenging to perform. Analysts struggle with linearity, breakdown, and lengthy calibrations; as well as column bleed, column reactivity, and poor separation. Restek has addressed all of these issues with the development of the Rtx®-CLPesticides and the Rtx®-CLPesticides2 capillary columns. These columns were designed specifically for the separation of chlorinated pesticides, to be used in parallel for simultaneous quantitation and confirmation by gas chromatography/electron capture detection (GC/ECD). We have shown the performance and separation that can be achieved with these columns for EPA Method 608, 8080, and 8081. Now many laboratories are dealing with the latest version of the chlorinated pesticides method—SW-846, 8081A. This method adds new target analytes to the 20 common single-component pesticides contained in earlier versions.

Because the Rtx®-CLPesticides and Rtx®-CLPesticides2 columns were designed with selectivity for neutral, halogenated compounds, they are easily adapted for the analysis of the extended list of pesticides in Method 8081A. Figure 1 shows the separation of the 22 chlorinated pesticides listed in both US EPA Method 8081 and 8081A, plus the the seven additional single-component compounds also listed in Method 8081A. Using a guard column and splitting the flow into the two columns with a glass 'Y' Press-Tight® connector, the chromatograms were acquired simultaneously. These two columns also have a high maximum operating

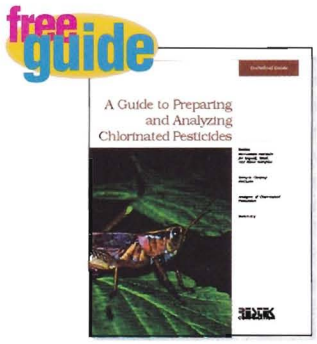
Figure 1 **Achieve full separation of US EPA Method 8081A chlorinated pesticides using the Restek Rtx®-CLPesticides and Rtx®-CLPesticides2 columns.**



30m, 0.32mm ID, 0.50µm Rtx®-CLPesticides and 30m, 0.32mm ID, 0.25µm Rtx®-CLPesticides2 columns (cat.#'s 11139 & 11324).
On-column concentration: 16-160pg; **Oven temp.:** 80°C (hold 1 min.) to 300°C @ 10°C/min. (hold 15 min.);
Inj. port: Direct, Uniliner® sleeve (cat.# 20335); **Detector:** ECD, 300°C with Anode Purge;
Dead time: 1.9 min.; **Head pressure:** 8.7psi (constant); **Flow rate:** 1.3mL/min. @ 120°C, helium.

temperature, excellent inertness, low bleed, and can be used under the same flow and temperature conditions. This is beneficial for installing them as a column pair into a single injection port, thereby minimizing injector maintenance concerns.

The combination of the Rtx®-CLPesticides and Rtx®-CLPesticides2 columns provides unsurpassed performance for the analysis of chlorinated pesticides. They can be baked-out at the end of each analysis to remove high-boiling contaminants, without degrading the stationary phase. They do not have the problems associated with cyanopropyl phases (1701) such as on-column methoxychlor and DDT breakdown, and low maximum temperature. The Rtx®-CLPesticides and Rtx®-CLPesticides2 columns are the best choice for improving resolution and capacity for the analysis of dirty extracts, and for increasing throughput for chlorinated pesticide samples.



Restek's 24-page technical guide, **A Guide to Preparing and Analyzing Chlorinated Pesticides** (lit. cat.# 59892), covers analytical details for the preparation and analysis of chlorinated pesticides. The guide discusses specific extraction methods for liquid, solid, and biota samples, in addition to sample cleanup methods and the actual analyses themselves.

To request your free copy, call our literature request hotline at 800-356-1688, ext. 5. or contact your local Restek representative.

For the most inert injection system with the lowest endrin breakdown, see page 3 for **Siltek™-deactivated** inlet liners, guard columns, and Press-Tight® connectors.

Product Listing

Rtx®-CLPesticides Columns

ID	df (µm)	stable to	10m	20m
0.18mm	0.18	340°C	42101	42102
ID	**df (µm)**	**stable to**	**15m**	**30m**
0.25mm	0.25	340°C	11120	11123
0.32mm	0.50	340°C	11136	11139
0.53mm	0.50	340°C	11137	11140

Rtx®-CLPesticides2 Columns

ID	df (µm)	stable to	10m	20m
0.18mm	0.14	340°C	42301	42302
ID	**df (µm)**	**stable to**	**15m**	**30m**
0.25mm	0.20	340°C	11320	11323
0.32mm	0.25	340°C	11321	11324
0.53mm	0.42	340°C	11337	11340

Rtx®-CLPesticides Column Kits

These kits include both a CLPesticides and CLPesticides2 column, a Universal Angled 'Y' Press-Tight® Connector, and a 5m guard column. (Note: Columns are not preconnected in these kits.)

