The Dawn of an Era

Superficially porous particles (commonly referred to as SPP or "core-shell" particles) have been proven to provide fast separations without the need for expensive Ultra High Performance Liquid Chromatography (UHPLC) instruments, thereby increasing sample throughput without capital investment. These particles feature a solid, impermeable core enveloped by a thin, porous layer of silica that decreases the diffusion path and reduces peak dispersion. As a result, they offer significantly higher efficiency than traditional fully porous particles of similar dimensions—often rivaling the efficiency of smaller particles. Core-shell particles changed LC, but they were only the beginning...

A New Species Has Evolved

Restek is proud to announce that SPP core-shell technology has evolved with the introduction of Raptor™ LC columns. Although column efficiency, which is boosted with superficially porous particles, considerably accelerates analysis time, it has little effect on resolution (i.e., peak separation). Selectivity, on the other hand, has a substantial impact on resolution, but shows minimal improvement in analysis times. New Raptor™ LC columns bond rugged 2.7 and 5 µm superficially porous particles with Restek's unique Ultra Selective Liquid Chromatography™ (USLC®) phases to offer chromatographers the best of both worlds.

By being the first to combine the speed of SPP with the resolution of highly selective USLC® technology, Raptor™ LC columns provide the practicing analyst with the most powerful tools available for fast and efficient method development. And because they are from Restek, Raptor™ LC columns are backed by the manufacturing and quality systems you've come to trust along with the best Plus 1 service in the industry. Choose them for all of your valued assays to experience *Selectivity Accelerated.*

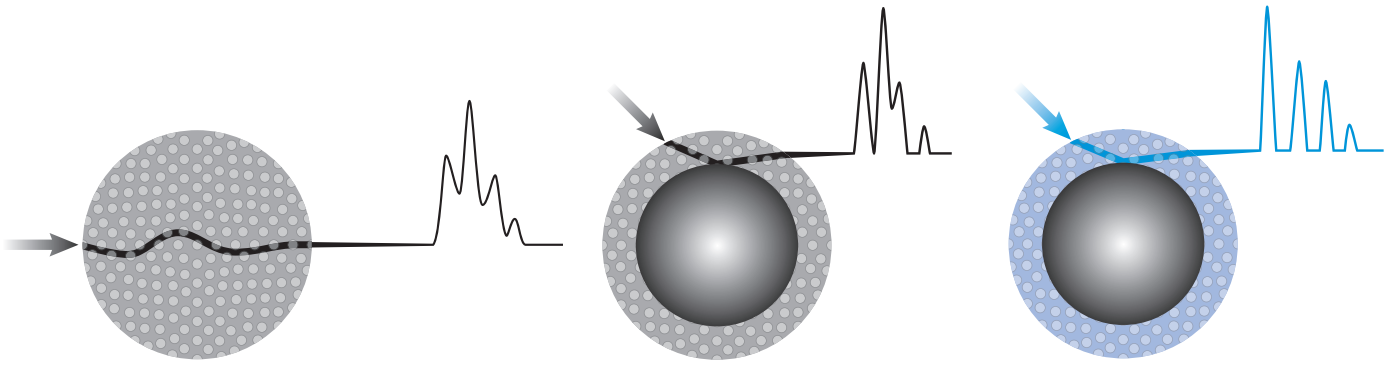
The History of USLC® Technology

Restek extended the hydrophobic-subtraction model to describe orthogonal selectivity and then applied it to create our unique USLC® stationary phases.

Learn more at **www.restek.com/uslc**

RESTEK USLC®
Ultra Selective Liquid Chromatography

Figure 1: Only Raptor™ LC columns offer the higher efficiency of a superficially porous particle *plus* the improved resolution of USLC® phases.



Fully porous particles with typical stationary phases show longer retention times and less resolution.

Ordinary superficially porous particles (SPP) with typical stationary phases show shorter retention times than fully porous particles, but still exhibit less resolution.

Only Raptor™ LC columns with highly selective USLC® stationary phases show shorter retention times and greater resolution.

Experience *Selectivity Accelerated.* Put Raptor™ LC columns and guards to the test today on your most challenging workflows.

Evolutionary Chromatography

It is only possible to fully utilize the efficiency of superficially porous particle technology when it is united with the power of USLC® selectivity. With Raptor™ LC columns, you can speed up method development and enhance sample throughput—without investing in costly UHPLC equipment—to create faster, more reliable, and more sensitive analyses.

- Run faster and avoid lengthy gradient adjustments.
- Separate isobaric and hard-to-resolve compounds with ease.
- Avoid eluting compounds near the void volume and limit ion suppression.
- Skip the complex mobile phases and multiple method modifications.

Dissecting Raptor™ LC Columns

A closer look at a new species

Adaptive Traits: Raptor™ LC Column

Restek's dedicated R&D group studied every aspect of superficially porous particles (commonly referred to as SPP or "core-shell" particles) to develop the bonding chemistries that are best suited to both the SPP construction and our highly selective USLC® phases. But we didn't stop there. In addition to implementing a new, proprietary column-packing technique, we upgraded our LC column hardware. By looking at not only the particles, but also the packing and hardware, we have made sure that you will get repeatable, rugged performance from each and every Raptor™ LC column.

Larger 2 µm Frit

Prevents clogging better than commonly used 0.5 µm frits; boosts column lifetime and helps maintain optimal pressures.

Rugged Label

Clearly identifies both flow direction and column; resists solvents and tearing to last as long as your column does.

Proprietary Column-Packing Technique

Provides greater pressure stability (600 bar for 2.7 µm; 400 bar for 5 µm); achieves higher linear velocities without sacrificing efficiency or lifetime.

