the RESTEK ADVANTAGE

2007.01

New pHidelity™ HPLC Columns

For Analyses at Extreme pH Conditions

See **page 3**.

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Restek: A Company of Owners

by Paul Silvis, Restek Founder & former Head Coach

Twenty-one years ago, I had a vision of creating a company where employees would enjoy coming to work as much as going home. Everyone kept telling me that we couldn't keep alive the Restek vision of being a great place to work as we got bigger, but I've always been too stubborn to agree. Today, more than 250 employee-owners and our families work, play, and celebrate milestones in our state-of-the-art facility in Bellefonte, in our new research facility in California, and in our subsidiary locations in England, France, Germany, and Ireland. And, in keeping with my vision, Restek is celebrating its twenty-first year in business by being selected as one of Pennsylvania's Top 100 Places To Work – for the third time!! We understand that our customers' happiness and our own are tightly intertwined – we care about the products we make, and the Plus 1 service we provide, because your best interests also are ours.

Plus 1 Service, Innovation, and Execution (PIE®) have been, and continue to be, the keys to our success, but another vital component to our success is that Restek employees have a positive vision of their future. Why? Because as the founder and controlling shareholder, I have set in motion a plan to sell the company to the employees, providing them the opportunity to chart their own future and continue the tradition of our customer-first culture.

Friends of mine who started companies, including Walt Jennings of J&W, and Nick Pelick and Walt Supina of Supelco, had a significant impact on my vision for Restek. These individuals all expressed regret once their exciting, entrepreneurial companies were sold. Each watched as the cultures they so carefully assembled began to change, and employees lost that "enjoy coming to work" feeling. I have come to believe that success is not measured by the price for which you can sell a company, but by the way the company prospers under the next generation of leadership. In 2005, I turned over the reins of Restek to Don McCandless, who took over as Head Coach and in the supporting role of mentoring and teaching the next generation of leadership. Now, we are fully engaged in the process of executing an employee stock ownership plan for selling the company to those whose labors have had a major role in building it. As we advance toward total employee ownership, our people and our products are positioning Restek to meet new challenges and opportunities, with even better service to our customers and community, and it is no exaggeration to say that Restekians truly do enjoy their work.

Restek will continue to be successful because our employees are excited that their future is in their own hands. Customers will continue to benefit because Restek will remain independent – able to work with all of the instrument companies – and will continue to create top quality products for all of them. We will be able to continue responding to all the ideas that pour in from customers around the world, telling us what products and services they need to make their lives easier in the lab.

Our company of owners will control their own destiny. I will be smiling from ear to ear when I see how employee ownership works to create a company in which employees still enjoy coming to work as much as going home! Isn't it fun to do business with employee-owners who love coming to work every day?

New pHidelity™ pH-Stable HPLC Columns

For Analyses at Extreme pH Conditions

By Becky Wittrig, Ph.D., HPLC Product Marketing Manager, Frank Dorman Ph.D., HPLC Innovations Manager, Rick Lake, Pharmaceutical Innovations Chemist, Vernon Bartlett, HPLC Innovations Scientist, Bruce Albright, HPLC Innovations Chemist, and Randy Romesberg, HPLC Innovations Chemist

We are pleased to introduce pHidelity™ pH-stable HPLC columns, designed for analyses that require, or benefit from, extreme pH conditions. pHidelity™ columns incorporate a proprietary barrier layer that protects the base silica particle, and a secondary layer that provides the functional stationary phase ligand. pHidelity™ columns can be used routinely up to pH 12 – a significant improvement over the typical pH 2.5 to 7.5 range for silica-based materials. pHidelity™ columns give you more control over analyte retention and resolution; mobile phase pH can be increased to enhance retention of basic analytes – without sacrificing column lifetime.

Continued on page 4.

New pHidelity pH-Stable HPLC Columns *(continued from page 3)*

- Stable pH 12 – superior chromatography for basic compounds.
- Patented barrier technology protects silica particles.
- True C18 selectivity, for simpler and more reproducible analyses.

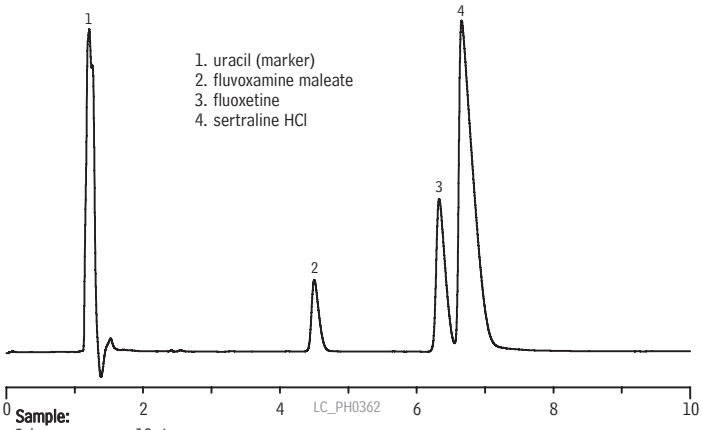
Practically, the useable pH range for conventional silica-based HPLC columns is pH 2.5 to 7.5. Columns are used outside of this range only when there is an extreme need for a separation, and the inevitable price – a very short column lifetime – must be accepted. pHidelity™ pH-stable HPLC columns can be used far above the typical pH range for silica-based stationary phases, with mobile phases up to pH 12, giving more control over analyte retention and resolution.

To illustrate the advantages of using high pH mobile phases for assaying basic analytes, we first analyzed selective serotonin reuptake inhibitors (SSRIs). SSRIs are basic compounds with high pKa values. Ideally, a high pH mobile phase would be used for this analysis. A high pH mobile phase will keep the analytes in their neutral forms and allow better retention and resolution on an alkyl C18 column. However, if using a mobile phase pH appropriately above compound pKa values (approximately 1.5-2 pH units) on a column with a limited alkaline range, the caustic mobile phase would rapidly degrade the silica particles – significantly shortening column lifetime. Therefore, with a conventional C18 column, an acidic or neutral mobile phase pH must be used. As result, when the compounds are assayed at a mobile phase pH below their pKas, they are in their ionized forms and their retention, peak shape, and resolution is limited on a conventional C18 column (Figure 1A). An extended range pHidelity C18 column allows the use of high pH mobile phases, above the analytes pKa, without deleterious effects to the column. Under these conditions, basic analytes are neutral, more hydrophobic and better retained (Figure 1B). By using a pHidelity™ column mobile phase pH can be optimized, improving retention, peak shape, and resolution on a C18 column.

Another advantage to extending the pH range of silica based columns, is improved analysis of multi-component test mixes with high pH mobile phases. When faced with a mixture of basic analytes, choosing the appropriate mobile phase pH can be problematic. An example of this is the mixture of bases which vary in pKa value, as shown in Figure 2. If a conventional C18 column was employed to assay this ionic mixture, a pH approximately 1.5 - 2 units below the lowest pKa would need to be used (a pH above the highest pKa would be above the operating range of conventional silica columns). This would result in protonation of the basic analytes, making them more hydrophilic, and less

Figure 1 Improve SSRI retention, peak shape, and resolution using an extended pH range pHidelity column.

A) Conventional C18 columns require mobile phases below the SSRI's pKa, limiting chromatography

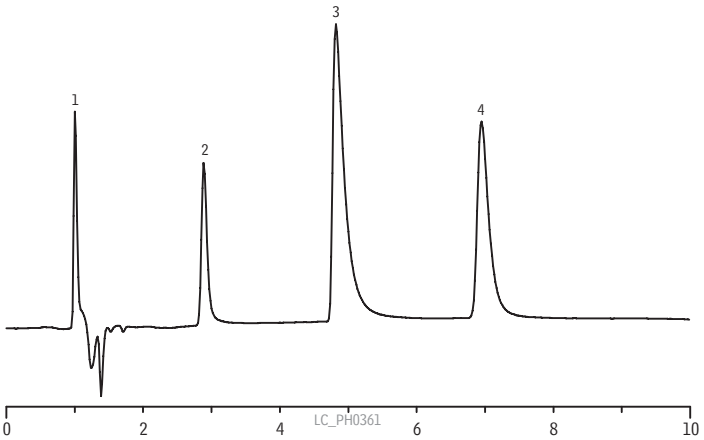


Sample:
Inj.: 10µL
Conc.: 100µg/mL each component
Sample diluent: acetonitrile

Column: C18
Dimensions: 150 x 4.6 mm
Particle size: 5µm
Pore size: 100Å

Conditions:
Mobile phase: 20mM potassium phosphate, monobasic **(pH 3)**:acetonitrile, 60:40
Flow: 1.0mL/min.
Temp.: ambient
Det.: UV @ 230 nm

B) pHidelity columns allow use of mobile phases above the SSRI's pKa – for improved chromatography

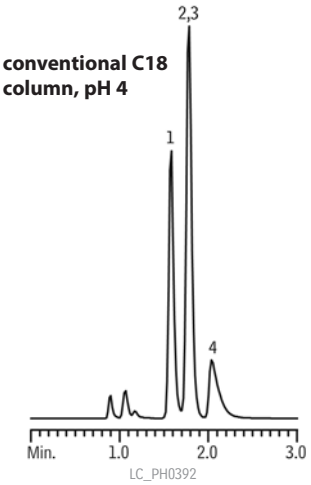


Column: pHidelity™ C18 (cat.# 9579365)
Dimensions: 150 x 4.6 mm
Particle size: 3µm
Pore size: 200Å

Conditions:
Mobile phase: 10mM ammonium bicarbonate **(pH 11)**:acetonitrile:tetrahydrofuran, 45:45:10
Flow: 1.5mL/min.
Temp.: ambient
Det.: UV @ 230 nm

Figure 2 Using a high pH mobile phase is an easy way to improve peak retention, resolution, and symmetry in a test mix of compounds varying in pKa values.

A) Poor separation of bases under typical conditions



conventional C18 column, pH 4

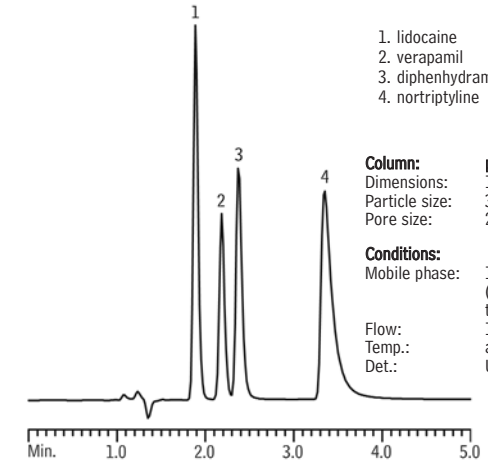
1. lidocaine
2/3. verapamil/diphenhydramine
4. nortriptyline

Sample:
Inj.: 10µL
Conc.: 100µg/mL each component
Sample diluent: acetonitrile

Column: C18
Dimensions: 150 x 4.6 mm
Particle size: 3µm
Pore size: 200Å

Conditions:
Mobile phase: 20mM ammonium acetate (pH 4):acetonitrile 50:50
Flow: 0.75mL/min.
Temp.: ambient
Det.: UV @ 254 nm

B) Complete separation of bases on a pHidelity™ column at pH 11



1. lidocaine
2. verapamil
3. diphenhydramine
4. nortriptyline

Column: pHidelity™ C18 (cat.# 9579365)
Dimensions: 150 x 4.6 mm
Particle size: 3µm
Pore size: 200Å

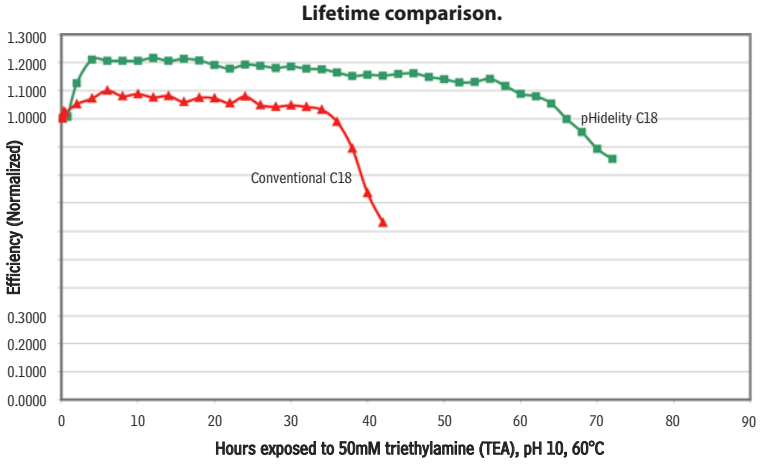
Conditions:
Mobile phase: 10mM ammonium bicarbonate (pH 11): acetonitrile: tetrahydrofuran, 35:55:10 (v/v/v)
Flow: 1.5mL/min.
Temp.: ambient
Det.: UV @ 254 nm

retained (Figure 2A). In contrast, using an extended range pHidelity™ C18 column and a mobile phase pH above the highest pKa of the analytes, the compounds will be uncharged and more hydrophobic, resulting in greater retention (Figure 2B). The analysis of basic compounds using a high pH mobile phase is an easy way to increase retention and to enhance resolution and peak shape. This makes a simpler task of method development, especially for complex test mixtures.

Non-silica-based chemistries have been developed in attempts to overcome the pH constraints of conventional silica-based HPLC columns, but silica-based phases offer a number of advantages, including high efficiencies, consistent lot-to-lot reproducibility, and predictable selectivities. Silica-based pHidelity™ pH-stable columns offer selectivity similar to conventional materials, but with dramatically increased column lifetime, even under the most harsh conditions. Figure 3 shows equivalent comparisons of a pHidelity™ C18 column and a conventional C18 column in an accelerated lifetime test under high pH conditions, at pH 10 and 60°C. This test demonstrates that pHidelity™ columns have a much greater lifetime when used in caustic environments than conventional C18 columns. Additionally, the pHidelity™ packing material is based on a true silica particle, ensuring a more C18-like selectivity than any competitive column based on non-silica or hybrid materials.

If your separation would benefit from extended pH conditions, we recommend you take advantage of pHidelity™ column for extreme-pH stability, C18-like selectivity, and long lifetimes. To discuss your separation, or for more information, please contact Restek's HPLC technical service group, and we will be happy to discuss how you can improve your analysis, and make fewer column [illegible] pHidelity™ column.

Figure 3 pHidelity™ C18 columns - exceptional performance under accelerated high pH stability testing conditions.



pHidelity™ C18 Columns

Physical Characteristics:

particle size: 3µm
pore size: 200Å
pH range: 1 to 12
temperature limit: 80°C

	cat. #
30mm	9579335
50mm	9579355
100mm	9579315
150mm	9579365

pHidelity™ C18 Guard Cartridges	qty.	cat. #
10 x 2.1mm	3-pk.	957930212
10 x 4.0mm	3-pk.	957930210
20 x 2.1mm	2-pk.	957930222
20 x 4.0mm	2-pk.	957930220

ordering note

For guard cartridges for these columns, visit our website at **www.restek.com**.

To order a column with a Trident™ inlet fitting, add -700 to the column's catalog number.

Simplified LC/MS/MS Analysis of Fluoroquinolones

Using An Allure® PFP Propyl Column

By Rick Lake, Pharmaceutical Innovations Chemist, and Benjamin Smith, Applications Technician

- Increase retention without ion-pairing.
- Better selectivity than C18 or cyano phases.
- Use desirable high-organic mobile phases for better ESI LC/MS sensitivity.

Fluoroquinolones are broad-spectrum antibiotics, used in both human and veterinary medicine. Because they are widely used, fluoroquinolones are target compounds in many analysis sectors, from research and clinical testing to environmental impact and residues in food. We have determined that an Allure® PFP Propyl column offers good retention capacity, and better selectivity than a C18 column, allowing simple method development strategies for fluoroquinolones.

Parent compound nalidixic acid is the structural basis for all quinolones, and fluoroquinolones are a fluorine-containing subset of this group (Figure 1). Chemically, fluoroquinolones exhibit amphoteric behavior: the nalidixic acid portion of the molecule has acidic functionality (carboxylic acid), while the compound as a whole also expresses a basic functionality. These characteristics, and the typical presence of polar functional groups, make chromatographic retention of the compounds difficult when using an alkyl phase and a simple (two-component) mobile phase. Polar groups reduce retention on alkyl phases, making a highly aqueous mobile phase, or ion-pairing, necessary for acceptable retention.

For non-selective, non-MS analyses, like potency assays, fluoroquinolones traditionally have been analyzed by reversed phase HPLC, on a C18 phase and in a highly aqueous mobile phase, as described in the USP monograph for ciprofloxacin.[1] When mass spectrometry is dictated, and a highly aqueous mobile phase is undesirable, ion-pairing with a volatile "MS friendly" reagent, like nonafluoropentanoic acid, has been used to increase retention. Although these mechanisms are sufficient, we sought to determine if, with a simple mobile phase, an Allure® PFP Propyl column would offer better retention, and possibly better selectivity, than a C18 phase.