Description	cat.#
0.53mm ID Rtx®-CLPesticides Kit	11197
0.32mm ID Rtx®-CLPesticides Kit	11198
0.25mm ID Rtx®-CLPesticides Kit	11199

Organochlorine Pesticide Mix AB #2

aldrin	8µg/mL	dieldrin	16µg/mL
α-BHC	8	endosulfan I	8
β-BHC	8	endosulfan II	16
δ-BHC	8	endosulfan sulfate	16
γ-BHC (lindane)	8	endrin	16
α-chlordane	8	endrin aldehyde	16
γ-chlordane	8	endrin ketone	16
4,4'-DDD	16	heptachlor	8
4,4'-DDE	16	heptachlor epoxide (B)	8
4,4'-DDT	16	methoxychlor	80

In hexane/toluene (1:1), 1mL/ampul.

	each	5-pack	10-pack
	32292	32292-510	—
w/data pack	32292-500	32292-520	32392

Organochlorine Pesticide Mix C #2

chlorobenzilate	32µg/mL	hexachlorobenzene	8µg/mL
diallate (cis & trans)	80	hexachlorocyclopentadiene	8
1,2-dibromo-3-chloropropane	8	isodrin	8

In hexane/toluene (1:1), 1mL/ampul.

	each	5-pack	10-pack
	32295	32295-510	—
w/data pack	32295-500	32295-520	32395

CLP Semi-Volatiles OLM 04.1

New Reference Materials Available

by Eric Steindl, Analytical Reference Materials Product Line Manager

Standards for the EPA Superfund Contract Lab Program (CLP):

- ✔ Meets latest Statement of Work.
- ✔ Fewest number of calibration solutions possible.
- ✔ Maximum shelf life.

The latest revision to the EPA Superfund Contract Lab Program (CLP) Methods for semi-volatile compounds have necessitated changes in the calibration standards. Restek has developed new mixtures that satisfy all requirements of the OLM 04.1 Methods. These high-quality reference materials are manufactured with raw materials that have been thoroughly tested for purity.

CLP 04.1 B/N Matrix Spike Mix

1000µg/mL each in methanol, 1mL/ampul
acenaphthene
2,4-dintrotoluene
N-nitroso-di-*n*-propylamine
pyrene

each	5-pk.	10-pk.
31492	31492-510	—
	w/ data pack	
31492-500	31492-520	31592

CLP 04.1 BNA Surrogate Mix

In methylene chloride, 1mL/ampul

2-chlorophenol-d4	1500µg/mL
1,2-dichlorobenzene-d4	1000
2-fluorobiphenyl	1000
2-fluorophenol	1500
nitrobenzene-d5	1000
phenol-d6	1500
p-terphenyl-d14	1000
2,4,6-tribromophenol	1500

each	5-pk.	10-pk.
31493	31493-510	—
	w/ data pack	
31493-500	31493-520	31593

CLP 04.1 Phenols Calibration Mix

2000µg/mL each in methylene chloride, 1mL/ampul
4-chloro-3-methylphenol
2,4-dichlorophenol
2,4-dimethylphenol
2,4-dinitrophenol
2-chlorophenol
2-methyl-4,6-dinitrophenol
2-methylphenol
4-methylphenol
2-nitrophenol
4-nitrophenol
pentachlorophenol
phenol
2,4,5-trichlorophenol
2,4,6-trichlorophenol

each	5-pk.	10-pk.
31494	31494-510	—
	w/ data pack	
31494-500	31494-520	31594

CLP OLM 04.1 SV Kit #1

Contains 1mL each:	Restek cat.#
SV Screening Mix	31000
SV Tuning Mix	31001
CLP 04.1 BNA Surrogate Mix	31493
CLP 04.1 B/N Matrix Spike Mix	31492
Acid Matrix Spike Mix	31005
SV Internal Standard Mix	31006
CLP 04.1 Phenols Calibration Mix	31494
CLP 04.1 B/N MegaMix	31495
SV Calibration Mix #6 (pesticides)	31012

each	each w/ data pack
31603	31603-500

CLP OLM 04.1 SV Kit #2

Contains 1mL each of:	Restek cat.#
CLP 04.1 Phenols Calibration Mix	31494
CLP 04.1 B/N MegaMix	31495
SV Calibration Mix #6 (pesticides)	31012

each	each w/ data pack
31604	31604-500

CLP OLM 04.1 SV Kit #3

Contains 1mL each of:	Restek cat.#
CLP 04.1 Phenols Calibration Mix	31494
CLP 04.1 B/N MegaMix	31495

each	each w/ data pack
31605	31605-500

New Catalog!