Raptor™ SPP Particles

Robust 2.7 and 5 µm Particles
Let you run high-speed analyses without UHPLC.

Narrow Silica Distribution
Ensures high efficiency and consistent flows.

Updated Bonding and QC
Guarantee retention time stability, run to run and column to column.

RESTEK

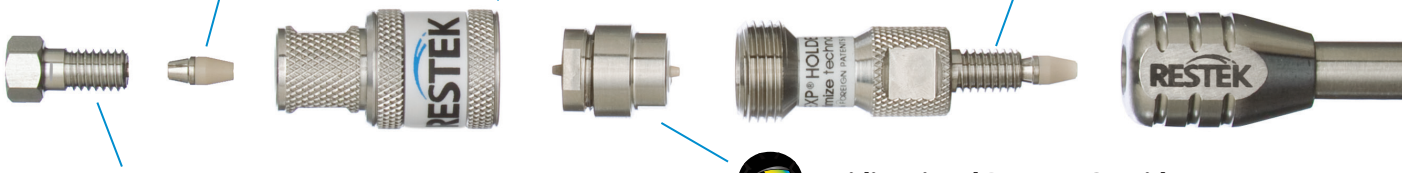
Natural Protection: Raptor™ EXP® Guard Column

Regardless of its performance, lifespan, or frit size, we know the LC column is the most expensive consumable used for your chromatographic assay. To help protect your investment and further extend the life of our already-rugged Raptor™ LC columns, we have mated our new superficially porous particles with patent-pending guard column hardware developed by Optimize Technologies. A Raptor™ LC guard column cartridge in an EXP® direct connect holder is the ultimate in column protection.

Patented Titanium Hybrid Ferrules
Can be installed repeatedly without compromising high-pressure seal.

Free-Turn® Architecture
Allows you to change cartridges without breaking inlet/outlet fluid connections—and without tools.

Auto-Adjusting Connection
Provides ZDV (zero dead volume) connection to any 10-32 female port.



Flexible Design
Replace nut with longer or even tool-free options (below) to best suit your needs.

Unidirectional Raptor™ Cartridge

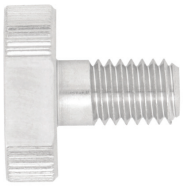
In-Tandem Development
Made to pair perfectly with Raptor™ LC columns.

Superior Packing Technique
Withstands 600 bar (2.7 µm) / 400 bar (5 µm) operating pressures.

Restek® Quality
Backed by the manufacturing and QC systems you trust.

View our full selection of Raptor™ EXP® guard column cartridges at **www.restek.com/raptor**

Restek also recommends:



Hand-Tight Nut (cat.# 25937–25939)
Upgrade the supplied nut to install your Raptor™ EXP® guard column by hand—no tools needed.

Long Hex-Head Nut (cat.# 25934)
Extend the nut on your Raptor™ EXP® guard column for easier access in tight spaces—no more bumped knuckles.

EXP® Hand-Tight Coupler (cat.# 25940)
Achieve tool-free 8,700+ psi (600+ bar) seals anywhere in your LC system with EXP® hand-tight couplers and connectors.

Visit **www.restek.com/exp** for more EXP® hex-head fittings, couplers, replacement parts, and more!

RESTEK®
Pure Chromatography

Questions about this or any other Restek® product?
Contact us or your local Restek® representative (www.restek.com/contact-us).

www.restek.com

Lit. Cat.# GNTS1895C-UNV

General Applications

The Effects of LC Particle Choice on Column Performance: 2.7 vs. 5 µm Diameter Superficially Porous Particles (SPP)

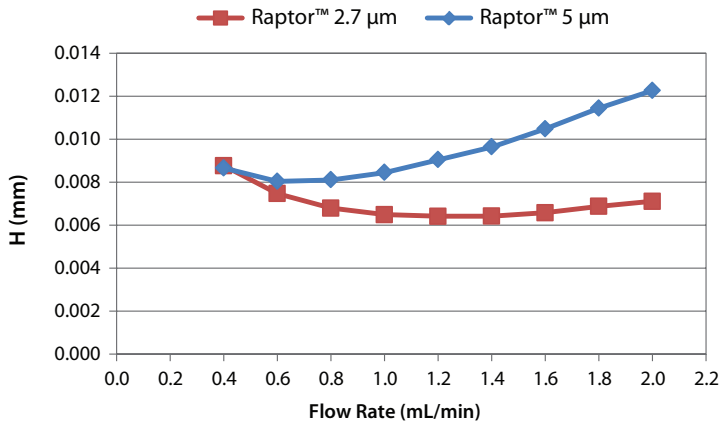
By Sharon Lupo, Ty Kahler, and Paul Connolly

Superficially porous particles (commonly referred to as SPP or "core-shell" particles) have been proven to provide fast and efficient LC separations. These particles feature a solid, impermeable core enveloped by a thin, porous layer of silica that offers significantly higher efficiency and sensitivity than traditional fully porous particles. Restek's Raptor™ SPP LC columns are available in both 2.7 and 5 µm diameter particle sizes, giving analysts the flexibility to select the most appropriate size for their specific assay. However, the best LC particle choice may not always be clear. In this technical note, we will examine the differences in efficiency, sensitivity, and pressure between Raptor™ LC columns packed with 2.7 vs. 5 µm diameter particles and provide advice on making the appropriate particle choice based on the intended experimental conditions and instrument capability.