Initially, we assayed the analytes on a C18 column, in an aqueous buffer and acetonitrile, to evaluate the retention and selectivity that could be achieved with a conventional stationary phase and isocratic mobile phase. As expected, retention was poor: an acceptable retention capacity value (roughly 2-5) required an aqueous concentration of 80% (Figure 2). Next, to see if we could improve retention through ionic

Figure 1 The polarity of fluoroquinolones make them a challenge to retain on C18 phases.

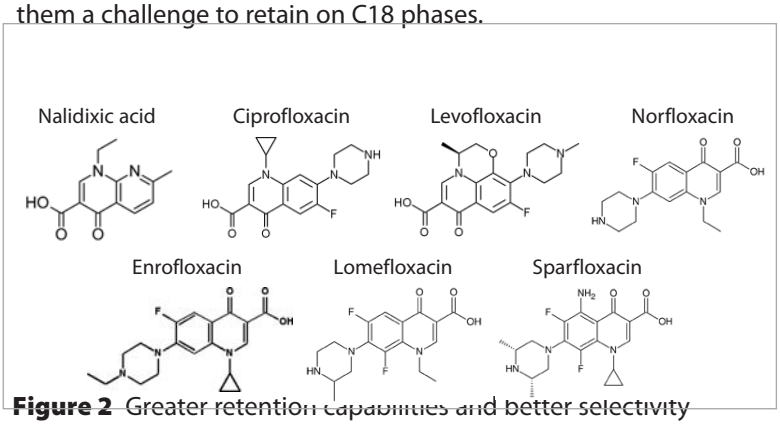


Figure 2 Greater retention capabilities and better selectivity enable you to use simple two-component mobile phases with an Allure® PFP Propyl column.

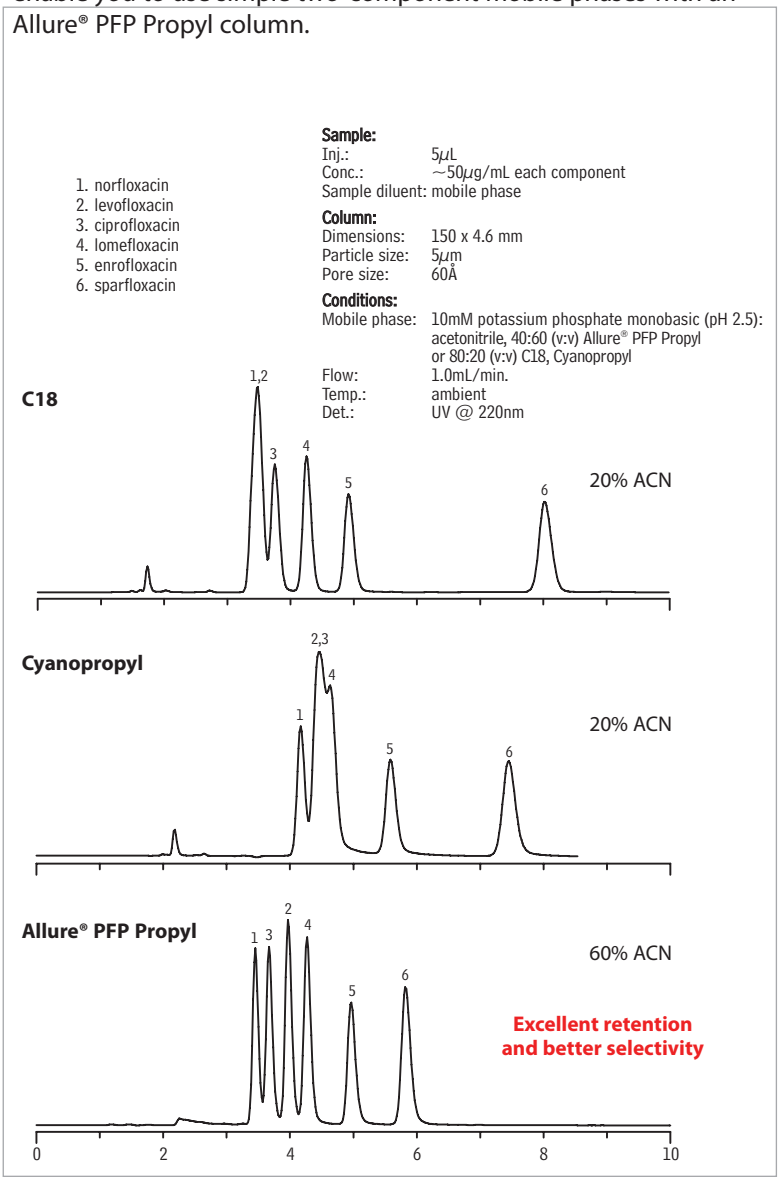
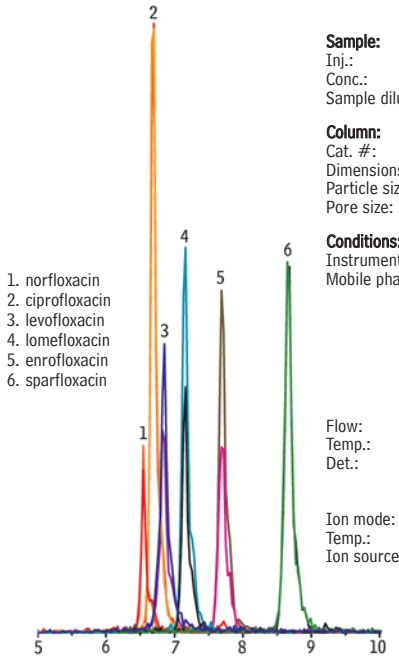


Figure 3 Optimizing retention with the Allure PFP Propyl gives high sensitivity and low matrix interference when analyzing fluoroquinolones by LC/MS/MS.



Sample:
Inj.: 5µL
Conc.: 50ng/mL
Sample diluent: mobile phase

Column: **Allure® PFP Propyl**
Cat. #: 9169352
Dimensions: 50 x 2.1 mm
Particle size: 3µm
Pore size: 60Å

Conditions:
Instrument: Shimadzu Prominence HPLC
Mobile phase: A: 0.1% formic acid in water
B: 0.1% formic acid in acetonitrile

Time (min.)	%B
0.00	10
10.00	90
10.10	10
15.00	10

Flow: 300µL/min.
Temp.: 30°C
Det.: Applied Biosystems API 3200 Triple Quadrupole LC/MS/MS Mass Spectrometer
Ion mode: positive
Temp.: 600°C
Ion source: TurboIonSpray®, Electrospray 4000V

LC_PH0426

Compound	Precursor Ion	Fragment Ion	Declustering Potential (V)	Collision Energy (V)
1. Norfloxacin	319.9	276.0	36.00	23.00
		233.1	36.00	35.00
2. Ciprofloxacin	332.1	288.2	41.00	23.00
		244.9	41.00	31.00
3. Levofloxacin	362.1	318.1	31.00	25.00
		261.0	31.00	41.00
4. Lomefloxacin	351.9	265.1	41.00	29.00
		308.0	41.00	23.00
5. Enrofloxacin	360.2	316.1	36.00	25.00
		245.3	36.00	37.00
6. Sparfloxacin	393.1	349.4	36.00	25.00
		292.2	36.00	29.00

interactions, we evaluated a cyanopropyl phase under the same conditions. This combination produced similar retention, but less selectivity (Figure 2). In contrast, an Allure® PFP Propyl column (pentafluorophenyl propyl phase), used under the same conditions, enabled us to achieve comparable retention capacities with the water content of the mobile phase reduced to 40% (Figure 2). In addition to greater retention capacity than the other phases, the Allure® PFP Propyl stationary phase has better selectivity – unlike with the C18 and cyano phases, there are no coelutions.

Another advantage to the Allure® PFP Propyl column's high retention capacity for fluoroquinolones is in LC/MS analysis. Maximizing retention causes the analytes to elute in mobile phases having higher percentages of the organic component. This can increase desolvation efficiency in electrospray ionization (ESI), and can eliminate unwanted adduct formation or charge competition from matrix interferences that are less retained by the column. The result is a potential for increasing sensitivity, while using simple analytical conditions. A simple mobile phase gradient, starting with a highly aqueous content and moving to a highly organic content, can be employed to elute salts and low molecular weight sample matrix interferences ahead of the compounds of interest. We observed the same improved retention when we assayed our fluoroquinolone test mix through positive ESI LC/MS/MS on an Applied Biosystems/MDS SCIEX API 3200 triple quadrupole LC/MS/MS mass spectrometer equipped with a Shimadzu Prominence binary pump LC system (Figure 3).

The Allure® PFP Propyl phase will retain polar analytes much more effectively than a C18 phase. When greater retention is needed to give the desired selectivity, or when LC/MS analysis is desired or required, simplify your method – use an Allure® PFP Propyl column and a simple mobile phase rather than a C18 column and an ion-pairing technique.

Reference
1. United States Pharmacopoeia, 28th revision; National Formulary, 23rd edition.

thank **you**

Instrument provided courtesy of Applied Biosystems

www.appliedbiosystems.com

Allure® PFP Propyl Columns (USP L43) Excellent Columns for LC/MS and ELSD

5µm Column, 4.6mm	cat. #
150mm	9169565
150mm (with Trident™ Inlet Fitting)	9169565-700

ordering **note**

For guard cartridges for these columns, visit our website at **www.restek.com**.

Monitor Antioxidants in Tea Extract

Using an Ultra Aqueous C18 HPLC Column and Unique® TOFMS

by Julie Kowalski, Ph.D., Innovations Chemist

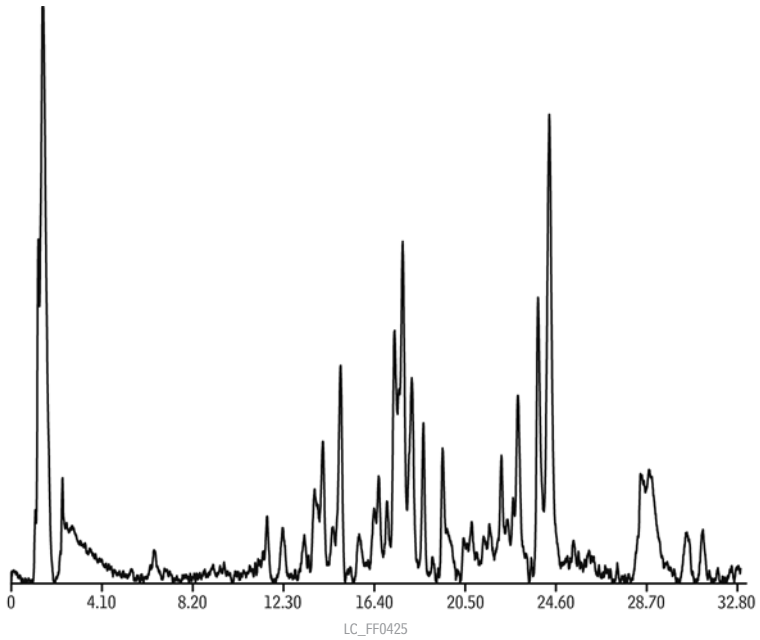
- Use highly aqueous mobile phases without collapsing the stationary phase.
- Extract data for specific compounds and manually inspect spectra for other compounds.
- Simple sample preparation.

Much focus has been given to the health benefits of foods and beverages that contain antioxidant compounds. By reacting with free radical-forming compounds before they can cause cell damage, antioxidants protect the body against oxidative stress.[1] Some foods and beverages naturally contain antioxidants, but supplementing foodstuffs has been on the rise due to demands by health conscious consumers. Recently, green tea has been successfully promoted as a health drink because it contains antioxidant phenolic compounds.

Using LC/TOFMS, we show a straightforward method for determining the presence of antioxidant compounds in commercial tea formulations. Samples were prepared by adding approximately 15g of dry tea product to 200mL of methanol which was cooled to approximately 20°C. The mixture was stirred for 5 minutes and decanted. The tea product was rinsed with an additional 20mL of cooled methanol. The 200mL and 20mL solutions were combined, then filtered through a 0.45µm syringe filter to capture particles. The filtered solution was used directly for analysis.

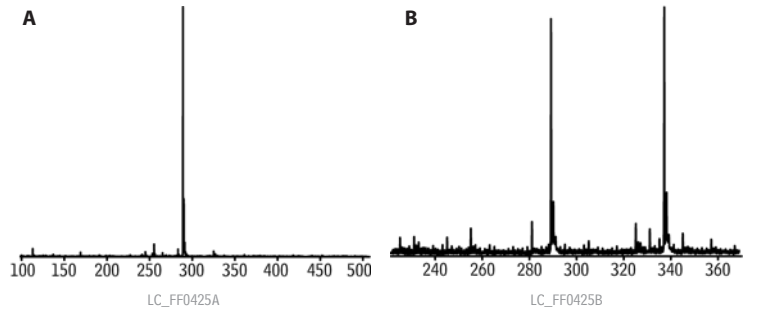
We used a 150 x 2.1mm Ultra Aqueous C18 HPLC column for the analysis and, because a tea extract is a complex matrix, we used a gradient elution and mobile phases with a high water content. The Ultra Aqueous C18 stationary phase is ideal for such an application: the phase is specifically designed to prevent collapse of the C18 alkyl chains in highly aqueous mobile phases.[2]

Figure 1 A complex mix of tea extract components is best separated on an Ultra Aqueous C18 column with a highly aqueous mobile phase (total ion chromatograms of Table 1 compounds).



For conditions see Figure 3.

Figure 2 (-)-Epicatechin produced by infusion of a standard (A) and spectrum of (-)-epicatechin created from an extracted ion chromatogram (B).



For conditions see Figure 3.

Figure 3 Spectra of phenolic compounds identified in the tea extract.

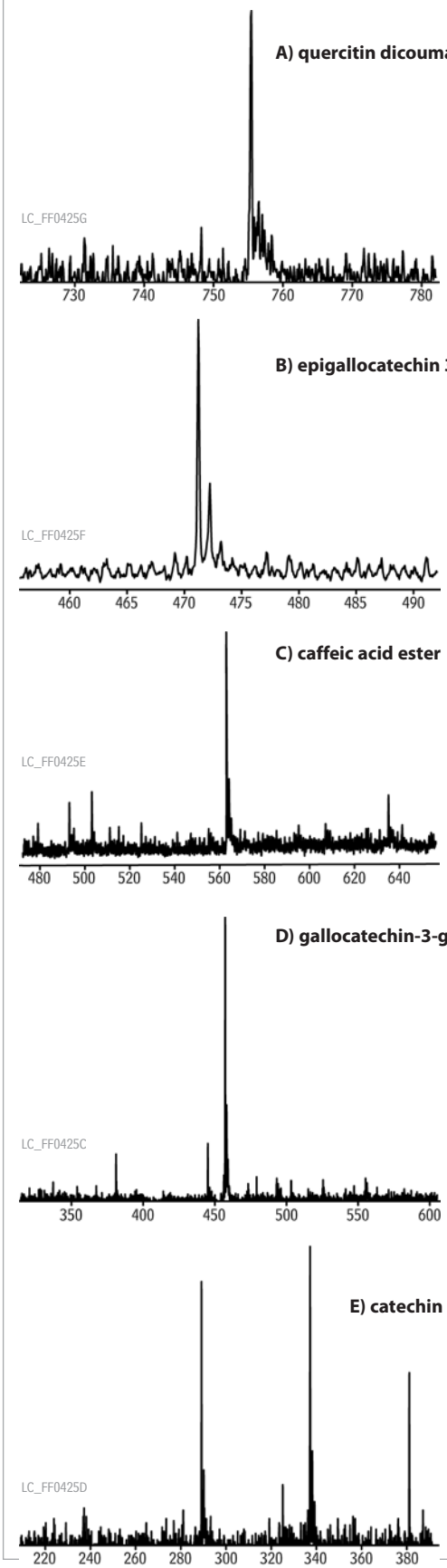


Table 1 Phenolic compounds of interest.

Compound	[M-H]-
gallocatechin-3-gallate	457.206
catechin	289.154
epigallocatechin-3-methyl gallate	471.208
epicatechin di-gallate	609.318
epicatechin-3-gallate	441.208
catechin gallate	

Note: m/z 441.2 can be either epicatechin-3-gallate or catechin gallate.

The Ultra Aqueous C18 phase proved ideal for resolving the complex tea matrix, as shown by the large number of peaks in Figure 1. The resolving power of this chromatographic system, in combination with the LECO Unique® TOF Mass Spectrometer, allow the analyst to both extract data for specific compounds of interest and manually inspect spectra for other compounds, including phenolic glycosides and esters of phenolic acid.

If you are analyzing antioxidants in tea, or other complex mixtures of compounds, an Ultra Aqueous C18 column gives you the reliable results you need, without restricting your ability to use the mobile phase composition that works best for your application.

For information about the LECO Unique® TOFMS, please visit the LECO website: **www.leco.com**

1 Free radical damage is implemented in many disease models, including cancer, in many degenerative illnesses, and in the aging process.

2 When the long, hydrophobic alkyl chain of a conventional C18 stationary phase is exposed to a highly aqueous mobile phase it folds down on itself, causing loss of retention. A prolonged equilibration time in a high organic solution is needed to restore the phase. The Ultra Aqueous C18 stationary phase is not susceptible to phase collapse – not even in mobile phases with very highly aqueous content.