Restek's new ***Purus™ Gas Systems Catalog*** details everything to design and maintain your gas delivery system. For your free copy, contact our literature request hotline at 800-356-1688, ext. 5 or contact your local Restek representative. (lit. cat.# 59966)

CLP 04.1 B/N MegaMix

1000µg/mL each in methylene chloride/benzene (3:1), 1mL/ampul
acenaphthene
acenaphthylene
acetophenone
anthracene
atrazine
benzaldehyde
benzo(a)anthracene
benzo(b)fluoranthene
benzo(k)fluoranthene
benzo(ghi)perylene
benzo(a)pyrene
biphenyl
4-bromophenyl phenyl ether
butyl benzyl phthalate
di-*n*-butyl phthalate
caprolactam
carbazole
4-chloroaniline
bis(2-chloroethoxy)methane
bis(2-chloroethyl)ether
2-chloronaphthalene
4-chlorophenyl phenyl ether
chrysene
dibenz(a,h)anthracene
dibenzofuran
3,3'-dichlorobenzidine
diethyl phthalate
dimethyl phthalate
2,4-dinitrotoluene
2,6-dinitrotoluene
bis(2-ethylhexyl)phthalate
fluoranthene
fluorene
hexachlorobenzene
hexachlorobutadiene
hexachlorocyclopentadiene
hexachloroethane
indeno(1,2,3-cd)pyrene
isophorone
2-methylnaphthalene
naphthalene
2-nitroaniline
3-nitroaniline
4-nitroaniline
nitrobenzene
N-nitroso-di-*n*-propylamine
N-nitrosodiphenylamine
di-*n*-octyl phthalate
2,2'-oxybis-(1-chloropropane)
phenanthrene
pyrene

each	5-pk.	10-pk.
31495	31495-510	—
	w/ data pack	
31495-500	31495-520	31595

New High-Performance Molecular Sieve 5A & 13X Packings

For Improved Gas Separations

by Barry Burger, R&D Chemist, and Michael Feeney, R&D Manager

Molecular sieves, a synthetic form of Zeolite, have been used since the 1950's for separation of light gases (e.g., oxygen, nitrogen, methane, carbon monoxide), and inert gases (e.g., helium, argon, neon, krypton, and xenon). Restek offers the two most common molecular sieves 5A and 13X, which are used in a wide range of packed and PLOT column gas chromatographic analyses. Molecular sieves have become a standard for gas separations, yet until now there have been few changes or improvements in their basic composition or performance. As part of Restek's strategy in developing innovative, high-quality products, we are introducing high-purity, Molecular Sieve 5A and 13X packings.

Quality Assurance Testing to Ensure Reproducibility

Research of the existing packed column market indicated that chromatographers have experienced problems with the current suppliers of molecular sieve packings and packed columns. Restek goal was to introduce a high-performance molecular sieve packing featuring inertness and reproducibility. This solution requires purification of each lot of Zeolite, to remove metals and other trace contaminants that cause adsorption of trace gases such as carbon monoxide. Each batch of material is then carefully classified to exact mesh ranges to ensure reproducible efficiency, column back pressure, and retention times. Furthermore, our research determined that the thermal conditioning process is critical in determining the relative retention of methane/carbon monoxide and for producing excellent peak symmetry for active compounds such as carbon monoxide. As a result, each lot of molecular sieve is precisely conditioned and quality assurance tested for efficiency, back pressure, peak symmetry and relative retention time using a permanent gas mixture.

Molecular Sieve 5A or 13X with Silcosteel® Tubing for Permanant Gas Analysis

Restek offers both Molecular Sieve 5A and 13X. These materials differ in pore size and composition, which results in differences in retention and selectivity for many gases. The 5A packing has greater retention, which aids in separation of argon, oxygen, and nitrogen. Therefore, it is a better choice for analysis of trace impurities in inert gases (helium, hydrogen, argon, and nitrogen) used in chromatography or the semiconductor industry.