Efficiency

The relationship between column efficiency and linear velocity, or flow rate, can be illustrated using a van Deemter plot. Column efficiency is represented by plate height (H); the smaller the plate height at a given flow rate, the more efficient the column. The end result is sharper peaks and increased resolution. As shown in Figure 1, Raptor™ 2.7 µm columns display on average 25% more efficiency than Raptor™ 5 µm SPP columns across the flow rates tested. In addition, minimal loss in efficiency was observed at higher flow rates on the Raptor™ 2.7 µm column. For a 4.6 mm ID column, flow rates from 1.0 to 1.6 mL/min yielded the highest efficiency for our 2.7 µm diameter particle column; while flow rates ranging from 0.4 to 1.0 mL/min yielded the highest efficiency for our 5 µm diameter particle column.

Figure 1: Raptor™ 2.7 µm SPP columns maintain efficiency, even at elevated flow rates.

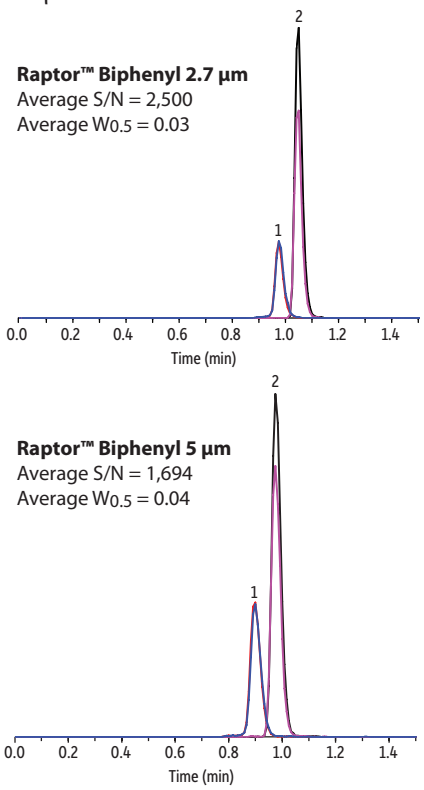


Column: Dimensions: 150 mm x 4.6 mm ID; Temp.: 30 °C;
Mobile Phase: Water:Acetonitrile (45:55); **Detection:** 254 nm;
Test Probes: Uracil and Biphenyl.

Sensitivity

Sensitivity can be measured by comparing signal-to-noise ratios (S/N) for a particular peak. Signal response can be increased by reducing peak width, thereby making peaks sharper and increasing sensitivity. Since superficially porous particles are less porous due to their solid, impermeable core, they offer a more direct diffusion path over fully porous particles, which results in reduced peak dispersion and narrower peaks. To demonstrate the impact of LC particle choice on S/N, a common pharmaceutical and its metabolite were analyzed on separate Raptor™ Biphenyl columns packed with 2.7 vs. 5 µm particles. The resulting chromatograms, peak widths, and S/N are compared in Figure 2. The Raptor™ 2.7 µm diameter particle column displays an average increase in S/N of 32% accompanied by a 25% decrease in average peak width when compared to the Raptor™ 5 µm diameter particle column.

Figure 2: Our 2.7 µm particles offer an average 32% increase in signal-to-noise ratio (i.e., greater sensitivity) over 5 µm.



Peaks	t_R 2.7 µm (min)	t_R 5 µm (min)	Precursor Ion	Product Ion 1	Product Ion 2
1. Naltrexone	0.98	0.90	342.4	270.1	267.1
2. 6-β-Naltrexol	1.06	0.98	344.4	308.0	254.1

Column
Temp.: 30 °C
Sample
Conc.: Prepared 500 ng/mL in human urine. Diluted 5x in mobile phase A. Final conc. = 100 ng/mL
Inj. Vol.: 10 µL
Mobile Phase
A: Water + 0.1% formic acid + 2 mM ammonium formate
B: Water:methanol (5:95) + 0.1% formic acid + 2 mM ammonium formate

Time (min)	Flow (mL/min)	%A	%B
0.00	0.5	70	30
1.50	0.5	0	100
1.51	0.5	70	30
3.00	0.5	70	30

Detector MS/MS
Ion Mode: ESI+
Instrument HPLC
Notes Top: Raptor™ Biphenyl 50 mm x 2.1 mm, 2.7 µm (cat.# 9309A52)
Bottom: Raptor™ Biphenyl 50 mm x 2.1 mm, 5 µm (cat.# 9309552)

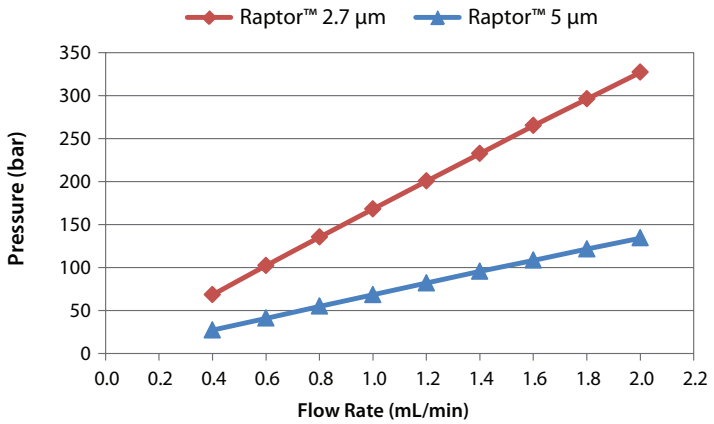
The S/N and $W_{0.5}$ calculations were made using Product Ion 1 (black trace).

LC_CF0597

Pressure

One of the primary advantages of SPP is its ability to provide increased column efficiency, often with similar or even reduced backpressure, when compared to fully porous particles. By decreasing the size of superficially porous particles, efficiency improves and pressure increases at a rate inversely proportional to the square of the particle size. In Figure 3, column backpressure is shown to increase by approximately 150% on average across the instrument flow rates tested (0.4 to 2 mL/min) when switching from a 5 µm diameter Raptor™ particle to a 2.7 µm diameter particle. Additional parameters that contribute to operating pressure include column dimensions, mobile phase composition, and sources of flow restriction on the LC and detection systems.