Ultra Aqueous C18 Columns (USP L1)

5µm Column, 2.1mm	cat. #
150mm	9178562
150mm (with Trident™ Inlet Fitting)	9178562-700

ordering note

For guard cartridges for these columns, visit our website at **www.restek.com**.

Syringe Filters

- Color coded for easy identification.
- Reusable storage container.

Size	Porosity	Color	qty.	cat.#
Nylon				
25mm	0.45µm	pink	100-pk.	26149
25mm	0.45µm	pink	500-pk.	26203

See our catalog or website for other sizes and materials.

thank you

Instrument provided courtesy of LECO Corporation.

www.leco.com

Superior Chromatography for Semivolatile Organics

Using the Rtx®-5Sil MS Capillary GC Column

by Robert Freeman, Environmental Innovations Chemist

- Superior resolution of benzo(b)- and benzo(k)fluoranthene.
- Symmetric peaks and excellent responses for phenols.
- Excellent thermal stability and exceptionally low bleed.

GC/MS analytical methods for semivolatile compounds, such as U.S. Environmental Protection Agency Method 8270D and equivalent methods in other countries, cover a broad range of environmental pollutants. The target lists often include complex mixtures of acidic, basic, and neutral analytes. Further, the sample extracts often contain problematic matrix interferences. These factors, coupled with the increasing need for lower detection limits, place significant demand on the thermal stability, inertness, and efficiency of the analytical column.

Restek chemists designed the Rtx®-5Sil MS capillary column to address the challenging demands of semivolatiles analysis. Phenyl rings in the polymer backbone of the stationary phase stiffen the siloxane chain, preventing thermal breakdown and reducing bleed. The content of this aryl functionality has been adjusted so that selectivity is similar, but improved, compared to that of conventional 5% diphenyl/95%dimethyl phases. The silarylene polymer not only exhibits improved thermal stability and reduced bleed, it has increased separation for aromatic isomers benzo(b)- and benzo(k)fluoranthene – as shown in Figure 1.

Surface activity in a column is revealed by the response factors for active analytes, such as 2,4-dinitrophenol (acidic) and pyridine (basic). Most column manufacturers struggle to attain adequate responses and good peak shapes for such analytes. Our unique deactivation process for the Rtx®-5Sil MS silarylene phase assures unsurpassed inertness and excellent responses for these active analytes – note the response for 2,4-dinitrophenol in Figure 2, and for many other semivolatiles in Figure 3.

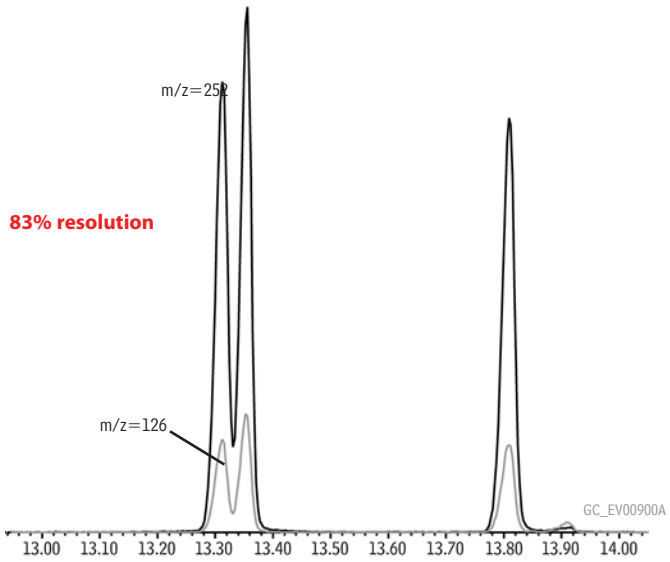
Featuring an optimized stationary phase, inherently low bleed, and proprietary deactivation, Rtx®-5Sil MS columns overcome the inherent problems associated with semivolatiles analyses. If you are performing these analyses, you can simplify life in your laboratory – rely on these new columns to help you obtain consistent results.

Rtx®-5Sil MS Column (fused silica)

(Crossbond®, selectivity similar to 5% diphenyl/95% dimethyl polysiloxane)

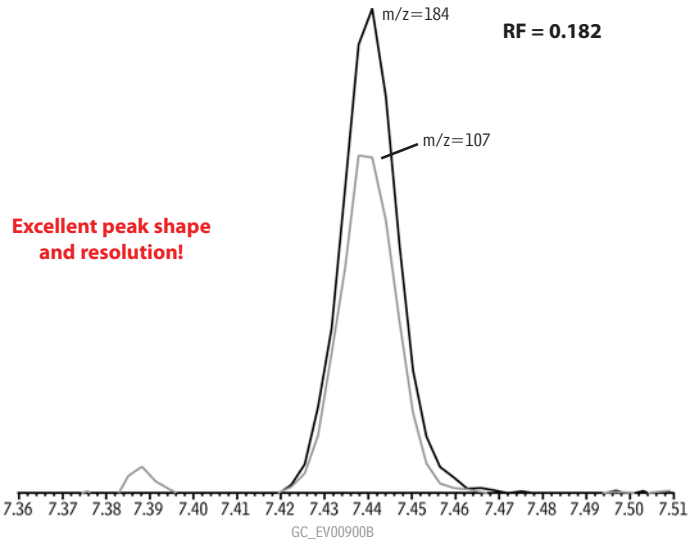
ID	df (µm)	temp. limits	length	cat. #
0.25mm	0.25	-60 to 330/350°C	30-Meter	12723

Figure 1 Superior resolution of benzo(b)fluoranthene, benzo(k)fluoranthene, and benzo(a)pyrene (10µg/mL).



For conditions see Figure 3.

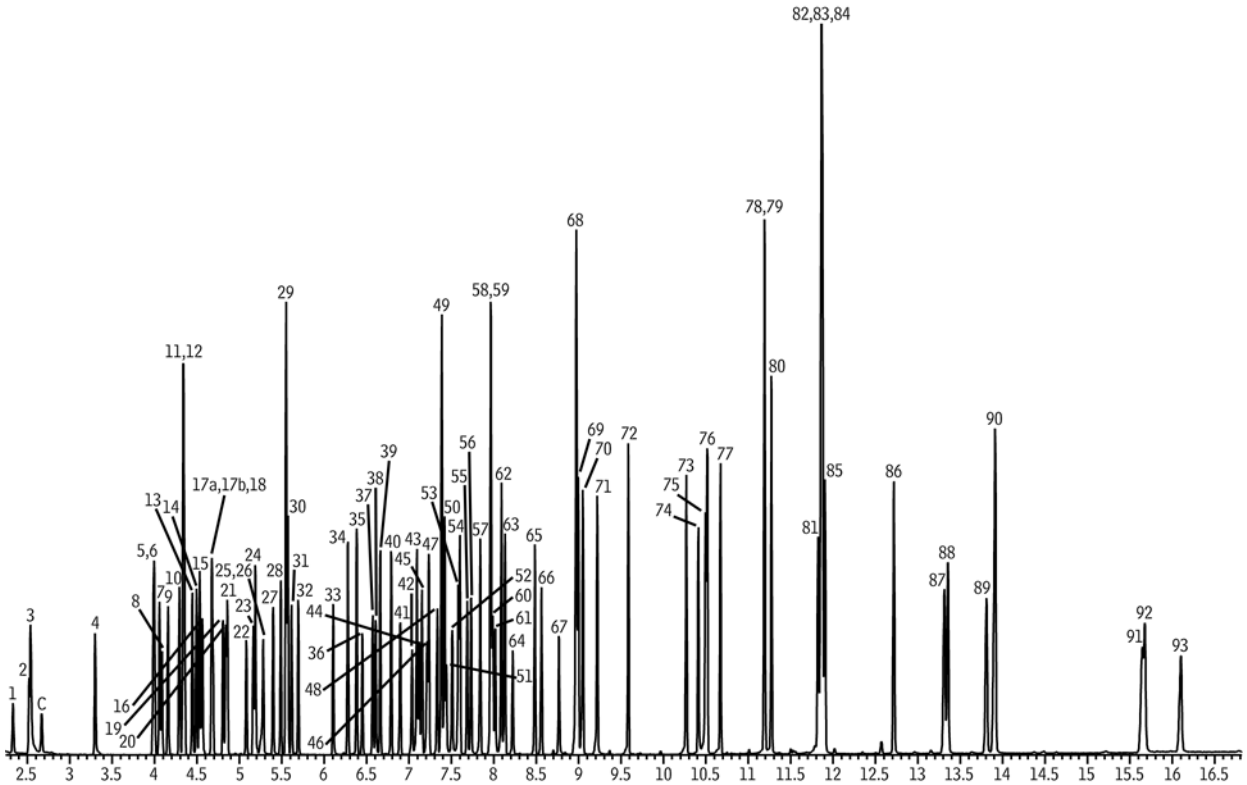
Figure 2 Excellent response for 2,4-dinitrophenol (10µg/mL).



For conditions see Figure 3.

Figure 3 Total ion chromatogram for 94 semivolatile analytes (10µg/mL).

	Peak	RT		Peak	RT		Peak	RT		Peak	RT
1.	1,4-dioxane	2.33	24.	2,4-dimethylphenol	5.19	49.	acenaphthene-d10 (IS)	7.39	72.	di-n-butyl phthalate	9.59
2.	N-nitrosodimethylamine	2.52	25.	benzoic acid	5.27	50.	acenaphthene	7.42	73.	fluoranthene	10.27
3.	pyridine	2.54	26.	bis(2-chloroethoxy)methane	5.28	51.	2,4-dinitrophenol	7.44	74.	benzidine	10.41
C	toluene	2.67	27.	2,4-dichlorophenol	5.40	52.	4-nitrophenol	7.51	75.	pyrene-d10 (Surr.)	10.50
4.	2-fluorophenol (Surr.)	3.30	28.	1,2,4-trichlorobenzene	5.49	53.	2,4-dinitrotoluene	7.58	76.	pyrene	10.52
5.	phenol-d6 (Surr.)	3.99	29.	naphthalene-d8 (IS)	5.55	54.	dibenzofuran	7.60	77.	p-terphenyl-d14 (Surr.)	10.67
6.	phenol	4.00	30.	naphthalene	5.57	55.	2,3,5,6-tetrachlorophenol	7.69	78.	3,3'-dimethylbenzidine	11.19
7.	aniline	4.06	31.	4-chloroaniline	5.62	56.	2,3,4,6-tetrachlorophenol	7.73	79.	butyl benzyl phthalate	11.20
8.	bis(2-chloroethyl) ether	4.09	32.	hexachlorobutadiene	5.70	57.	diethyl phthalate	7.84	80.	bis(2-ethylhexyl) adipate	11.27
9.	2-chlorophenol	4.16	33.	4-chloro-3-methylphenol	6.11	58.	4-chlorophenyl phenyl ether	7.96	81.	3,3'-dichlorobenzidine	11.82
10.	1,3-dichlorobenzene	4.29	34.	2-methylnaphthalene	6.28	59.	fluorene	7.97	82.	bis(2-ethylhexyl) phthalate	11.86
11.	1,4-dichlorobenzene-d4 (IS)	4.34	35.	1-methylnaphthalene	6.38	60.	4-nitroanaline	7.99	83.	benzo(a)anthracene	11.86
12.	1,4-dichlorobenzene	4.35	36.	hexachlorocyclopentadiene	6.45	61.	4,6-dinitro-2-methylphenol	8.02	84.	chrysene-d12 (IS)	11.88
13.	benzyl alcohol	4.45	37.	2,4,6-trichlorophenol	6.57	62.	N-nitrosodiphenylamine (diphenylamine)	8.09	85.	chrysene	11.91
14.	1,2-dichlorobenzene	4.50	38.	2,4,5-trichlorophenol	6.61	63.	1,2-diphenylhydrazine (as azobenzene)	8.13	86.	di-n-octyl phthalate	12.72
15.	2-methylphenol	4.53	39.	2-fluorobiphenyl (Surr.)	6.66				87.	benzo(b)fluoranthene	13.31
16.	bis(2-chloroisopropyl) ether	4.56	40.	2-chloronaphthalene	6.79				88.	benzo(k)fluoranthene	13.36
17a.	4-methylphenol	4.67	41.	2-nitroaniline	6.90	64.	2,4,6-tribromophenol (Surr.)	8.22	89.	benzo(a)pyrene	13.81
17b.	3-methylphenol	4.67	42.	1,4-dinitrobenzene	7.04	65.	4-bromophenyl phenyl ether	8.49	90.	perylene-d12 (IS)	13.91
18.	N-nitroso-di-n-propylamine	4.69	43.	dimethyl phthalate	7.09	66.	hexachlorobenzene	8.56	91.	dibenzo(a,h)anthracene	15.65
19.	hexachloroethane	4.81	44.	1,3-dinitrobenzene	7.12	67.	pentachlorophenol	8.77	92.	indeno(1,2,3-cd)pyrene	15.68
20.	nitrobenzene-d5 (Surr.)	4.84	45.	2,6-dinitrotoluene	7.15	68.	phenanthrene-d10 (IS)	8.97	93.	benzo(ghi)perylene	16.10
21.	nitrobenzene	4.86	46.	1,2-dinitrobenzene	7.21	69.	phenanthrene	9.00			
22.	isophorone	5.08	47.	acenaphthylene	7.23	70.	anthracene	9.05			
23.	2-nitrophenol	5.16	48.	3-nitroaniline	7.34	71.	carbazole	9.22			



GC_EV00900

Column: Rtx®-5Sil MS, 30m, 0.25mm ID, 0.25µm (cat.# 12723)
Sample: US EPA Method 8270D mix: 8270 MegaMix® (cat.# 31850), Benzoic Acid (cat.# 31879), 8270 Benzidines Mix (cat.# 31852), Acid Surrogate Mix (4/89 SOW) (cat.# 31025), Revised B/N Surrogate Mix (cat.# 31887), 1,4-Dioxane (cat.# 31853), SV Internal Standard Mix (cat.# 31206)
Inj.: 1.0µL, pulsed splitless, 10µg/mL each component, int. stds. 20µg/mL (10ng or 20ng on column), 4mm Drilled Uniliner® inlet liner, hole on bottom (cat.# 20756), pulse: 30psi @ 0.4 min.; 60mL/min. @ 0.3 min.
GC: Agilent 6890
Inj. temp.: 250°C
Carrier gas: helium
Flow rate: 1.2mL/min., constant flow
Oven temp.: 50°C (hold 0.5 min.) to 290°C @ 23°C/min., to 325°C @ 6°C/min. (hold 0.5 min.)
Det.: Agilent 5973 GC/MS
Transfer temp.: 280°C
Scan range: 35-550 amu
Solvent delay: 2.20 min.
Tune: DFTPP
Ionization: EI

8-Minute Dual Column Analysis of Organochlorine Pesticides

Using Rtx®-CLPesticides / Rtx®-CLPesticides2 Columns

By Jason Thomas, Environmental Chemist

- Analysis and confirmation of 20 pesticides in 8 minutes.
- Baseline resolution of all compounds, for improved accuracy.
- Low-bleed columns, for reliable data.

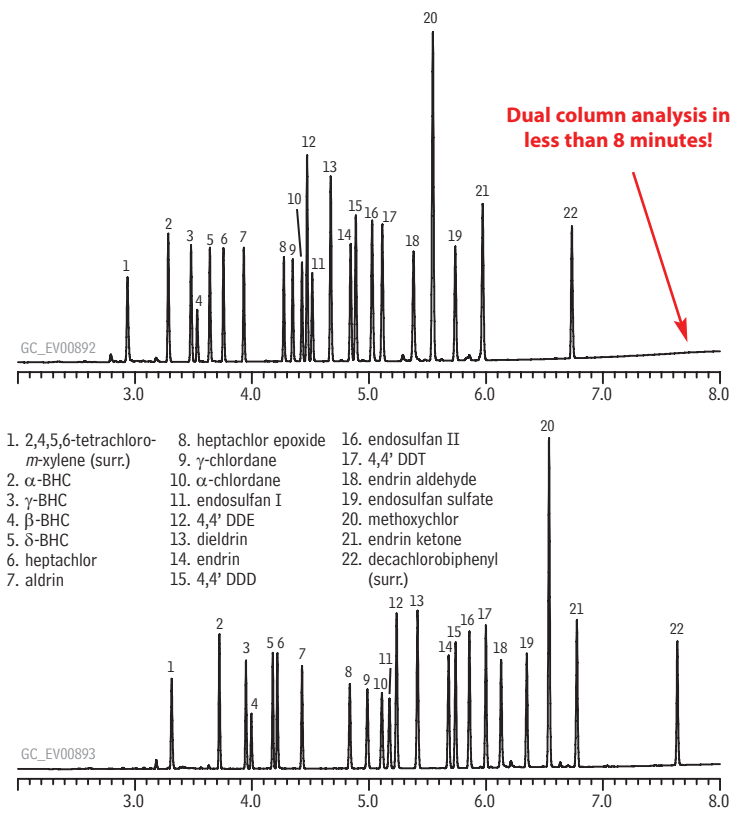
Analyses for organochlorine pesticides are among the most common pesticide methodologies in use today. US EPA Method 8081, for example, requires separation of 20 organochlorine pesticides, some of which are isomers or are otherwise structurally similar and, therefore, are difficult to separate. Restek introduced two proprietary phases to address this issue, the Rtx®-CLPesticides phase and the Rtx®-CLPesticides2 phase, which have proven very popular within the environmental community. The unique selectivities of this column pair allow laboratories to significantly reduce analysis times for Method 8081.