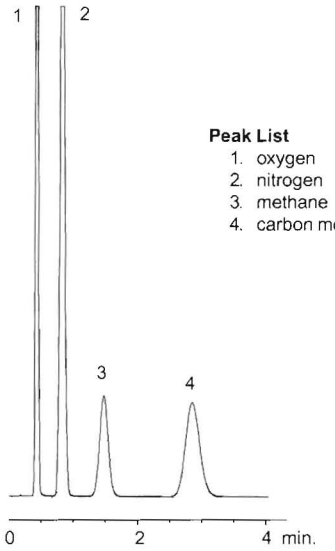
(cont. on page. 14)

Figure 1

Molecular Sieve 5A column provides excellent resolution of oxygen, nitrogen, methane, and carbon monoxide.

1m x 1/8" x 2mm ID Silcosmooth™ tubing
Molecular Sieve 5A 80/100 mesh
(cat.# 80440-800)
10µL gas sample with 5-10% each component in helium.

Oven temp.: 50°C
Inj./det. temp.: 150°C/200°C
Flow: 30mL/min., helium



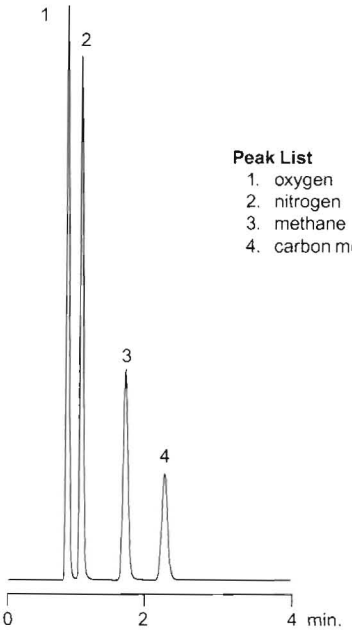
Peak List
1. oxygen
2. nitrogen
3. methane
4. carbon monoxide

Figure 2

Molecular Sieve 13X column provides rapid analysis and excellent peak symmetry for carbon monoxide.

2m x 1/8" x 2mm (ID) Silcosmooth™ tubing
Molecular Sieve 13X 80/100 mesh
(cat.# 80439-800)
10µL gas sample with 5-10% each component in helium.

Oven temp.: 50 °C
Inj./det. temp.: 150 °C/200°C
Flow: 30 mL/min., helium



Peak List
1. oxygen
2. nitrogen
3. methane
4. carbon monoxide

Peak Performers

by Doug Elliott, GC Accessories Product Line Manager

Thermolite® Septa

Achieve the Lowest Bleed at the Most Affordable Prices

- ✔ Tested for low bleed—Ensures optimum performance.
- ✔ Excellent puncturability—Septa fragments will not interefere with data.
- ✔ Packaged in non-contaminating tins—Ensures product integrity with every shipment.
- ✔ Usable to 340°C inlet temperatures—Analysis of high molecular weight compounds.
- ✔ Preconditioned and ready to use—Saves time.

free septa

To request a **FREE** sample of Thermolite® or IceBlue™ septa, call 800-356-1688, ext. 3, or contact your local Restek representative.

Thermolite® Septa			
Septum Diameter	**25-pk.**	**50-pk.**	**100-pk.**
5mm (3/16")	20351	20352	20353
6mm (1/4")	20355	20356	20357
7mm	20381	20382	20383
8mm	20370	20371	—
9.5mm (3/8")	20359	20360	20361
10mm	20378	20379	20380
11mm (7/16")	20363	20364	20365
12.5mm (1/2")	20367	20368	20369
17mm	20384	20385	20386
Shimadzu Plug	20372	20373	20374

Restek has assembled a free trial pack filled with vials, caps, and inserts for you to evaluate. Contact us at 800-356-1688, ext. 5, or contact your local Restek representative to request your free vial pack (lit. cat.# 53076).