Figure 3: Switching from a 5 µm to 2.7 µm Raptor™ particle increases backpressure approximately 150%.



Column: Dimensions: 150 mm x 4.6 mm ID; Temp.: 30 °C; **Mobile Phase:** Water:Acetonitrile (45:55).

Conclusion

It is important to consider instrumentation and assay objectives when choosing between Raptor™ 2.7 vs. 5 µm diameter particle SPP LC columns.

Raptor™ 5 µm columns:

Raptor™ 5 µm diameter particle columns display low backpressure as well as good efficiency and sensitivity. These columns can be substituted into existing methods to increase analysis speed on traditional LC systems, especially those with pressure limitations. Raptor™ 5 µm SPP is an ideal LC particle choice for fast assays containing fewer analytes.

- Large amount of system volume.
- Maximum operating pressure of 400 bar.
- Fewer compounds requiring less peak capacity.

Raptor™ 2.7 µm columns:

Raptor™ 2.7 µm diameter particle columns exhibit greater efficiency and sensitivity than 5 µm SPP at the cost of higher pressures. Since extra-column effects are most pronounced on short, small-diameter columns packed with small particles, 2.7 µm columns are best suited for instrumentation with reduced system volume that can sustain pressures up to 600 bar. Raptor™ 2.7 µm SPP is the right LC particle choice for larger analyte lists that require additional peak capacity.

- Minimal system volume.
- Maximum operating pressure 600 bar.
- Large number of compounds requiring more peak capacity.

RESTEK®

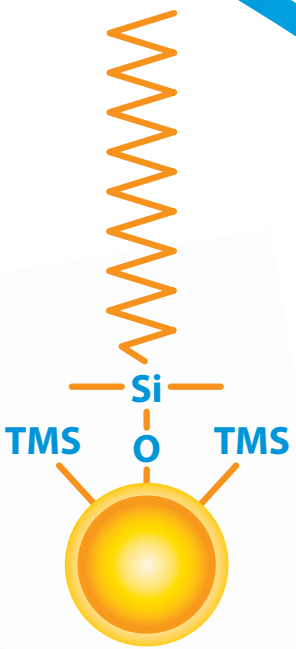
Lit. Cat.# GNAR2079-UNV

Stationary Phase: **C18**

Raptor™ LC Columns

Selectivity Accelerated

Raptor™ Speed, Efficiency, and Ruggedness—in C18



RESTEK® Pure Chromatography

www.restek.com/raptor

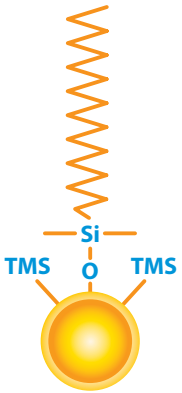
The Raptor™ C18 Column

With Raptor™ LC columns, Restek chemists became the first to combine the speed of superficially porous particles (also known as SPP or "core-shell" particles) with the resolution of highly selective USLC® technology. This new breed of chromatographic column allows you to more easily achieve peak separation and faster analysis times without expensive UHPLC instrumentation.

Even though every LC lab has a cache of C18s, not every C18 is created equal. Because the chemistry tends to be similar, the silica support that carries this ubiquitous octadecylsilane phase becomes vitally important. When you need a general-purpose LC column, don't just grab any C18. Choose the speed, efficiency, and long-lasting ruggedness of the new Raptor™ C18 SPP LC column.

The traditional end-capped Raptor™ C18 offers the highest hydrophobic retention of any Raptor™ phase, and it is compatible with a wide range of mobile phases from moderately acidic to neutral (pH 2–8). Whether for food safety, environmental or bioanalytical analyses, this new phase offers consistently excellent data quality in less time across myriad reversed-phase applications, matrices, and compound classes.

Column Description:



Stationary Phase Category:
C18, octadecylsilane (L1)

Ligand Type:
End-capped C18

Particle:
2.7 µm or 5 µm superficially porous silica (SPP or "core-shell")

Pore Size:
90 Å

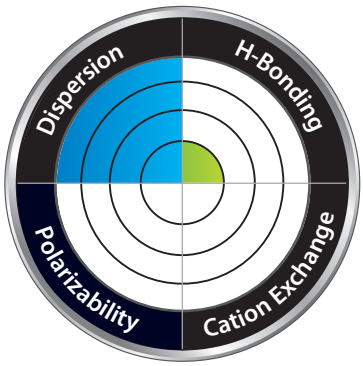
Surface Area:
150 m^2/g (2.7 µm)
or 100 m^2/g (5 µm)

Recommended Usage:
pH Range: 2.0–8.0
Maximum Temperature: 80 °C
Maximum Pressure: 600 bar / 8,700 psi (2.7 µm)
or 400 bar / 5,800 psi (5 µm)

Properties:
- Compatible with moderately acidic to neutral mobile phases (pH 2–8).
- Excellent data quality in food, environmental, bioanalytical, and other applications.

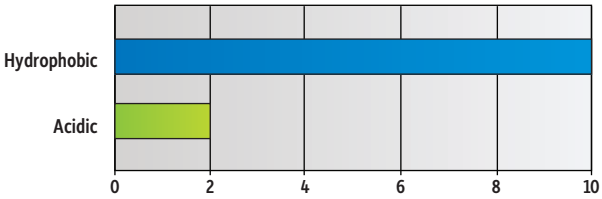
Switch to a C18 when:
- You need a general-purpose column for reversed-phase chromatography.
- You need to increase retention of hydrophobic compounds.