There is a constant need for faster analyses, to help increase sample throughput and, thereby, increase productivity. Fast GC is a good solution, but the reduced column internal diameters and thinner phase film coatings associated with fast GC have been deterrents, due to concerns about the columns' ability to cope with the harsh sample matrices often encountered in environmental samples, and shortened column lifetimes have not been acceptable.

Using a 0.53mm ID guard column at the inlet end of a dual column configuration protects the analytical columns downstream. This configuration allows 20m x 0.18mm ID thin film columns to be used, with their associated high efficiency, to greatly reduce analysis time without the reduction of column lifetime usually associated with introducing "dirty" samples into small bore columns.

Figure 1 shows separation of the 20 target pesticides in EPA Method 8081 in 8 minutes using 20m x 0.18mm ID Rtx®-CLPesticides/Rtx®-CLPesticides2 columns with a 0.53 ID guard column. In addition to rapid, baseline resolution, the pesticides are eluted as sharp, symmetric peaks. This, in turn, helps assure reliable quantification data for these analytes. Clearly the Rtx®-CLPesticides/Rtx®-CLPesticides2 columns, in conjunction with a 0.53mm ID guard column, are an excellent choice for analyzing EPA Method 8081 pesticides, or equivalent target lists of these pesticides.

Figure 1 20 organochlorine pesticides resolved and confirmed in 8 minutes, using Rtx®-CLPesticides/Rtx®-CLPesticides2 columns.



Column: Rtx®-CLPesticides, 20m, 0.18mm ID, 0.18µm (cat.# 42102) (top) and Rtx®-CLPesticides2, 20m, 0.18mm ID, 0.14µm (cat.# 42302) with 5m x 0.53mm ID intermediate-polarity deactivated guard tubing (cat.# 10045), connected using SeCure™ "Y" Connector Kit (cat.# 20276) with Universal "Y" Press-Tight® Connector
Sample: Organochlorine Pesticide Mix AB #2 (cat.# 32292), 8-80µg/mL each component in hexane/toluene, Pesticide Surrogate Mix (cat.# 32000), 200µg/mL each component in acetone
Inj.: 0.5µL splitless (hold 0.75 min.), 2mm single gooseneck inlet liner (cat.# 20795)
Inj. temp.: 250°C
Carrier gas: helium, constant flow
Linear velocity: 20cm/sec. @ 140°C
Oven temp.: 140°C (hold 1 min.) to 250°C @ 35°C/min. (hold 1 min.) to 330°C @ 35°C/min. (hold 3 min.)
Det.: ECD @ 350°C

Rtx®-CLPesticides Column (fused silica)

ID	df (µm)	temp. limits	length	cat. #
0.18mm	0.18	-60 to 310/330°C	20-Meter	42102

Rtx®-CLPesticides2 Column (fused silica)

ID	df (µm)	temp. limits	length	cat. #
0.18mm	0.14	-60 to 310/330°C	20-Meter	42302

IP Deactivated Guard Column

length, ID	cat. #
5m, 0.53mm ID	10045

SeCure™ "Y" Connector Kits

Ferrules Fit Column ID	qty.	cat.#
0.25/0.28mm	kit	20276

Organochlorine Pesticide Reference Mixes

Popular Restek Analytical Standards

By Ken Herwehe, Analytical Reference Materials Product Marketing Manager

Organochlorine Pesticide Mix AB #2

(20 components)

aldrin	8µg/mL	dieldrin	16
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

cat. # 32292 (ea.)

Organochlorine Pesticide Mix AB #1

(20 components)

same components as Organochlorine Pesticide Mix AB #2, listed above

200µg/mL each in hexane:toluene (1:1), 1mL/ampul

cat. # 32291 (ea.)

Organochlorine Pesticide Mix AB # 3

(20 components)

same components as Organochlorine Pesticide Mix AB #2, listed above

2,000µg/mL each in hexane:toluene (1:1), 1mL/ampul

cat. # 32415 (ea.)

Pesticide Surrogate Mix

decachlorobiphenyl	2,4,5,6-tetrachloro-*m*-xylene

200µg/mL each in acetone, 1mL/ampul

cat. # 32000 (ea.)

Pesticide Surrogate Mix

decachlorobiphenyl	200µg/mL
2,4,5,6-tetrachloro-*m*-xylene	100

In P&T methanol, 1mL/ampul

cat. # 32453 (ea.)

did you **know**?

Restek offers the ChemService product line of neat pesticides and metabolites.

See **www.restek.com** for more information.

ChemService

Resprep™ Florosil® SPE Cartridges

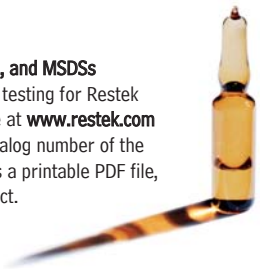
(EPA SW 846 methods and CLP protocols)

3mL/500mg (50-pk.)	6mL/500mg (30-pk.)	6mL/1000mg (30-pk.)
24031	—	24034
24032*	26086**	26085**

*Teflon® frits

**Glass tubes with Teflon® frits

free data



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Analyze and Confirm Cannabinoids by LC/MS/MS

Using an Allure® Biphenyl Column

by Kristi Sellers, Clinical/Forensic Innovations Chemist, Becky Wittrig, Ph.D., HPLC Product Marketing Manager, and André Schreiber, Ph.D., Application Chemist, Applied Biosystems

- Faster sample throughput (short analysis time, no derivatization)
- Reliable response at 1ng on-column
- Undisputable identification, using two +MRM transitions

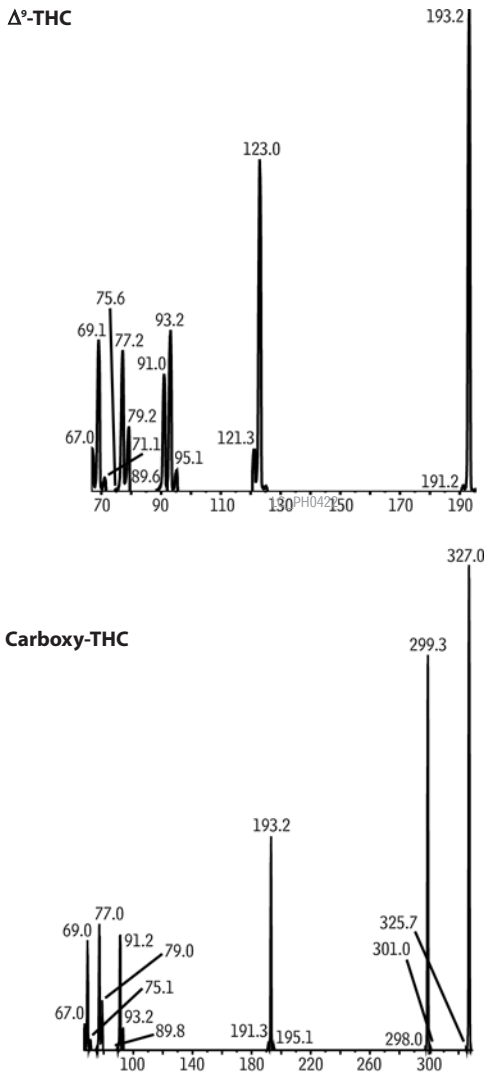
As marijuana is smoked, the main psychoactive component, Δ^9-tetrahydrocannabinol (Δ^9-THC), is quickly absorbed and metabolized to 11-hydroxy-Δ^9-tetrahydrocannabinol (hydroxy-THC), an active metabolite. Hydroxy-THC is further metabolized, rapidly, to 11-nor-9-carboxy-Δ^9-tetrahydrocannabinol (carboxy-THC), an inactive metabolite commonly found in urine, blood, hair, and tissues.[1] GC/MS often is used for confirming and quantifying Δ^9-THC and carboxy-THC[2]; however, GC/MS methods require time-consuming steps, like derivatization, to obtain acceptable chromatography. By using HPLC, derivatization can be eliminated, saving time without sacrificing sensitivity.

We developed a quantitative method for analyzing underivatized cannabinoids by HPLC/tandem mass spectrometry. Our goals were threefold; 1) to optimize column selection, 2) to provide a short analysis time, and 3) to obtain reliable confirmation and quantification data in the low nanogram range (< 10ng). We used an Applied Biosystems API 3200 MS/MS detector coupled to a Shimadzu LC20AD Prominence Series chromatograph for optimum chromatographic and detection capabilities.

Figure 1 shows the final product spectra for Δ^9-THC and carboxy-THC used to develop the +MRM (multiple reaction monitoring) method.[3] We determined the 30mm, 2.1mmID, 3µm Allure® Biphenyl HPLC column to be the best column for this analysis. This column employs a unique separation mechanism, π-π interaction, which greatly improves selectivity and retention, relative to conventional C18 phases. In addition, with the increased retention of the biphenyl phase, higher amounts of methanol can be used in the mobile phase. This noticeably increases sensitivity when using an electrospray interface.

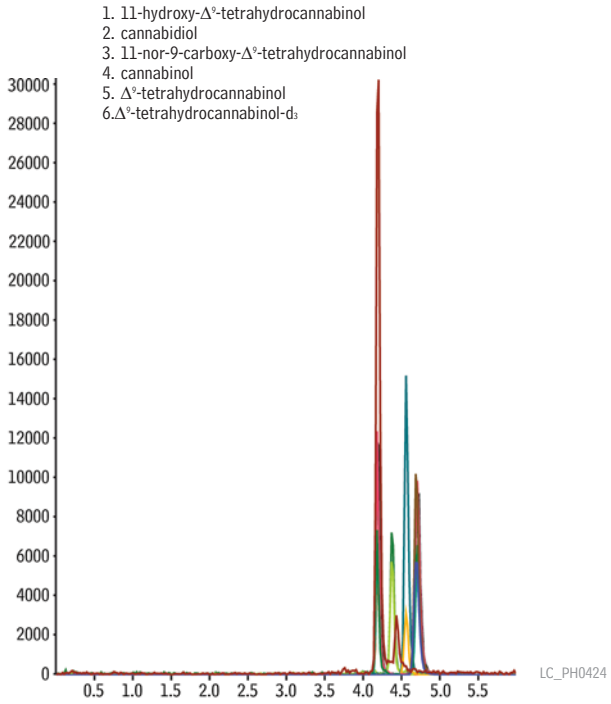
The Allure® Biphenyl column provides good resolution of all compounds in less than 5 minutes – including baseline resolution of Δ^9-THC and cannabidiol, which have very similar product ion spectra and +MRM transitions (Figure 2). By using MS/MS detection, we were able to target two

Figure 1 Final product spectra used in developing MRM transitions for compound identification and optimized sensitivity.



For conditions see Figure 2.

Figure 2 Fast, selective separation of Δ⁹-THC and its metabolites, using an Allure® Biphenyl HPLC column (extracted ion chromatography).



Sample:
Inj.: 10μL
Conc.: 100ng/mL each component
Sample diluent: mobile phase

Column: Allure® Biphenyl
Cat. #: 9166332
Dimensions: 30 x 2.1 mm
Particle size: 3μm
Pore size: 60Å

Conditions:
Mobile phase: A: 0.1% formic acid in water
B: 0.1% formic acid in methanol

Time (min.)	%B
0.5	50
2.5	90
5.0	90
6.0	50
6.1	—

Flow: 0.5mL/min.
Temp.: ambient
Det.: Spectrum Model (Sciex API 3200 Triple Quadrupole)
Interface: ESI
Ion mode: positive
Temp.: 500°C
Ion source: 5500V

Table 1 MRM transitions for THC and metabolites: multiple transitions are monitored for each compound for definitive identifications.

Analyte	Q1 Mass	Q3 Mass	Time (ms)	DP (V)	EP (V)	CE (V)	CXP (V)
Hydroxy-THC (MRM1)	331.2	313.1	100	36	5	21	10
Hydroxy-THC (MRM2)	331.2	193.1	100	36	5	35	6
Carboxy-THC (MRM1)	345.2	327.0	100	41	4.5	21	10
Carboxy-THC (MRM2)	345.2	299.3	100	41	4.5	25	6
Cannabidiol (MRM1)*	315.2	193.2	100	36	4.5	31	6
Cannabidiol (MRM2)*	315.2	123.2	100	36	4.5	43	6
Cannabinol (MRM1)	311.2	223.0	100	46	8.5	27	8
Cannabinol (MRM2)	311.2	222.5	100	46	8.5	37	10
Δ⁹-THC (MRM1)*	315.2	193.2	100	41	4.5	33	6
Δ⁹-THC (MRM2)*	315.2	123.1	100	41	4.5	43	6
Δ⁹-THC-d3 (MRM1)	318.3	196.3	100	36	4.5	31	6
Δ⁹-THC-d3 (MRM2)	318.3	123.2	100	36	4.5	43	6

*Note, cannabidiol and Δ⁹-THC share the same transitions, but are separated chromatographically.
DP – declustering potential, EP – entrance potential, CE – collision energy, CXP – collision cell exit potential

+MRM transitions per compound to verify compound identity at approximately 1ng on-column. Table 1 shows the +MRM transitions and the source conditions for approximately 1ng each of several cannabinoid metabolites.

Based on this work, we conclude an Allure® Biphenyl column, coupled with an API MS/MS 3200 detector and a Shimadzu LC20AD Prominence, can be used to quantify low levels of cannabinoid analytes from underivatized sample, and can achieve baseline separation of Δ⁹-THC and cannabidiol, in less than 5 minutes.

References:
1 Abbara, C., R. Galy, A. Benyamina, M. Reynaud and L. Bonhomme-Faivre, *Development and validation of a method for quantitation of Δ⁹-tetrahydrocanabinol in human plasma by high performance liquid chromatography after solid phase extraction* J. Pharma. Biomed. Anal. 41 (2006) 1011-1016.
2 Sellers, K. *Reliably Confirm Cannabinoids by GC/MS* Restek Advantage 2006.04 (2006) 16-17.
3 Weinmann, W., S. Vogt, R. Goerke, C. Muller and A. Bromberger, *Simultaneous determination of THC-COOH and THC-COOH-glucuronide in urine samples by LS/MS/MS* Forens. Sci. Intl. 113 (2000) 381-387.

Reference 2 available from Restek – request lit. cat.# 580120.

Allure® Biphenyl Columns (USP L11)

3μm Column, 2.1mm	cat. #
30mm	9166332
50mm	9166352
100mm	9166312
30mm (with Trident™ Inlet Fitting)	9166332-700
50mm (with Trident™ Inlet Fitting)	9166352-700
100mm (with Trident™ Inlet Fitting)	9166312-700

ordering note

For guard cartridges for these columns, visit our website at **www.restek.com**.

Exempted Drug of Abuse Reference Materials

1,000μg/mL in P&T methanol, 1mL/ampul

Compound	CAS#	Individual cat.#
Cannabinoid & Metabolites		
cannabidiol	13956-24-1	34011
cannabinol	521-35-7	34010
Δ⁹-THC	1972-08-3	34067
±11-nor-9-carboxy-Δ⁹-THC	104874-50-2	34068

No datapacks available.

thank you

Instrument provided courtesy of Applied Biosystems

www.appliedbiosystems.com

Sampling Volatile Organic Compounds in Air

Restek Sampling Equipment Helps Assure Accurate Data

By Irene DeGraff, Air Monitoring Product Marketing Manager

One of the most widely used methods for ambient air monitoring, USEPA TO-15, specifies sample collection with a specially prepared stainless steel canister, followed by GC/MS analysis. Restek can support all facets of this or other air monitoring programs – from state-of-the-art sampling equipment to high quality analytical reference standards.

An inert canister surface is critical to obtaining accurate sample results. Restek offers a complete line of TO-Cans™ (Summa® equivalent canisters) which are electropolished and extensively cleaned prior to shipping to ensure a high-quality passivated surface for improved analyte stability. No weld marks on the spheres further reduce the occurrence of active sites. For reactive compounds, such as sulfur-containing components, a SilcoCan™ is your best canister choice. SilcoCan™ canisters are deactivated with Siltek® surface treatment ensuring exceptional inertness and maximum sample stability, even for low level sulfur compounds.

Optional gauge
- Quickly confirm vacuum or pressure inside canister.
- Monitor pressure changes.
- Fully protected by canister frame.
- Can be heated to 90°C during cleaning.

High-quality vacuum gauge

2 or 3 Port high quality valve
Metal-to-metal seal, 2/3 turn with stainless steel diaphragm.

All configurations also available in 1L, 3L, and 15L volumes: please see our website.