New High-Performance Molecular Sieve 5A & 13X Packings *(continued from pg. 13)*

Molecular Sieve 13X often is preferred for analysis of carbon monoxide, particularly at trace concentrations, because the lower retention results in a sharper chromatographic peak and improved detection limits. Figures 1 and 2 (page 13) compare the same gas mixture analyzed using a 1-meter high-performance Molecular Sieve 5A column with a 2-meter high-performance Molecular Sieve 13X column. Notice the excellent peak symmetry for carbon monoxide, indicating that the packing and column tubing are extremely inert. Combining high-quality molecular sieves with Restek's Silcosmooth™ tubing produces a packed column optimized for trace analysis of the difficult components oxygen and carbon monoxide.

Restek Offers a Wide Range of Packed Columns and Packings

In addition to offering a wide range of standard packings and packed columns, Restek offers micropacked columns and many unique bonded GC packings. The new high-performance Molecular Sieve 5A and 13X packings are the latest examples of Restek's innovation in providing unique improvements and solutions to solving problems in chromatography.

Silcosmooth™ Tubing
1/8"OD x 2mm ID: cat.# 21596 (ft.)
3/16"OD x 4mm ID: cat.# 21595 (ft.)

Molecular Sieve 5A Packings		
mesh	**cat.#**	**qty. (g)**
45/60	25600	50
60/80	25601	50
80/100	25602	50
100/120	25603	50
Molecular Sieve 13X Packings		
mesh	**cat.#**	**qty. (g)**
45/60	25604	50
60/80	25605	50
80/100	25606	50
100/120	25607	50

Peak Performers

by Doug Elliott, GC Accessories Product Line Manager

FastPack™ Inlet Maintenance Kits

For HP GCs

- ✔ **Clean**—Mylar® bag is sealed factory-clean; no aging or contamination from weeks in the lab.
- ✔ **Convenient**—The parts you use in one bag means no hunting for individual parts.
- ✔ **Economical**—Cost less than the quantity catalog price for the individual parts.

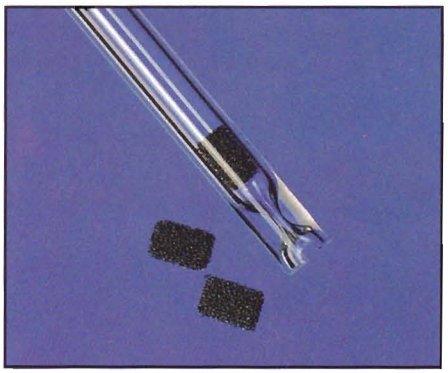
FastPack™ Inlet Maintenance Kits are a great way to make performing routine maintenance on your HP inlet easy! The kit includes your preferred deactivated liner with a Viton® O-ring, a 0.8mm ID gold-plated inlet seal, a washer, and an 11mm Thermolite® septa—all sealed in a factory-clean Mylar® bag.

FastPack™ Inlet Maintenance Kits for HP GCs				
1 pack includes 5 maintenance kits				
Kit includes: o-ring, inlet seal, washer, septa, & liner (liner dimensions: 4mm ID, 6.5mm OD, 78.5mm)		pack of 5 kits	5 or more packs	20 or more packs
4mm Splitless	cat.# 21101			
4mm Splitless Gooseneck	cat.# 21102			
4mm Splitless Double Gooseneck	cat.# 21103			
4mm Split with F.S. Wool*	cat.# 21104			

* The 4mm split liner with fused silica wool dimensions are 4mm ID, 6.3mm OD, 78.5mm.

CarboFrit™ Liner Packing Material

An Alternative to Glass Wool Packings for Split and Splitless Liners



- ✔ Highly inert.
- ✔ Extends analytical column lifetime.
- ✔ Enhances split and splitless injection reproducibility.
- ✔ Improves retention of high molecular weight contaminants.
- ✔ Uniform pore size guarantees consistent flow through the liner.
- ✔ Consistent packing density.
- ✔ Easy to install in any sleeve with an ID >3.5mm.

CarboFrit™ liner packing

CarboFrit™-Packed Inlet Liners for HP GCs		
each	*5-pack*	*25-pack*
4mm Splitless		
20772-209.1	20773-209.5	20774-209.25
4mm Gooseneck		
20798-209.1	20799-209.5	20800-209.25
CarboFrit™-Packed Inlet Liners for Varian GCs		
4mm Gooseneck		
20904-209.1	20905-209.5	20906-209.25
Other Liners Pre-Packed with CarboFrit™ Inserts		
add suffix -209.1	add suffix -209.5	add suffix -209.25

Replacement CarboFrit™ Inserts		
Frit for liner size ID	**cat. #**	**10-pack**
≤4mm	20295	
>4mm	20294	

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