Column Interaction Profile:



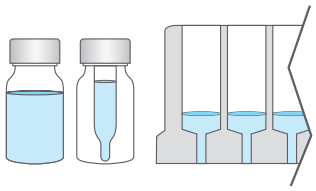
Defining Solute Interaction:
- Dispersion

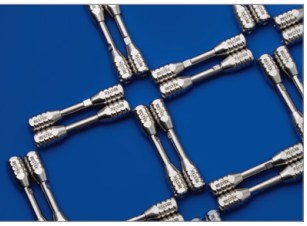
Solute Retention Profile:



Target Analyte Structure:
- Hydrocarbons

Target Analyte Functionalities:
- Hydrophobic compounds





Raptor™ C18 Performance: Speed, Efficiency, and Ruggedness in Action

Raptor™ C18 columns provide outstanding dependability and data quality with high efficiency and peak symmetry, and they are built to exacting specifications that make your columns exceptionally consistent and improve their lifetime. To lower costs and improve profitability, you need columns to last longer, data to be reproducible, and existing HPLC instrumentation to run faster. Get there with the only general-purpose C18 that gives you *Selectivity Accelerated.*

Figure 1: Even at high pressures, long-lasting Raptor™ C18 columns maintain their stability and efficiency, so you can operate at higher linear velocities to achieve fast, accurate separations without UHPLC.

Stable at high pressures for faster run times

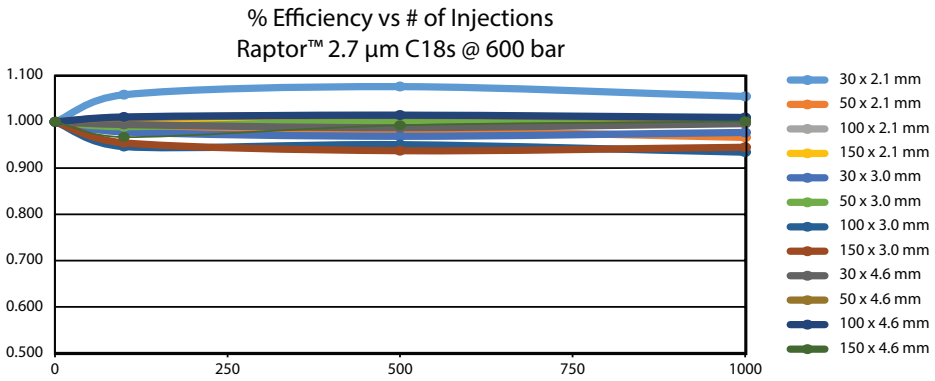
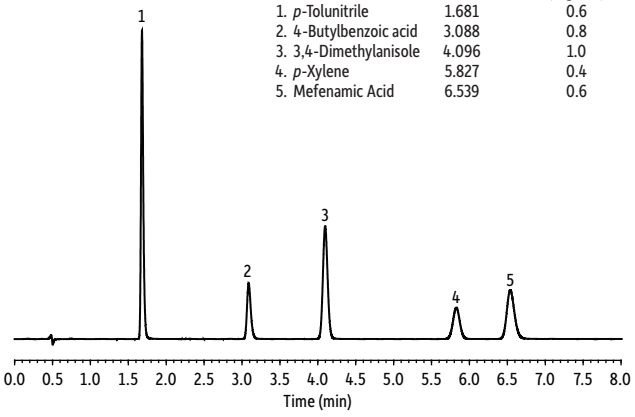


Figure 2: Raptor™ columns' stringent quality control (QC) specifications guarantee outstanding peak shape, even with active compounds, for superior data quality.

Outstanding peak shapes for top-notch data

Peaks	tR (min)	Conc. (mg/mL)
1. *p*-Tolunitrile	1.681	0.6
2. 4-Butylbenzoic acid	3.088	0.8
3. 3,4-Dimethylanisole	4.096	1.0
4. *p*-Xylene	5.827	0.4
5. Mefenamic Acid	6.539	0.6

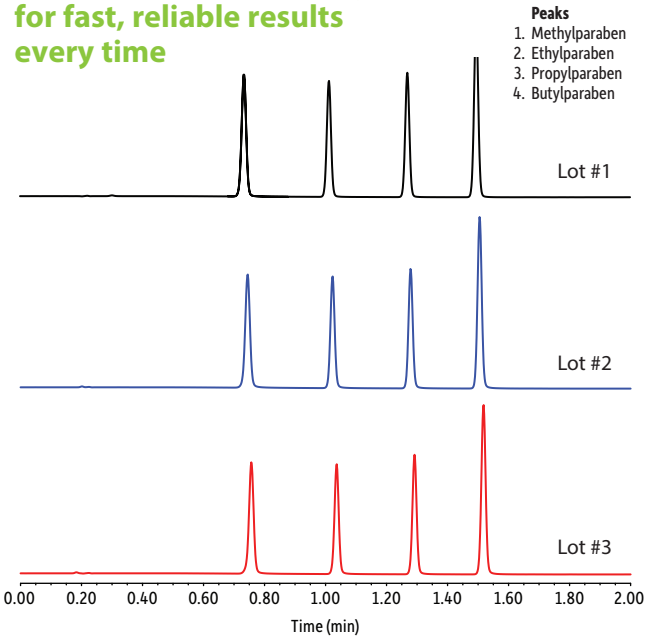


LC_GN0557

Column: Raptor™ C18 (cat.# 9304A1E); Dimensions: 100 mm x 3 mm ID; Particle Size: 2.7 µm; Pore Size: 90 Å; Temp.: 30 °C; **Sample:** Diluent: Acetonitrile:water:phosphoric acid (65:34:1); Inj. Vol.: 1 µL; **Mobile Phase:** A: 0.05% Formic acid in water, B: 0.05% Formic acid in acetonitrile; **Gradient (%B):** 0.00 min (45% B), 8.00 min (45% B); **Flow:** 0.8 mL/min; **Detector:** UV/Vis @ 220 nm; Cell Temp: 40 °C; **Instrument:** HPLC.