TO-Can™ Air Monitoring Canisters

Optimized for US EPA Methods TO-14 and TO-15, and ASTM D5466

Description	qty.	cat.#
6L Volume		
TO-Can™ Canister, 1/4" Valve	ea.	24174
TO-Can™ Canister with Gauge, 1/4" Valve	ea.	24178
TO-Can™ Canister with No Valve	ea.	22096

SilcoCan™ Air Monitoring Canisters

Ideal for low-level reactive sulfur (1-20ppb), TO-14, or TO-15 compounds

Description	qty.	cat.#
6L Volume		
SilcoCan™ Canister, 1/4" Valve	ea.	24182
SilcoCan™ Canister, Siltek® Treated 1/4" Valve	ea.	24182-650
SilcoCan™ Canister with Gauge, 1/4" Valve	ea.	24142
SilcoCan™ Canister with Gauge, Siltek® Treated 1/4" Valve	ea.	24142-650
SilcoCan™ Canister with No Valve	ea.	22092
Replacement 1/4" Valves for Air Monitoring Canisters		
1/4" Replacement Valve (2-port)	ea.	24145
1/4" Siltek® Replacement Valve (2-port)	ea.	24144
1/4" Replacement Valve (3-port)	ea.	24147
1/4" Siltek® Replacement Valve (3-port)	ea.	24146

Restek canisters are originally equipped with high-quality Parker Hannifin diaphragm valves. Each valve is helium leak-tested to 4 x 10^{-9}cc/sec. The all-stainless steel construction eliminates contamination and withstands temperatures from -100°C to 250°C. Compression outlet fitting, indicator plate to display open or closed position, 1/4" inlet and outlet.

free literature

A Guide to Passive Air Sampling
request lit. cat. # 59977B

Rxi™-1ms Column (fused silica)

(Crossbond® 100% dimethyl polysiloxane)

ID	df (µm)	temp. limits	length	cat. #
0.32mm	1.00	-60 to 330/350°C	60-Meter	13357

TO-15 62 Component Mix (62 components)

Cylinder Construction:	aluminum
Cylinder Size:	8 x 24 cm.
Volume/Pressure:	104 liters of gas @ 1800psig
Cylinder Fitting:	CGA-180 outlet
Weight:	1.5 lbs./0.7 kg

acetone
benzene
benzyl chloride*
bromodichloromethane
bromoform
bromomethane
1,3-butadiene
2-butanone (MEK)
carbon disulfide*
carbon tetrachloride
chlorobenzene
chloroethane
chloroform
chloromethane
cyclohexane
dibromochloromethane
1,2-dichlorobenzene
1,3-dichlorobenzene
1,4-dichlorobenzene
1,1-dichloroethane
1,2-dichloroethane
1,1-dichloroethene
cis-1,2-dichloroethene
trans-1,2-dichloroethene
1,2-dichloropropane
cis-1,3-dichloropropene
trans-1,3-dichloropropene
1,4-dioxane
ethanol*
ethyl acetate
ethyl benzene
ethylene dibromide (1,2-dibromoethane)
4-ethyltoluene
trichlorofluoromethane (Freon® 11)
dichlorodifluoromethane (Freon® 12)
1,1,2-trichloro-1,2,2-trifluoroethane (Freon® 113)
1,2-dichlorotetrafluoroethane (Freon® 114)
heptane
hexachloro-1,3-butadiene
hexane
2-hexanone (MBK)
4-methyl-2-pentanone (MIBK)
methylene chloride
methyl *tert*-butyl ether (MTBE)
2-propanol
propylene
styrene
1,1,2,2-tetrachloroethane
tetrachloroethene
tetrahydrofuran
toluene
1,2,4-trichlorobenzene
1,1,1-trichloroethane
1,1,2-trichloroethane
trichloroethene
1,2,4-trimethylbenzene
1,3,5-trimethylbenzene
vinyl acetate
vinyl chloride
m-xylene
o-xylene
p-xylene

In nitrogen, 104 liters @ 1800psig

1ppm cat. # 34436 (ea.)

100ppb cat. # 34437 (ea.)

*Stability of this compound cannot be guaranteed.

TO-14A Internal Standard/Tuning Mix

Cylinder Construction:	aluminum
Cylinder Size:	8 x 24 cm.
Volume/Pressure:	104 liters of gas @ 1800psig
Cylinder Fitting:	CGA-180 outlet
Weight:	1.5 lbs./0.7 kg

bromochloromethane
1-bromo-4-fluorobenzene (4-bromofluorobenzene)
chlorobenzene-d5
1,4-difluorobenzene

In nitrogen, 104 liters @ 1800psig

1ppm cat. # 34408 (ea.)

Additional TO-14 and TO-15 Analytical Reference Materials are also available. Please see our catalog or website.

2007.01

Increase Accuracy & Efficiency

Air Canister Heating Jacket

Our heating jacket can help you prepare your canisters for sampling faster and more efficiently. The jacket's novel design ensures complete cleaning by heating the canister and valve together. When used during the analysis, it prevents condensation, ensuring more accurate results. Two temperature settings, 75ºC and 150ºC. Fits all canisters up to 6L in size.

Description	qty.	cat.#
Air Canister Heating Jacket	ea.	24123

*Not CE certified.

The ultimate in controlled heating, for reliably cleaning your air canisters!

Passive Air Sampling Kits

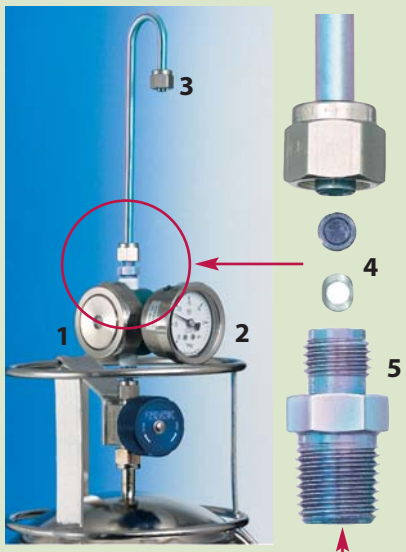
Our easy-to-assemble passive sampling kits include all hardware required for field sampling (except the canister). Our kits were designed to reduce the number of potential leak sites and are available in seven flow ranges, and in stainless steel or with Siltek® surface treatment. Individual parts also are available.

1. Veriflo™ SC423XL flow controller
This flow controller is a high-quality device designed to maintain a constant mass flow as the pressure changes from 30" Hg to 5" Hg (we recommend you stop sampling at or before 5" Hg of vacuum). All wetted parts of the flow controller can be Siltek® treated.

2. Stainless steel vacuum gauge
Fitted to the flow controller, the gauge monitors canister vacuum change during sampling.

3. ¼-inch Siltek® sample inlet
The 0.3m x ¼-inch tubing includes a stainless steel nut on the inlet end, to prevent water droplets from accumulating at the edge of the tubing, where they could be pulled into the sampling train.

4. 2-micron frit filter and washer
Located prior to the critical orifice to prevent airborne particles from clogging the critical orifice. Replaceable. Available in stainless steel, or Siltek® treated for optimum inertness.



All fitting connections are ¼" tube, except where noted.

¼" NPT

5. Interchangeable critical orifice
An interchangeable ruby critical orifice allows you to control the flow with very high precision. To select the correct critical orifice for your sample, see the table below. Available in stainless steel, or Siltek® treated for optimum inertness.

Sampling Time 6 Liter	Flow (sccm)	Orifice size	Siltek® Treated Sampling Kits*	Stainless Steel Sampling Kits*
125 hour	0.5–2	0.0008"	24217	24216
24 hour	2–4	0.0012"	24160	24165
12 hour	4–8	0.0016"	24161	24166
8 hour	8–20	0.0020"	24162	24167
3 hour	20–40	0.0030"	24163	24168
1.5 hour	40–80	0.0060"	24164	24169
0.5 hour	80–350	0.0090"	22101	22100

*Air sampling canisters sold separately. Available in 400cc, 1L, 3L, 6L, and 15L volumes.

See our catalog or website for other canister volumes and sampling times.

Faster Extraction and Cleanup of Pesticide Residue Samples

With QuEChERS Products

By Lydia Nolan, Innovations Chemist

cat. # 26123

cat. # 26124

cat. # 26125

cat. # 26126

- Fast, simple sample cleanup.
- Variety of formats, to meet all needs.
- Custom products prepared on request.

Quick, **E**asy, **Ch**eap, **E**ffective, **R**ugged, and **S**afe, the QuEChERS ("catchers") method is based on work done and published by the US Department of Agriculture Eastern Regional Research Center in Wyndmoor, PA.[1] Researchers there were looking for a simple, effective, and inexpensive way to extract and clean pesticide residues from the many varied sample matrices with which they routinely worked. They had been using the Modified Luke Extraction Method, which is highly effective and rugged, but is both labor and glassware intensive, leading to a relatively high cost per sample. Solid phase extraction also had been effective, but the complex matrices the investigators were dealing with required multiple individual cartridges and packings to remove the many classes of interferences, adding costs and complexity to the process. A new method would have to remove sugars, lipids, organic acids, sterols, proteins, pigments and excess water, any of which often are present, but still be easy to use and inexpensive.

The researchers developed a simple two-step procedure. First, the homogenized samples are extracted and partitioned, using an organic solvent and salt solution. Then, the supernatant is further extracted and cleaned, using a dispersive SPE technique. Multiple adsorbents are placed in a centrifuge tube, along with the 1mL of organic solvent and the extracted residues partitioned from step 1. The contents are thoroughly mixed, then centrifuged, producing a clean extract ready for a variety of GC or HPLC analytical techniques.[2] Validation and proficiency data for the QuEChERS method are available for a wide variety of pesticides in several common food matrices at **www.quechers.com**

Using the dispersive SPE approach, the quantity and type of adsorbents, as well as the pH and polarity of the solvent, can be easily adjusted for differing matrix interferences and "difficult" analytes. Results from this approach have been verified and modified at several USDA and Food and Drug Administration labs, and the method now is widely accepted for many types of pesticide residue samples.

Commercially available products make this approach even simpler. We offer QuEChERS extraction products in a variety of standard sizes and formats. The centrifuge tube format, available in 2mL and 15mL sizes, contains magnesium sulfate (to partition water from organic solvent) and PSA* adsorbent (to remove sugars and fatty acids), with or without graphitized carbon (to remove pigments and sterols) or C18 packing (to remove nonpolar interferences). The PSA and graphitized carbon packings also are available in a 6mL packed bed SPE cartridge, with Teflon® frits, for whenever a standard SPE format is preferred. Custom products are available by quote request. If you are frustrated by the time and cost involved with your current approach to pesticide sample cleanup, we suggest you try this simple and economical new method.

*PSA – primary and secondary amine exchange material

QuEChERS SPE Cartridges

SPE Cartridge	qty.	cat#
QuEChERS SPE 2mL Micro-Centrifuge Cartridge Packed with 150mg Magnesium Sulfate and 50mg PSA	100-pk.	26124
QuEChERS SPE 2mL Micro-Centrifuge Cartridge Packed with 150mg Magnesium Sulfate, 50mg PSA, and 50mg Graphitized Carbon	100-pk.	26123
QuEChERS SPE 2mL Micro-Centrifuge Cartridge Packed with 150mg Magnesium Sulfate, 50mg PSA, and 50mg C18	100-pk.	26125
QuEChERS SPE 15mL Centrifuge Cartridge Packed with 900mg Magnesium Sulfate, 300mg PSA, and 150mg Graphitized Carbon	50-pk.	26126
QuEChERS SPE 6mL SPE Cartridge Packed with 200mg Graphitized Carbon and 400mg PSA, Teflon® Frits	30-pk.	26127
QuEChERS SPE 6mL SPE Cartridge Packed with 250mg Graphitized Carbon and 500mg PSA, Teflon® Frits	30-pk.	26128
QuEChERS SPE 6mL SPE Cartridge Packed with 500mg Graphitized Carbon and 500mg PSA, Teflon® Frits	30-pk.	26129

References

1. Anastassiades, M., S.J. Lehotay, D. Stajnbaher, F.J. Schenck, *Fast and Easy Multiresidue Method Employing Acetonitrile Extraction/Partitioning and "Dispersive Solid-Phase Extraction" for the Determination of Pesticide Residues in Produce*, J AOAC International, 2003, vol 86 no 22, pp 412-431.
2. Schenck, F.J., *SPE Cleanup and the Analysis of PPB Levels of Pesticides in Fruits and Vegetables*. Florida Pesticide Residue Workshop, 2002.

References not available from Restek.

Resprep™ Cell Parts and Tools for ASE® Extraction Units

Enhanced Design For Faster Installation and Easier Cleaning

By Irene DeGraff, Sample Preparation Product Marketing Manager

Resprep™ Extraction Cell Parts for ASE® 200 Systems, Restek Enhanced Design

- Choose original equipment-equivalent stainless steel, or Siltek® deactivation for improved inertness.
- Inner surfaces polished, for easier cleaning.
- Caps include frit, washer, PTFE O-ring, and threaded insert.

	Stainless Steel		Siltek® Treated	
Description	qty.	cat.#	qty.	cat.#
Extraction Cell Kit, Resprep™ for ASE® 200, 1mL	kit	25980	kit	25981
Extraction Cell Kit, Resprep™ for ASE® 200, 5mL	kit	25982	kit	25983
Extraction Cell Kit, Resprep™ for ASE® 200, 11mL	kit	25984	kit	25985
Extraction Cell Kit, Resprep™ for ASE® 200, 33mL	kit	25986	kit	25987
Extraction Cell Body, Resprep™ for ASE® 200, 1mL	ea.	25960	ea.	25961
Extraction Cell Body, Resprep™ for ASE® 200, 5mL	ea.	25962	ea.	25963
Extraction Cell Body, Resprep™ for ASE® 200, 11mL	ea.	25964	ea.	25965
Extraction Cell Body, Resprep™ for ASE® 200, 33mL	ea.	25966	ea.	25967
Extraction Cell Caps, Resprep™ for ASE® 200	2-pk.	25968	2-pk.	25969
PEEK® Seal/Frit Assembly, Resprep™ for ASE® 200	2-pk.	25970	2-pk.	25971
Frit, Resprep™ for ASE® 200	12-pk.	25972	12-pk.	25973

Description	qty.	cat.#
PEEK® Seal, Resprep™ for ASE® 200	12-pk.	25974
PEEK® Seal, Resprep™ for ASE® 200	48-pk.	25975
PTFE O-Rings for ASE® 200 & ASE® 300 Caps	100-pk.	26187
Viton® O-Rings for ASE® 200 & ASE® 300 Caps	50-pk.	26188

- Simpler design with fewer parts.
- Faster installation.
- Easier cleaning.

20mm Filters for ASE® 200 Extraction Cells

- Cellulose or glass fiber construction.
- Cellulose filters available in economical 1000-packs.

Description	Similar to Dionex part #	qty.	cat.#
Cellulose Filters for ASE® 200	049458	100-pk.	26118
Cellulose Filters for ASE® 200	049458	1000-pk.	26190
Glass Fiber Filters for ASE® 200	047017	100-pk.	26119

Resprep™ Tools for ASE® Systems

- Specialized tools that simplify routine chores.
- Use with ASE® 100, ASE® 200, or ASE® 300 systems.

New 2-in-1 Filter/O-Ring Insertion Tool Kit for ASE® 100/200/300

Inserting a filter, using the Filter Insertion Attachments and the Resprep™ Tool Handle.

Screw the appropriate attachment onto the end of the tool.

Place a filter at the top of the extraction cell.

Push the filter to the bottom of the extraction cell.

Inserting an O-ring, using the Resprep™ Tool Handle.

Place the O-ring over the tip of the tool.

Insert the tool into the center hole of the extraction cell cap.

Press the tool firmly until the O-ring snaps into place.

Resprep™ Tool Handle

Filter Insertion Attachments

Description	qty.	cat.#
2-in-1 Filter/O-Ring Insertion Tool Kit for ASE® 100/200/300 (includes Resprep™ Tool Handle and Filter Insertion Attachments)	kit	26181
Resprep™ Tool Handle for ASE® 100/200/300	ea.	26182
Filter Insertion Attachments for ASE® 100/200/300 (1mL, 5mL, 11mL, 33mL)	4-piece set	26183

Extend Process Component Lifetime and Enhance Durability

Restek Surface Treatments Improve Sampling and Transfer Component Performance

by Marty Higgins and Carrie Sprout, Restek Performance Coatings Division

- Economical—lower cost than specialty alloys, more durable than traditional stainless steels.
- Versatile—suitable in a variety of environments and temperature ranges.
- Simple—can be applied to existing equipment; stock tubing and fittings also available.

When surface activity or corrosion are a concern, solutions must be engineered. The Restek Performance Coatings group offers a family of surface treatments that address activity and corrosion concerns over a wide spectrum of applications. Table 1 lists applications in which a Restek Performance Coating treatment of sample pathway components prevents adsorption of active compounds, thereby contributing toward reliable and accurate information, or greatly reduces corrosion.

Adsorption problems in sample pathways often can be traced to the tubing and fittings used to transfer the sample to the analytical instrument. Always use deactivated tubing and fittings for applications involving active compounds. For special requirements, ensure maximum inertness and minimal surface area by applying the deactivating treatment to electropolished tubing. Figure 1 shows uptake and release curves for 500ppbv of methyl mercaptan, an active sulfur compound, in a gas stream passing through a variety of tubing substrates.[1] Siltek®/Sulfinert® treated tubing reduces uptake by orders of magnitude, relative to untreated stainless steel tubing.

In corrosive environments, Silcosteel®-CR treated tubing is an excellent alternative to expensive alloys. Silcosteel®-CR treatment extends the lifetime of the tubing, reducing the frequency of preventive maintenance and helping to ensure the purity of the process or sample stream.†

Silcosteel®-CR improves corrosion resistance by up to 10X over untreated 316 stainless steel (per ASTM G48 Method B, see graph below).

Figure 1 Sulfinert® treated electropolished seamless stainless steel tubing (red) does not adsorb methyl mercaptan (500ppbv).
Blue-untreated electropolished tubing; violet-raw tubing.

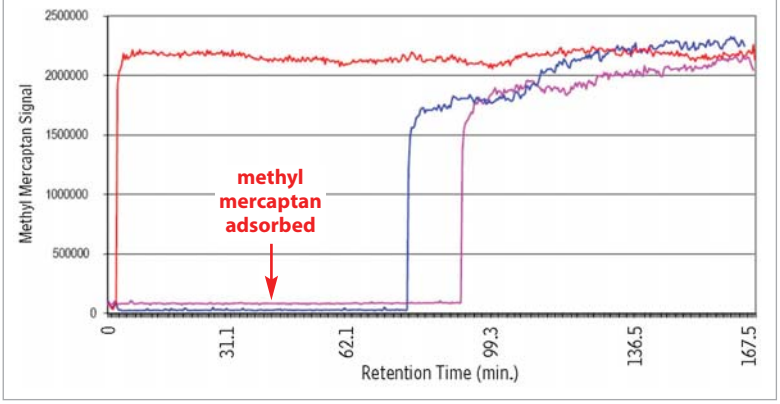


Table I Applications in which Restek treated sample pathway components minimize corrosion** or prevent adsorption of active compounds*.

Sulfur compounds in:*
- automotive exhaust
- beverage grade CO_2
- diesel fuels
- environmental samples
- ethylene
- gasoline
- liquefied petroleum gas
- natural gas (odorants)
- propylene
- stack gas emissions
- wines and beers

Nitric oxide (NOx) compounds in:*
- automotive exhaust
- stack gas emissions

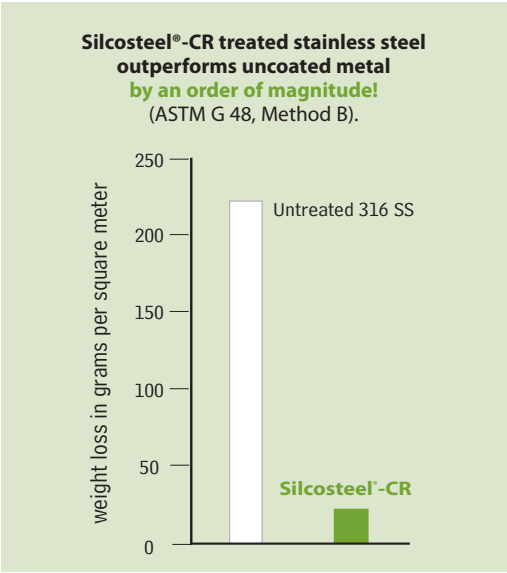
Mercury compounds in:*
- crude oil
- environmental samples
- exhaust
- stack gas emissions from coal fired electric power plants

Corrosive environments:**
- hydrochloric acid
- hydrogen peroxide
- seawater

Moisture hold-up in high purity sampling lines**
- sample systems
- gas delivery systems
- process systems

*Siltek®/Sulfinert® treatment.
**Silcosteel®-CR treatment.

†Note that with any corrosive stream, regular inspections are needed to confirm there are no leaks or breakthroughs.



Siltek®/Sulfinert® Treated and Silcosteel®-CR Treated Swagelok® Fittings

- Wide selection of treated 1/16", 1/8", 1/4", and 3/8" fittings.
- Siltek®/Sulfinert® treatment ensures ultimate inertness.
- Silcosteel®-CR treatment enhances corrosion resistance by 10X, or more.
- Custom treatment available for any Swagelok® fittings, or other system parts.

Fitting Type	Size	Siltek®/Sulfinert® treated cat.#	Silcosteel®-CR Treated cat.#
Union	1/16"	22540	22575
	1/8"	22541	22576
	1/4"	22542	22577
	3/8"	22909	22904
Tee	1/16"	22543	22578
	1/8"	22544	22579
	1/4"	22545	22580
	3/8"	22910	22905
Reducing Union	1/8" to 1/16"	22546	22581
	1/4" to 1/16"	22547	22582
	1/4" to 1/8"	22548	22583
	3/8" to 1/4"	22911	22906
Elbow	1/8"	22549	22584
	1/4"	22550	22585
Plug	1/16"	22572	22619
	1/8"	22573	22620
	1/4"	22574	22597
Cross	1/8"	22551	22586
	1/4"	22552	22587
Tube End Reducer	1/8" tube to 1/16"	22553	22588
	1/4" tube to 1/16"	22554	22589
	1/8" tube to 1/4"	22555	22590
	1/4" tube to 1/8"	22556	22591
Port Connector	1/8"	22557	22592
	1/4"	22558	22593
	1/8" tube to 1/4"	22559	22594
Male Connector	1/8" to 1/8" NPT	22561	22595
	1/4" to 1/4" NPT	22562	22596
	1/16" to 1/8" NPT	22563	22610
	1/8" to 1/4" NPT	22564	22611
	1/4" to 1/8" NPT	22565	22612
	3/8" to 3/8" NPT	22912	22907
	3/8" to 1/4" NPT	22913	22908
Female Connector	1/8" to 1/8" NPT	22566	22613
	1/4" to 1/4" NPT	22567	22614
	1/4" to 1/8" NPT	22568	22615
	1/8" to 1/4" NPT	22569	22616
Bulkhead Union	1/8"	22570	22617
	1/4"	22571	22618

Silcosteel®-CR Treated Coiled Stainless Steel Tubing

Electropolished 316L Grade, Coiled

ID	OD	cat.#	5-24 ft.	25-99 ft.	100-299 ft.	>300 ft.
0.085" (2.16mm)	1/8" (3.18mm)*	22536				
0.180" (4.57mm)	1/4" (6.35mm)**	22537				
316L Grade, Coiled						
0.055" (1.40mm)	1/8" (3.18mm)**	22896				
0.180" (4.57mm)	1/4" (6.35mm)**	22897				
0.277" (7.04mm)	3/8" (9.52mm)***	22915				

Straight Seamless 316L Grade, 6 foot Length

ID	OD	qty.	cat.#
0.055" (1.40mm)	1/8" (3.18mm)**	ea.	22898
0.180" (4.57mm)	1/4" (6.35mm)**	ea.	22899
0.277" (7.04mm)	3/8" (9.52mm)***	ea.	22900

*0.020" wall thickness **0.035" wall thickness ***0.049" wall thickness

Summary

Surface treatments from the Restek Performance Coatings group prevent corrosion or adsorption of active compounds in delivery systems, and always should be considered in applications in which corrosive or active streams are to be sampled, transferred, or analyzed.

References

1 *Relative Response Time of True Tube™ when Measuring Moisture Content in a Sample Stream* Test Report, Haritec Scientific & Engineering Support, Calgary, Alberta, Canada, May 2004. Reference courtesy of O'Brien Canada, available on request from Restek.

Economical solutions for varied sample stream challenges

Restek surface treatments are:

Silcosteel®—A general-purpose passivation layer for steel and stainless steel. U.S. patent 6,511,760.

Silcosteel®-AC—Dramatically reduces carbon buildup on stainless steel components. U.S. patent 6,444,326.

Silcosteel®-CR—A corrosion resistant layer that increases the lifetime of system components in acidic environments containing hydrochloric acid, nitric acid, or seawater. U.S. patent 7,070,833.

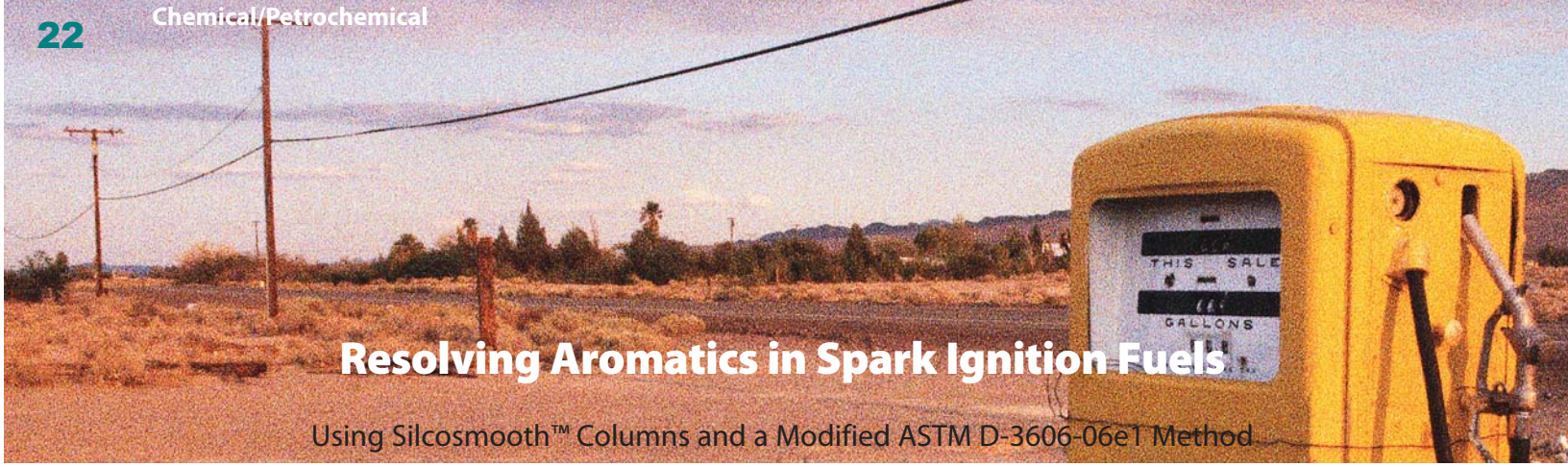
Silcosteel®-UHV—Greatly reduces outgassing from components of ultra-high vacuum systems. U.S. patent 7,070,833.

Siltek®—The ultimate passivation for treated components, from glass to high nickel alloys of steel. U.S. patent 6,444,326.

Sulfinert®—A required treatment for metal components when analyzing for parts-per-billion levels of organo-sulfur compounds. U.S. patent 6,444,326.

for **more** info

For more information about Restek performance coatings, request lit. cat.# 59493, or visit us online at **www.restekcoatings.com**.



Resolving Aromatics in Spark Ignition Fuels

Using Silcosmooth™ Columns and a Modified ASTM D-3606-06e1 Method

By Barry L. Burger, Petroleum Chemist

- Easy quantification of aromatics, using 2-butanol as an internal standard.
- Complete resolution of benzene from ethanol.
- Fully conditioned column set – ready to use out of the box.

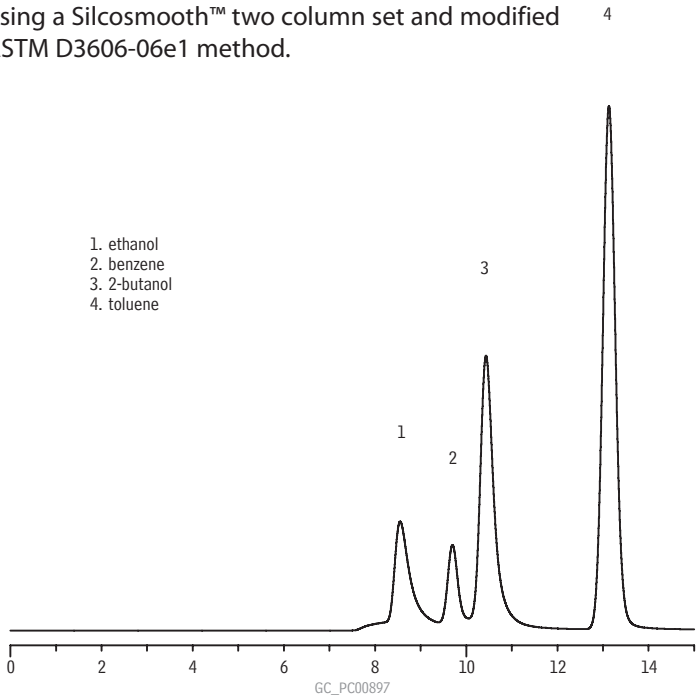
Laboratories analyzing benzene and toluene in spark ignition fuels reformulated to contain ethanol must use a modified ASTM D-3606-06e1 method to prevent the co-elution of ethanol and benzene. This method modification also is a requirement of the US EPA. The benzene range of determination is between 0.1 and 5 volume percent, and the toluene range is between 2 and 20 volume percent.

Our robust two column set for this modified D-3606-06e1 application completely resolves benzene from ethanol. Column A is a 2.46m x 1/8" OD x 2mm ID Silcosmooth™ (Silcosteel® treated) stainless steel column packed with 10% Rtx®-1 on 80/100 Silcoport™ W, which separates the components by boiling point. After the elution of n-octane (C8) from Column A, the column is backflushed to prevent the heavier compounds from entering Column B, the main analytical column. Column B is a unidirectional 6.15m x 1/8" OD x 2mm ID Silcosmooth™ stainless steel column packed with separate beds of 15% Carbowax® 1540 on 80/100 Chromosorb® WAW and 20% TCEP on 80/100 Chromosorb® PAW. To demonstrate the performance of the column set, we installed it in an Agilent 6890 GC equipped with a flame ionization detector (FID). Helium was used as the carrier gas at a flow rate of 25mL/min. in the constant flow mode. Figure 1 shows the aromatic compounds are fully resolved, and can easily be quantified, using 2-butanol as an internal standard.

This column set is fully conditioned, and is ready to use right out of the box. Only a brief (10 min.) carrier gas purge at ambient temperature, followed by a 30 min. hold at 165°C, is required.

If your laboratory has been struggling with ASTM method D-3606-06e1 for reformulated fuels containing ethanol, Restek's new column set is the solution.

Figure 1 Complete resolution of benzene from ethanol, using a Silcosmooth™ two column set and modified ASTM D3606-06e1 method.



Column:	Column A: 10% Rtx® 1 on 80/100 Silcoport™ W, 2.46m x 1/8" OD x 2mm ID Silcosteel® treated stainless steel Column B: 20% TCEP on 80/100 Chromosorb® PAW / 15% Carbowax® 1540 on 80/100 Chromosorb® WAW, 6.15m x 1/8" OD x 2mm ID Silcosteel® treated stainless steel
Sample:	ethanol (10%), benzene (1.5%) toluene, (10%), and 2-butanol (10%) in carbon disulfide
Inj.:	1.0µL on-column
Inj. temp.:	200°C
Carrier gas:	helium, constant flow
Flow rate:	25.0mL/min.
Oven temp.:	135°C
Det.:	FID @ 200°C

D3606 Application Columns (2 column set)

OD	ID	9.2-Meter cat. #*
1/8" Silcosmooth™	2.0mm	80487

*Please add column configuration suffix number from our catalog to cat.# when ordering–see our catalog or website.

Separate Argon from Oxygen Above Ambient Temperatures

Using an Rt-Msieve™ 5A PLOT Column

By Gary Stidsen, GC Columns Product Marketing Manager, and Barry L. Burger, Petroleum Chemist

- Fast, efficient separations at above ambient temperatures.
- High permeability and narrow column diameter mean sharper peaks.
- 100% bonding process eliminates the need for particle traps.