Figure 3: Lot-to-lot reproducibility is the key to keeping your productivity high and budget low. You can expect the same exceptional performance from every Raptor™ C18 column you purchase.

Lot-to-lot reproducibility for fast, reliable results every time



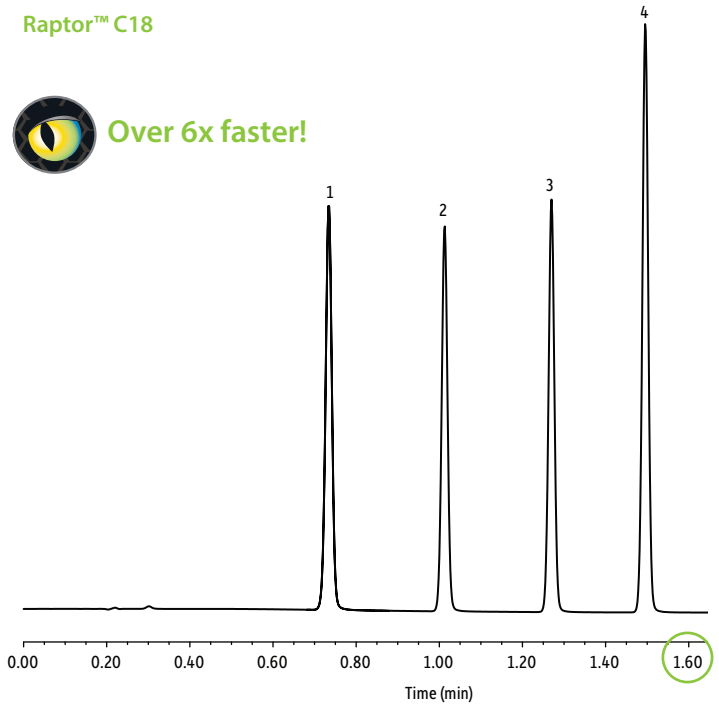
LC_PH0532

Column: Raptor™ C18 (cat.# 9304512); Dimensions: 100 mm x 2.1 mm ID; Particle Size: 5 µm; Temp.: 40 °C; **Sample:** Conc.: 100 µg/mL in water; Inj. Vol.: 1 µL; **Mobile Phase:** A: Water, B: Acetonitrile; **Gradient** (%B): 0.00 min (20% B), 2.00 min (80% B), 2.01 min (20% B), 3.50 min (20% B); **Flow:** 1.0 mL/min; **Detector:** PDA @ 254 nm; **Instrument:** UHPLC.

Boost Your Productivity with Raptor™ C18 Columns

When developing an assay, it is important to consider how productive your method will be. Because superficially porous, or core-shell, particles are well known for very high efficiency with minimal backpressure, they are ideal for decreasing analysis time on your current instrumentation (Figure 4). With its general-purpose applicability and SPP core-shell particles, the Raptor™ C18 column lets you quickly develop faster methods with existing LCs, thereby boosting your productivity without breaking your budget.

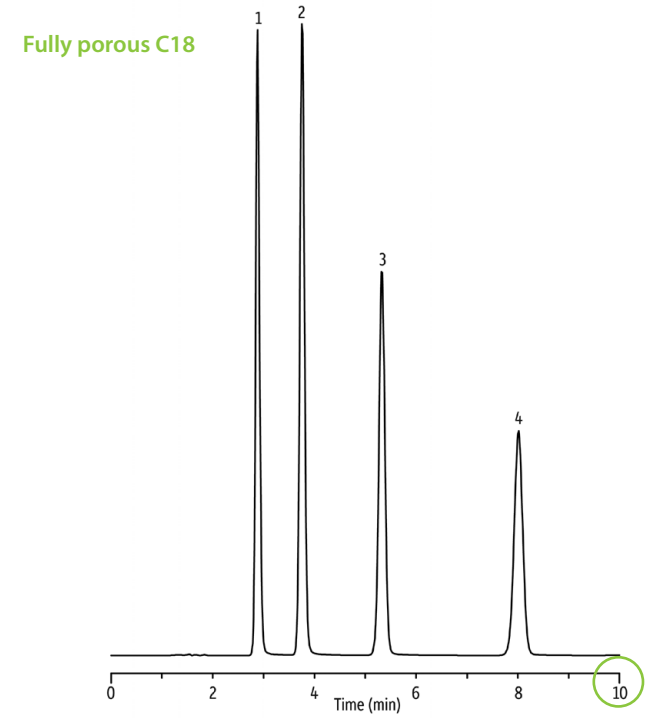
Figure 4: Switching from a conventional 5 µm fully porous particle column to a Raptor™ SPP column allows you to optimize method conditions and significantly reduce analysis time.



Peaks	t_R (min)
1. Methylparaben	0.73
2. Ethylparaben	1.01
3. Propylparaben	1.27
4. Butylparaben	1.50

Column: Raptor™ C18 (cat.# 9304512); Dimensions: 100 mm x 2.1 mm ID; Particle Size: 5 µm; Temp.: 40 °C; **Sample:** Conc.: 100 µg/mL in water; Inj. Vol.: 1 µL; **Mobile Phase:** A: Water B: Acetonitrile; **Gradient (%B):** 0.00 min (20% B), 2.00 min ;(80% B), 2.01 min (20% B), 3.50 min (20% B); **Flow:** 1.0 mL/min; **Detector:** PDA @ 254 nm; **Instrument:** UHPLC.