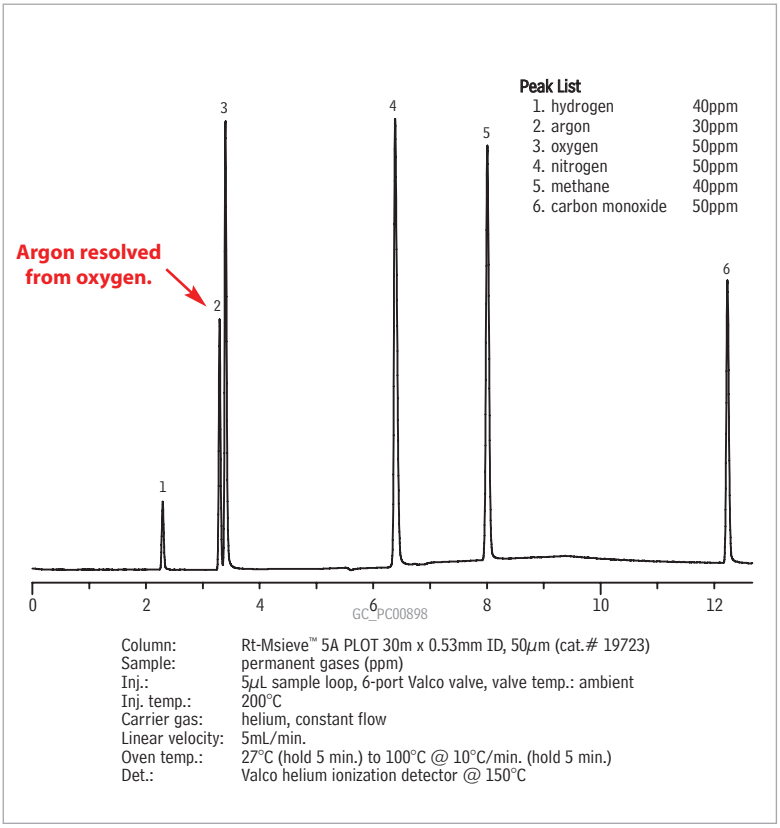
Porous layer open tubular columns—PLOT columns—offer significant advantages over packed gas-solid chromatography (GSC) columns. The open tubular design gives PLOT columns greater permeability, and their narrow diameter ensures sharper peaks. The open construction affords a smaller pressure drop per unit length, so longer columns can be used. This means much higher column efficiency and, therefore, superior resolution. In brief, PLOT columns provide faster and more sensitive analyses than packed GSC columns.

Restek PLOT columns are especially effective for separating mixtures of gaseous analytes. Rt-Msieve™ 5A PLOT columns contain molecular sieve 5A particles that are bonded to prevent particle dislocation, thus protecting valves and detection systems from damage. They are designed for fast, efficient separation of argon and oxygen, hydrogen and helium, and other permanent gases, including permanent gases admixed in refinery or natural gas. Finely controlled pore size allows selective adsorption of specific target compounds, ensuring that difficult separations can be made without subambient temperatures.

Figure 1 shows a 30m x 0.53mm ID Rt-Msieve™ 5A PLOT column can separate oxygen from argon to baseline, at above ambient temperature, in approximately 4 min. Also, the permanent gases are resolved from methane in the same analysis. Carbon dioxide does not elute from a molecular sieve 5A column, but can be chromatographed on an Rt-QPLOT™ porous polymer column. For more information, and additional example analyses on Restek PLOT columns, refer to our current chromatography products catalog or our website.

If your analyses call for difficult separations of gaseous analytes, and neither conventional packed GC columns nor WCOT capillary columns are providing the separations you want, or if your analyses depend on costly or time-consuming conditions, a Restek PLOT column may be your solution.

Figure 1 Excellent resolution at above ambient temperatures on an Rt-Msieve™ 5A-PLOT column.



Rt-Msieve™ 5A Columns (fused silica PLOT)

ID	df (µm)	temp. limits	length	cat. #
0.53mm	50	to 300°C	30-Meter	19723
0.32mm	30	to 300°C	15-Meter	19720
0.32mm	30	to 300°C	30-Meter	19722
0.53mm	50	to 300°C	15-Meter	19721

Plot Column **Advantages**

Gas-liquid chromatography (GLC), the most common mode of gas chromatography, has limited application in analyses of gases. Subambient temperatures often are required to achieve a separation, and cryogenic cooling systems are costly and inconvenient.

Gas-solid chromatography (GSC), in which gaseous analytes are adsorbed onto the packing particles, rather than into a surface coating, is far more effective for separating gases. Difficult-to-separate small molecules, such as argon and oxygen, ethane isomers, and many others, can be separated by GSC at above ambient temperatures.

When analyzing gases, PLOT columns offer significant advantages over both GLC and GSC packed columns, including:

- Excellent separations at above ambient temperature; no costly cooling systems required.
- Sharper peaks, due to smaller tubing internal diameters.
- Higher efficiency and greater sensitivity.

Biodiesel Analysis by European Methodology

Exceptional Peak Symmetry, Using an Rtx®-Biodiesel GC Column

By Barry L. Burger, Petroleum Chemist

- Excellent peak shape, even for free glycerin.
- Low column bleed at >350°C.
- Quantify oil components more easily and more reliably.

In less than a decade biodiesel oil has become a significant fuel source, especially in European countries, where current usage has soared to 1,800,000 tons annually.[1] Transesterification of the rapeseed oil or other fats from which biodiesel oil is prepared yields two products: methyl esters – biodiesel oil – and glycerin. Glycerin is extremely challenging to analyze by GC, but because excessive amounts in biodiesel products can cause problems during storage or in the engine it is necessary to monitor glycerin levels. In the US, American Society for Testing and Materials (ASTM) Method D6584-00e1 is an accepted GC procedure for biodiesel oil analysis; the standard European method is Deutsches Institut fur Normung (DIN) EN14105. Both methods set limits on free glycerin and glycerides in biodiesel oil product. While these methods differ in GC column specifications and chromatographic conditions, both require a column that can perform reliably at elevated temperatures, with minimal bleed.

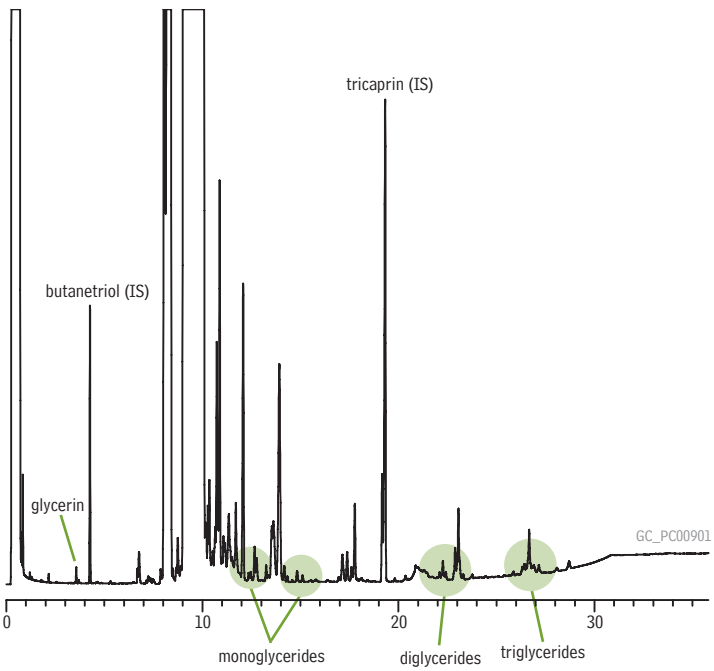
Figure 1 shows the chromatography for the DIN analysis, using an Rtx®-Biodiesel column. Peaks for glycerin and the glycerides exhibit minimal tailing, and bleed is low, even at 370°C. Thus, components of the oil can be more easily and more reliably quantified. These results confirm the Rtx®-Biodiesel column is a wise choice for biodiesel oil analysis according to DIN EN14105 conditions. The Rtx®-Biodiesel column also has proven well suited for analyzing biodiesel oil according to the ASTM method.[2]

To obtain Figure 1, we spiked a soybean oil-based sample of B100 biodiesel oil with internal standards butanetriol and tricaprin, silylated the mixture with MSTFA and, using simple on-column injection mode, injected a 1µL aliquot into a low dead volume direct injection liner in a Shimadzu 2010 GC equipped with an on-column injector (OCI). The liner has a 1mm internal diameter and a Press-Tight® constriction one-third of its length from the outlet end. The Rtx®-Biodiesel column forms a seal with the liner at the Press-Tight® constriction; the sample is injected into, and vaporizes in, the top two-thirds of the liner.

Glycerin is a notoriously difficult challenge in GC, particularly at the levels involved in biodiesel oil analysis, yet an Rtx®-Biodiesel column provides a symmetric peak that makes quantification easier and more reliable. Restek chromatographers always are happy to help you with your toughest analytical problems. If you have questions regarding biodiesel oil analysis, please call our technical service team, or contact your Restek distributor, for fast and reliable assistance.

References
1. www.ufop.de/publikationen_english.php
2. Restek Advantage 2006.04, pp 3-5 (2006).
Reference 2 available from Restek – request lit. cat.# 580120.

Figure 1 Biodiesel oil analysis using an Rtx®-Biodiesel column and DIN EN14105 conditions: peaks for glycerin and glycerides are symmetric, and bleed is low, even at 370°C.



Column:	Rtx®-Biodiesel, 10m, 0.32mm ID, 0.10µm (cat.# 10292)
Sample:	B100 biodiesel oil plus butanetriol and tricaprin, in heptane, derivatized with MSTFA
Inj.:	1µL onto Shimadzu on-column injector (OCI) equipped with low dead volume Shimadzu direct injection liner
Inj. temp.:	oven track
Carrier gas:	hydrogen, constant flow
Flow rate:	4mL/min.
Oven temp.:	50°C (hold 1 min.) to 180°C @ 15°C/min., to 230°C @ 7°C/min., to 370°C @ 10°C/min. (hold 5 min.)
Det.:	FID
Det. temp.:	390°C

Rtx®-Biodiesel Column (fused silica)

ID	df (µm)	temp. limits	length	cat. #
0.32mm	0.10	330°/380°C	10-Meter	10292

did you know?

We also offer biodiesel calibration standards.
For more information visit us online at **www.restek.com**

COOL TOOLS!

Restek Innovations Save You Time and Money

MLE Capillary Tool Kits

All kits include these components:

- 1/8" nylon brush
- 3/16" nylon brush
- 1/4" nylon brush
- 1/4" stainless steel wire tube brush
- 3/8" stainless steel wire tube brush
- 3/16" stainless steel wire tube brush
- stainless steel surface brush
- 6 stainless steel jet reamers (0.25–0.65mm OD)
- 1/4" x 5/16" open end wrench
- 3/8" x 7/16" open end wrench
- rubber-tipped slide-lock tweezers
- scoring wafers with handles
- inlet liner removal tool
- septum puller
- mini wool puller/inserter tool
- 4-inch tapered needle file
- swivel head flashlight
- mini hand drill set
- 15cm compact steel ruler
- pocket magnifier
- high temperature string (1 meter)
- pipe cleaner (12-inch)
- cotton tip swabs (pk. of 25)

MLE Capillary Tool Kit for Agilent GCs (cat.# 22186) also includes:

- capillary installation gauge for Agilent GCs
- injector wrench for Agilent GCs
- septum nut removal tool
- 7/16" x 1/2" open end wrench
- 1/2" x 9/16" open end wrench

MLE Capillary Tool Kit for PerkinElmer GCs (cat.# 22185) also includes:

- 7/16" x 1/2" open end wrench
- 1/2" x 9/16" open end wrench

MLE Capillary Tool Kit for Shimadzu GCs (cat.# 22182) also includes:

- capillary installation gauge for Shimadzu GCs
- injector wrench for Shimadzu GCs
- 6mm x 7mm open end wrench
- 8mm x 10mm open end wrench
- 16mm x 17mm open end wrench

MLE Capillary Tool Kit for Thermo Scientific GCs (cat.# 22183) also includes:

- capillary installation gauge for Thermo Fisher GCs
- liner cap removing tool for Thermo Fisher GCs
- 6mm x 7mm open end wrench
- 8mm x 10mm open end wrench
- 16mm x 17mm open end wrench

MLE Capillary Tool Kit for Varian GCs (cat.# 22184) also includes:

- capillary installation gauge for Varian GCs
- 7/16" x 1/2" open end wrench
- 1/2" x 9/16" open end wrench

For Agilent GCs
(cat.# 22186)

new!

For PerkinElmer GCs
(cat.# 22185)

For Shimadzu GCs
(cat.# 22182)

For Thermo Scientific GCs
(cat.# 22183)

For Varian GCs
(cat.# 22184)

Description	qty.	cat.#
MLE Capillary Tool Kit for Agilent GCs	kit	22186
MLE Capillary Tool Kit for PerkinElmer GCs	kit	22185
MLE Capillary Tool Kit for Shimadzu GCs	kit	22182
MLE Capillary Tool Kit for Thermo Scientific GCs	kit	22183
MLE Capillary Tool Kit for Varian GCs	kit	22184

did you know?

Make Life Easier!

MLE Tool Kits provide the tools necessary for easier installation and maintenenace of capillary columns!

The essential tool kits for capillary chromatographers!

Super-Clean™ Click-On Traps

Click-On Inline Super-Clean™ Traps

by Donna Lidgett, GC Accessories Product Manager

- High-purity output ensures 99.9999% pure gas.
- Click-On fittings for easy, leak-tight cartridge changes; no tools required!
- Helium-Specific Triple Trap is packaged and purged under helium; ideal for GC/MS.

Using the same features and benefits as the Super-Clean™ base-plates and filters, SGT designed an inline trap. Click-On adaptor connectors allow cartridges to be exchanged without introducing oxygen. Spring-loaded check valves seal when a filter is removed and open only when a new filter has been locked in place. There is no need for loosening and tightening fittings every time a trap is changed, and your system will not become contaminated during the process.

The Triple Trap is ideal for purifying carrier gas—it contains oxygen, moisture, and hydrocarbon scrubbers in one cartridge.

The Fuel Gas Trap is ideal for purifying flame ionization detector (FID) fuel gases, removing both moisture and hydrocarbons.

The Helium-Specific Triple Trap is ideal for purifying helium in GC/MS systems. This trap is packed and purged under helium and contains oxygen, moisture, and hydrocarbon scrubbers in one cartridge.

please **note**

Super-Clean™ Gas Filters are recommended for purifying non corrosive gases with low concentrations of contaminants. The maximum concentration of oxygen in the incoming gas stream for oxygen purifiers is 0.5%.

Trap replacement depends on the quality of the incoming gas. Use the double connector and install an indicating cartridge after a trap to indicate when the trap should be replaced.

Filter Type	Gas Quality at Outlet	Maximum Pressure	Maximum Flow (L/min.)	Use For	H_2O (g)	Capacity O_2 (mL)	Hydrocarbons (g)	Estimated Lifetime (years)
Moisture cat.#22467	>99.9999	11 bar 160psi	25	Inert carrier gas, helium, air, H_2	21	NA	NA	>3
Oxygen cat.#22468	>99.9999	11 bar 160psi	25	Inert carrier gas	NA	3000	NA	>3
Hydrocarbon cat.#22466	>99.9999	11 bar 160psi	25	Inert carrier gas, helium, air, H_2	NA	NA	36[3]	>3
Fuel Gas[1] cat.#22465	>99.9999	11 bar 160psi	25	Inert carrier gas, helium, air, H_2	10	NA	18[3]	>2
Triple cat.#22464	>99.9999	11 bar 160psi	25	Inert carrier gas	6	1000	12[3]	>2

[1]Removes hydrocarbons, moisture. [2]Removes hydrocarbons, moisture, oxygen. [3]As *n*-butane.

Click-On Inline Super-Clean™ Traps and Connector Kits

Brass or stainless steel 1/4" or 1/8" fittings available.

Description	qty.	cat.#
Carrier Gas Purification Kit, 1/8" Stainless Steel Includes (2) 1/8" SS connectors and (1) oxygen/moisture/hydrocarbon triple trap	kit	22456
Carrier Gas Purification Kit, 1/8" Brass Includes (2) 1/8" brass connectors and (1) oxygen/moisture/hydrocarbon triple trap	kit	22457
Carrier Gas Purification Kit, 1/4" Stainless Steel Includes (2) 1/4" SS connectors and (1) oxygen/moisture/hydrocarbon triple trap	kit	22458
Carrier Gas Purification Kit, 1/4" Brass Includes (2) 1/4" brass connectors and (1) oxygen/moisture/hydrocarbon triple trap	kit	22459
Fuel Gas Purification Kit, 1/8" Stainless Steel Includes (4) 1/8" SS connectors and (2) hydrocarbon/moisture traps	kit	22460
Fuel Gas Purification Kit, 1/8" Brass Includes (4) 1/8" brass connectors and (2) hydrocarbon/moisture traps	kit	22461
Fuel Gas Purification Kit, 1/4" Stainless Steel Includes (4) 1/4" SS connectors and (2) hydrocarbon/moisture traps	kit	22462
Fuel Gas Purification Kit, 1/4" Brass Includes (4) 1/4" brass connectors and (2) hydrocarbon/moisture traps	kit	22463

Click-On Inline Super-Clean™ Replacement Traps

Description	qty.	cat.#
Click-On Super-Clean™ Replacement Triple Trap (removes oxygen, moisture and hydrocarbons)	ea.	22464
Click-On Super-Clean™ Replacement Fuel Gas Trap (removes moisture and hydrocarbons)	ea.	22465

Click-On Inline Super-Clean™ Ultra-High Capacity Traps

Description	qty.	cat.#
Ultra-High Capacity Hydrocarbon Trap	ea.	22466
Ultra-High Capacity Moisture Trap	ea.	22467
Ultra-High Capacity Oxygen Trap	ea.	22468

Helium-Specific Click-On Inline Super-Clean™ Trap and Connector Kits

Description	qty.	cat.#
Kits		
Helium-Specific Carrier Gas Cleaning Kit, 1/8" Stainless Steel Includes (2) 1/8" SS connectors and (1) oxygen/moisture/hydrocarbon helium-specific triple trap	kit	22469
Helium-Specific Carrier Gas Cleaning Kit, 1/8" Brass Includes (2) 1/8" brass connectors and (1) oxygen/moisture/hydrocarbon helium-specific triple trap	kit	22470
Helium-Specific Carrier Gas Cleaning Kit, 1/4" Stainless Steel Includes (2) 1/4" SS connectors and (1) oxygen/moisture/hydrocarbon helium-specific triple trap	kit	22471
Helium-Specific Carrier Gas Cleaning Kit, 1/4" Brass Includes (2) 1/4" brass connectors and (1) oxygen/moisture/hydrocarbon helium-specific triple trap	kit	22472
Replacement Trap		
Helium-Specific Replacement Triple Trap (removes oxygen, moisture and hydrocarbons)	ea.	22473

did you **know**?

Helium-Specific Click-On Inline Super-Clean™ Trap and Kits are designed specifically for purification of helium in GC/MS systems!

Click-On Inline Super-Clean™ Indicator

- Oxygen: Green to Grey
- Moisture: Beige to Clear

Description	qty.	cat.#
Click-On Inline Super-Clean™ Indicator (oxygen, moisture)	ea.	22474

tech tip

Install an indicator after the Click-On inline trap so there is no confusion about when to replace the trap.

Click-On Inline Super-Clean™ Connectors

- Click-On connectors allow you to change traps quickly, without introducing oxygen into your system.

Description	qty.	cat.#
1/8" Brass Click-On Inline Super-Clean™ Connectors	2-pk.	22475
1/8" Stainless Steel Click-On Inline Super-Clean™ Connectors	2-pk.	22476
1/4" Brass Click-On Inline Super-Clean™ Connectors	2-pk.	22477
1/4" Stainless Steel Click-On Inline Super-Clean™ Connectors	2-pk.	22478

Click-On Inline Super-Clean™ Double Connector

- Connects any Click-On trap to a Click-On indicator.

Description	qty.	cat.#
Click-On Inline Super-Clean™ Double Connector, stainless steel	ea.	22479

Wall-Mounting Clamps for Click-On Inline Super-Clean™ Traps

Description	qty.	cat.#
Wall-Mounting Clamps for Click-On Inline Super-Clean™ Traps	4-pk.	22480

Replacement O-Rings for Click-On Inline Super-Clean™ Connectors

Description	qty.	cat.#
Replacement O-Rings for Click-On Inline Super-Clean™ Connectors	20-pk.	22481

- Pack includes 10 large O-rings and 10 small O-rings.

Genuine Restek Replacement Parts

For Agilent HPLC Systems

By Becky Wittrig, Ph.D., HPLC Product Marketing Manager

new!

Outlet Cap and Gold Seal Assembly Tool for Agilent 1100 HPLC Systems

Easily install the gold seal into the outlet cap.

Put Outlet Cap on male part of Assembly Tool.

Push the Assembly Tool together.

Hold onto Outlet Cap and pull Assembly Tool apart.

Put Gold Seal over pin on male part of Assembly Tool.

Push the Assembly Tool together and press the Gold Seal in the Outlet Cap.

Pull the Assembly Tool apart and remove assembled Outlet Cap and Gold Seal.

Description	qty.	cat.#
Outlet Cap and Gold Seal Assembly Tool for Agilent 1100 HPLC Systems	ea.	24989

Restek Replacement Parts for Agilent HPLC Systems

• Meet or exceed OEM performance.

Outlet Ball Valve

Needle Seat Assembly

Lamp, VWD G1314A

Description	Model #	Similar to Agilent part #	qty.	cat.#
Preventive Maintenance Kit (Includes: rotor seal, needle seat, needle assembly, seat cap)	1050	01078-68721	kit	25259
Autosampler Preventive Maintenance Kit (Includes: rotor seal, needle assembly, needle seat)	1100	G1313-68709	kit	25271
Pump Maintenance Kit (Includes: PTFE frit, outlet cap, active inlet cartridge, gold disk seal, 2 piston seals, glass solvent filter)	1050 & 1100	G1311-68710	kit	25270
Outlet Ball Valve, Binary Pump	1100	G1312-60012	ea.	25267
Outlet Ball Valve	1050 & 1100	G1311-60012	ea.	25276
Sieves for Outlet Valve	1050 & 1100	5063-6505	10-pk.	25266
Check Valve Cartridge Assembly	1090	79835-67101	ea.	25344
Piston Seals, Teflon® w/Graphite	1050 & 1100	5063-6589	2-pk.	22482
Piston Seals, Teflon® w/Graphite	1050 & 1100	5063-6589	10-pk.	22483
Piston Seals (Black)	1090	5062-2494	4-pk.	25347
Seal Wash Kit, Binary Pump (4 seals, 4 gaskets)	1100	—	kit	25268
Seal Wash Kit (2 seals, 2 gaskets)	1100	—	kit	25269
Wash Seal	1050 & 1100	0905-1175	ea.	25277
Sapphire Piston	1050 & 1100	5063-6586	ea.	25273
Sapphire Piston	1090	6980-0672	ea.	25345
Needle Seat	1050	79846-67101	ea.	25258
Needle Seat	1090	79846-67101	ea.	25348
Needle Seat Assembly	1100	G1313-87101	ea.	25265
Needle Assembly	1100	G1313-87201	ea.	25278
Rotor Seal (not for use with 7125 injection valve)	1050	0101-0626	ea.	25272
Rotor Seal	1100	0100-1853	ea.	25275
Rotor Seal (Rheodyne®-style)	1090	0101-0623	ea.	25349
Frits, PTFE	1050 & 1100	01018-22707	5-pk.	25466
Seal, Gold Disk (outlet)	1050 & 1100	5001-3707	ea.	25467
Outlet Cap	1050 & 1100	5062-2485	4-pk.	25139
Outlet Cap & Gold Seal Assembly	1050 & 1100	—	2-pk.	25140
Connecting Tube	1050 & 1100	G1311-67304	ea.	25058
Detector Lamp, 1090 DA, 1050 VW/DA/MWD	1090, 1050	79883-60002	ea.	25260
Lamp, DAD G1315A, G1365A	1100	2140-0590	ea.	25261
Lamp, VWD G1314A	1100	G1314-60100	ea.	25262
8453 Deuterium Lamp	—	2140-0605	ea.	25263
G1321 Fluorescence Detector Flash Lamp	—	2140-0600	ea.	25264
Lamp, DAD Long Life Deuterium (2000 hours)	1100	5181-1530	ea.	25399

HPLC Mobile Phase Accessories

An economical way to store and deliver your mobile phases.

By Becky Wittrig, Ph.D., HPLC Product Marketing Manager

Hub-Cap Bottle Tops and Adapters

new!

cat. # 26541

cat. # 26540 cat. # 26538

Allows the use of the Opti-Cap™ with 4-liter solvent bottles.

Description	qty.	cat.#
Adapters		
Hub-Cap Adapter	ea.	26538
Hub-Cap Adapter Multi-pack	3-pk.	26539
Hub-Cap Adapter and Opti-Cap™	kit	26540
4 Liter Bottle Tops		
Hub-Cap (assembly of the bottle cap and plug)	kit	26541
Hub-Cap Multi-pack	3-pk.	26542

Opti-Cap™ Bottle Top

The most economical way to helium-sparge and deliver HPLC mobile phases. The Opti-Cap™ top fits all standard GL-45 bottles and has two $^1/_8$-inch holes and one $^1/_{16}$-inch hole for tubing.

Description	qty.	cat.#
Opti-Cap™ (Cap and PEEK® Plug)	ea.	25300
Opti-Cap™ Kit (Opti-Cap™, 3 meters of tubing, sparging filters)	kit	25301
Opti-Cap™ Kit with 1L Bottle	kit	25302
Opti-Cap™ Kit with 2L Bottle	kit	25303
Related items and replacement parts	**qty.**	**cat.#**
Mobile Phase Mobile Phase Sparge Filter: 2µm, stainless steel	ea.	25311
Mobile Phase Inlet Filter: 10µm	ea.	25312
Teflon® Tubing, $^1/_8$" OD x 0.094" ID x 3m (2.4mm ID)	3m	25307
Teflon® Tubing, $^1/_8$" OD x 0.063" ID x 3m (1.6mm ID)	3m	25306
PEEK® Plug, $^1/_4$"-28 threads	3-pk.	25319
1L Graduated Safety-Coated Bottle – GL-45 threads	ea.	25304
2L Graduated Safety-Coated Bottle – GL-45 threads	ea.	25305

Opti-Cap™ Kit with bottle

Solvent Debubbler

Bubbles in an HPLC system can cause check valve malfunctions and pump cavitation, seriously affecting pump performance. The debubbler removes bubbles from the fluid stream before it enters the pump.

Special geometry at the base of the housing allows bubbles entrained in the inlet fluid stream to rise and be trapped in the reservoir. The gas/liquid interface is easily visible through the translucent wall of the device. Loosening the airtight cap releases the trapped gas. The debubbler is fitted with a bracket and universal connecting tips.

Description	qty.	cat.#
Solvent Debubbler with Bracket	ea.	25014

Using Micropacked Columns

By Alan Sensue, Technical Service Specialist

Most analysts are familiar with capillary gas chromatography columns and packed GC columns, but many are not familiar with micropacked columns. Here, we briefly discuss these useful columns, instrument requirements, and applications.

What Are Micropacked Columns?

Micropacked columns are short, narrow bore stainless steel columns packed with diatomaceous earth solid support, porous polymer, molecular sieve, or other particles. Standard Restek micropacked columns are 1 meter or 2 meters long and 0.75mm ID x 0.95mm OD or 1mm ID x 1/16 inch OD. Like most micropacked columns, ours have a larger internal diameter than mega-bore (wide-bore) capillary columns (0.53mm ID) and a smaller outside diameter than traditional packed columns (1/8 inch or 3/16 inch).

As you might suspect from this description, performance characteristics of micropacked columns are intermediate between those of packed columns and those of capillary columns: they offer higher efficiency than traditional packed columns, and higher capacity than wall coated open tubular (WCOT) capillary columns or porous layer open tubular (PLOT) columns. They are inexpensive, very durable, and easy to install and operate.

Instrument Requirements

To use micropacked columns, a high carrier gas head pressure is needed to overcome the large pressure drop created in the narrow, densely packed bore. For helium, typical column head pressures for 1-2 meter micropacked columns range from 30-45psi for 1mm ID columns to 50-65psi for 0.75mm ID columns.

Installation of micropacked columns will vary according to instrument make and model. The injection port nuts in many capillary column injection ports will accommodate 0.95mm OD micropacked columns, but not 1/16 inch OD columns. If the injection port nut will not accommodate the column, you can attach a short piece of 0.53mm ID fused silica tubing to each end of the column, using 1/16 inch compression fitting unions and appropriate ferrules. Alternatively, Restek sells inlet conversion kits which contain appropriate selections of injection port accessories.

For GCs with packed column injection ports, a reducing ferrule or a tube-end reducer fitting, and appropriate ferrules, usually are all that are needed for installing a micropacked column.

Applications

Micropacked columns have a wide range of applications, from analyses of the lightest gases (permanent gases) to simulated column distillation (Sim-Dist). They are especially useful for analyses of gas mixes, including sulfur compounds or light hydrocarbons, in which the use of a packed column is necessary to obtain baseline separations of the gaseous components.

Typically, chromatogram peaks are sharper than from traditional packed columns, and micropacked columns are less likely to be overloaded by concentrated samples than are capillary columns. Micropacked columns do have limitations, however: like packed columns, they do not have the efficiency of capillary columns. Therefore, they typically are not adequate for baseline separations of complex multi-component mixtures. Also like packed columns, they require a carrier gas flow rate that is higher than most mass spectrometer pumping systems can accept.

When choosing a micropacked column, consider that, as with any column, internal diameter affects column capacity. If you intend to use a sensitive detector, such as a helium ionization detector (HID), flame ionization detector (FID), nitrogen-phosphorus detector (NPD), or flame photometric detector (FPD), typically you can use a smaller ID column – either a conventional capillary column or a micropacked column. If you intend to use a thermal conductivity detector (TCD), however, consider using a 1/8 inch OD packed column, rather than either a capillary column or a micropacked column.

For a complete listing of micropacked columns and installation kits offered by Restek, please visit our website, www.restek.com and enter "micropacked columns" in the search feature. For typical applications, see web page: **www.restek.com/micropacked**

You also will find these items in the Restek Chromatography Products Catalog. For additional information concerning micropacked columns, please contact Restek Technical Service at **800-356-1688, ext 4**.

Custom **Micropacked** Columns

To Order:

Contact your Restek representative and specify the following:

1) dimensions (length, OD, ID, and tubing material)

2) packing description (percent coating and phase, support mesh size, and treatment)

3) installation kit

Ordering Example:
(2m x 1/16" OD x 1.00mm ID)
(Silcosteel® tubing) (5%)
(Carbowax® 20M)
(CarboBlack™ B) (80/120)
(installation kit for valve applications, cat. #21065)

To Obtain a Quote:

See our catalog or website, or contact technical service at 800-356-1688, ext. 4.

Maximum length for custom micropacked columns is 25ft./8m.

Pittcon Presentations by Restek Personnel

Sunday Feb. 25

Analysis of EPA Method 527 Using New Capillary Column Technology

JASON THOMAS, Gary Stidsen, Neil Mosesman, William Goodman (PerkinElmer Co.)

Poster Session 220: New Developments in Analytical Instrumentation and Software

Posters on display from 3:30 pm - 7:30 pm, authors present from 5:30 pm - 7:30 pm. Location: S100A (poster 220-41P)

Monday Feb. 26

Enhancing Resolution of Unsaturated Compounds Using a Unique Biphenyl Stationary Phase

RICHARD LAKE, Rebecca Wittrig, Frank Dorman

Oral Session 420: New Developments in Pharmaceutical Separations Room 501BC (420-8 / 11:05 am)

Forensic Applications Using a New 5% Diphenylpolysiloxane Stationary Phase for Gas Chromatography

KRISTI SELLERS, Richard Lake, Gary Stidsen, Neil Mosesman

Poster Session 820: Homeland Security/Forensics

Posters on display from 9:00 am - 4:30 pm, authors present from 2:30 pm - 4:30 pm. Location: Hall A1-A2 (poster 820-14P)

Tuesday Feb. 27

GCxGC-TOFMS of Volatile Organic Compounds in Urban and Rural Air

JACK COCHRAN, Mark Libardoni (LECO Corporation), Frank Dorman, David M. Shelow

Oral Session 1340: GC-MS Methodology II Room 501A (1340-1 / 1:30 pm)

Thursday Mar. 1

An Innovative Approach to Low Mass, Zero Dead Volume Connection of Fused Silica Columns

MICHAEL GOSS, William Grove, Brad Rightnour, Matt Lininger, Paul Silvis, Gary Stidsen

Poster Session 2330: Gas Chromatography: Development and Applications

Posters on display from 9:00 am - 2:00 pm, authors present from 9:30 am - 11:30 am. Location: Hall A1-A2 (poster 2330-24P)

New, In-Situ Cross-Linkable Wax Phase for Gas Chromatography

JULIE KOWALSKI, Shawn Reese, Roy Lautamo, Gianna Barlupi, Rick Morehead, Don Rhodes, Frank Dorman, Chris Cox, Jennifer Weston, Gary Stidsen

Oral Session 2500: Gas Chromatography: Method Development Room 501D (2500-5 / 3:05 pm)

If you're attending Pittcon 2007, please stop by and visit us at **Booth 1313**!

Leading Chromatographers to Join Restek

New expertise available to help solve your technical challenges

Restek celebrates continued growth in 2007 with the addition of two key chromatographers: Jack Cochran and Jaap de Zeeuw.

Jack Cochran comes to Restek with extensive experience at LECO Corporation, where he was most recently the International Director of Separation Science. Jack is a recognized expert in GC-TOFMS and GCxGC-TOFMS, as well as in the analysis of pesticides, PCBs, explosives, PAHs, and other priority pollutants in soils, sediments, air, and waters. His many years of employment at the Waste Management and Research Center in Champaign, IL and with the US EPA in Ada, OK provide real-world experience in methods development, sample preparation, and analysis that he can share with chromatographers world-wide, in order to help them optimize their separations. Jack will be based at our headquarters in Bellefonte, Pennsylvania.

Jaap de Zeeuw spent 27 years with Varian/Chrompack, and has distinguished himself as an authority on every aspect of capillary column technology. After working as an R&D scientist, product specialist, and international product manager for GC and LC columns, he has most recently focused on industrial analysis issues in the USA, Europe, and the Far East. Jaap is widely published, and he travels extensively, giving seminars, workshops, and presentations at international symposia. In 1999 he received the first "Presenter of the Year" award at the Gulf Coast Conference in Galveston, Texas. Jaap will be based in Middleburg, the Netherlands; his main focus will be supporting Restek's European activities in the form of training, seminars, and participation in professional meetings and trade shows.

We welcome Jack & Jaap into the Restek family!