LC_PH0531



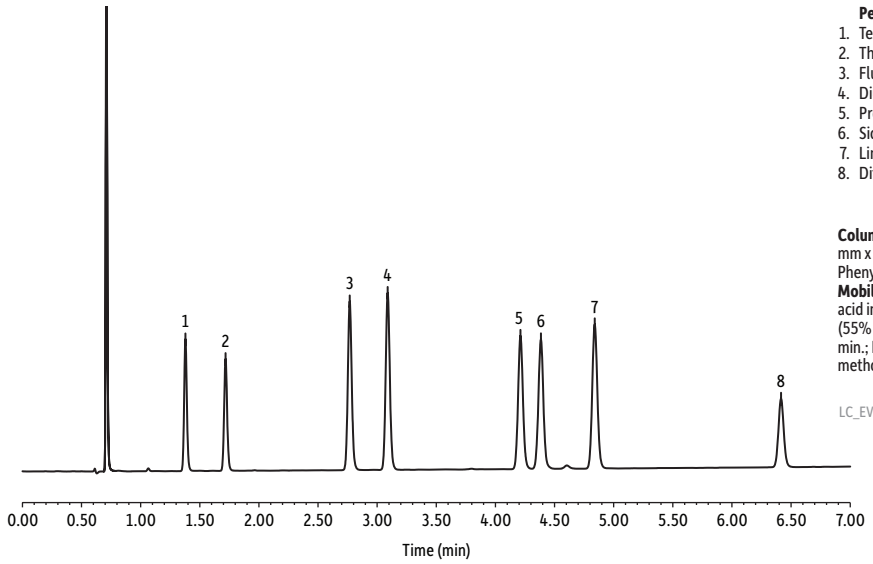
Peaks	t_R (min)
1. Methylparaben	2.90
2. Ethylparaben	3.77
3. Propylparaben	5.34
4. Butylparaben	8.03

Column: Traditional fully porous C18; Dimensions: 150 mm x 4.6 mm ID; Particle Size: 5 µm; Pore Size: 100 Å; Temp.: Ambient; **Sample:** Diluent: Methanol; Conc.: 100 µg/mL each component; Inj. Vol.: 5 µL; **Mobile Phase:** 0.1% Acetic acid in water:acetonitrile (50:50); Flow: 1.0 mL/min; **Detector:** UV/Vis @ 254 nm.

Your New Go-To Column for Fast and Dependable Analyses on Any Instrument

C18 columns are often a method developer's first choice, not only for their trusted performance, but also for their effectiveness with many types of compound and instrument. The Raptor™ C18 was designed to build on that foundation, offering usability, peak symmetry, efficiency, and dependability—with the unmatched reproducibility, speed, and reliability of a Raptor™ SPP LC column. Whether you are doing environmental, food safety, or bioanalytical work, you will finish your work faster if you choose the right column the first time. For general-purpose applications, the Raptor™ C18 is your best first choice.

Figure 5: Get the data quality and short analysis times you need with Raptor™ C18 columns, as shown here with phenylurea herbicides on a photodiode array (PDA) detector.

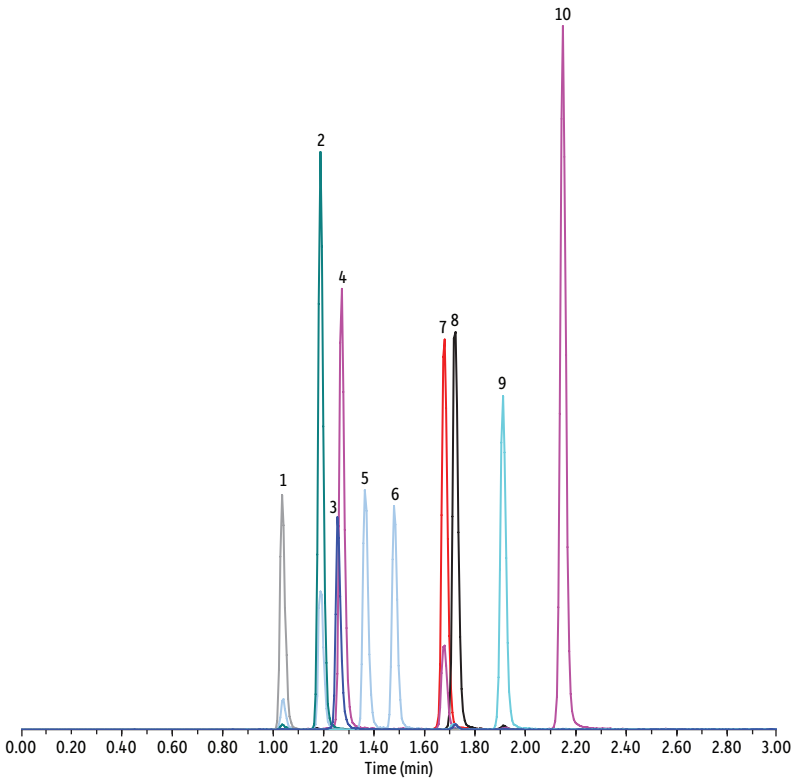


Peaks	t_R (min)
1. Tebuthiuron	1.38
2. Thidiazuron	1.72
3. Fluometuron	2.77
4. Diuron	3.09
5. Propanil	4.21
6. Siduron	4.39
7. Linuron	4.84
8. Diflubenzuron	6.42

Column: Raptor™ C18 (cat.# 9304565); Dimensions: 150 mm x 4.6 mm ID; Particle Size: 5 µm; Temp.: 30 °C; **Sample:** Phenylurea pesticide mixture (cat.# 32434); Inj. Vol.: 2 µL; **Mobile Phase:** A: 0.1% Formic acid in water; B: 0.1% Formic acid in acetonitrile; **Gradient (%B)** 0.00 min (30% B), 7.00 min (55% B), 7.01 min (30% B), 10.00 min (30% B), **Flow:** 2 (mL/min.; **Detector:** PDA @ 245 nm; **Instrument:** HPLC; **Notes:** This method is not EPA 532 tested or compliant.

LC_EV0533

Figure 6: Raptor™ C18s offer exceptional peak symmetry and efficiency for high sensitivity and very low bleed—making them ideal for high-throughput LC-MS/MS.



Peaks	t_R (min)	Precursor Ion	Product Ion
1. Rutin	1.04	611.5	303.3
2. Quercitrin	1.19	449.4	303.3
3. Myricetin	1.26	319.3	153.2
4. Fisetin	1.27	287.3	137.3
5. Morin	1.36	303.3	153.2
6. Quercetin	1.48	303.3	153.2
7. Kaempferol	1.68	287.3	153.2
8. Isorhamnetin	1.72	317.3	153.2
9. Rhamnetin	1.91	317.3	123.3
10. Galangin	2.15	271.3	153.2

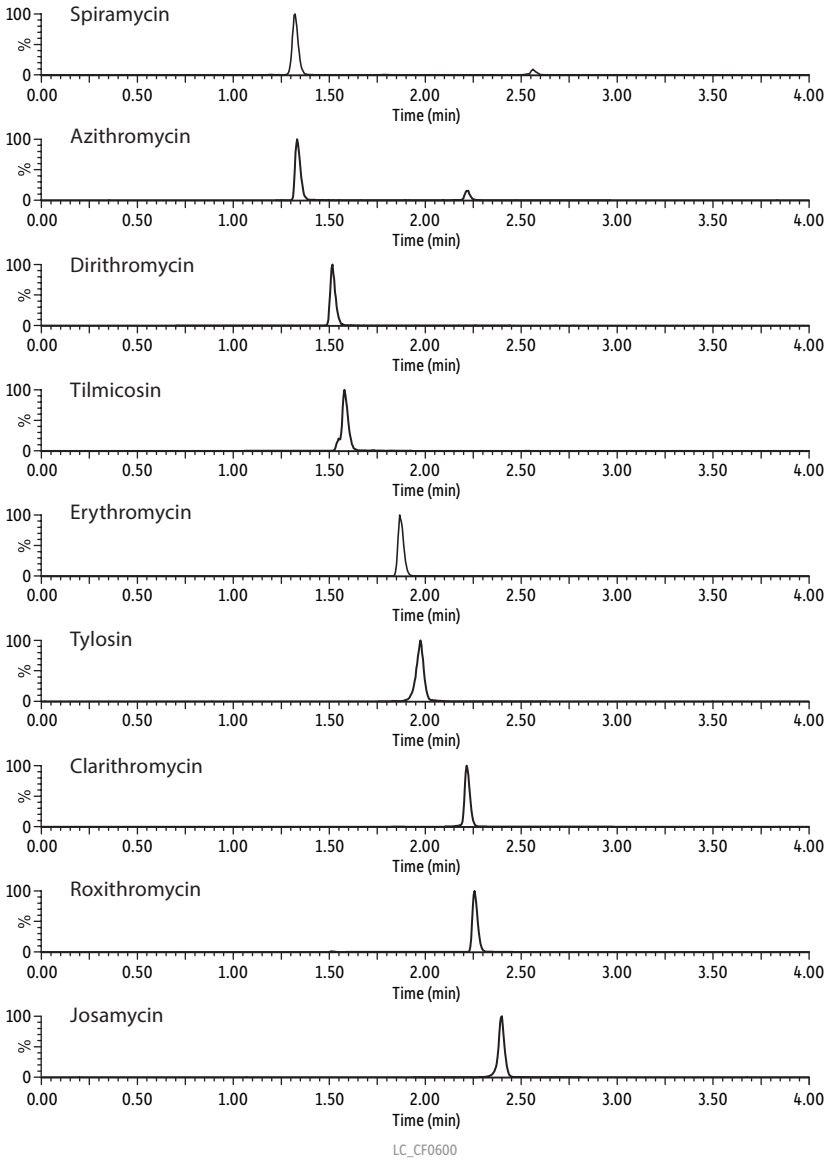
Column: Raptor™ C18 (cat.# 9304552); Dimensions: 50 mm x 2.1 mm ID; Particle Size: 5 µm; Pore Size: 90 Å; Temp.: 40 °C; **Sample:** Diluent: 90:10 (water:acetonitrile); Conc.: 500 ng/mL; Inj. Vol.: 5 µL; **Mobile Phase:** A: 0.1% Formic acid in water; B: 0.1% Formic acid in acetonitrile; **Gradient (%B):** 0.00 min (10% B), 2.40 min (70% B), 2.41 min (10% B), 3.50 min (10% B), **Flow:** 0.5 mL/min; **Detector:** MS/MS; Ion Mode: ESI+; **Instrument:** HPLC.

LC_FF0557

The Perfect Complement to High-Throughput Mass Spec

Fast LC-MS/MS screens with their exacting MRM transitions place severe demands on your LC column. The Raptor™ C18 can easily and dependably handle mass spec analysis of closely related compounds like macrolide antibiotics, which are widely used in human and veterinary medicine (Figure 7). Because it's a Raptor™ LC column, this C18 provides the reproducibility and consistent retention required for precise MRM analyses (see p. 3).

Figure 7: Confidently analyze closely eluting compounds, like macrolide antibiotics in this bioanalytical analysis, by LC-MS/MS.



Peaks	t_R (min)	Precursor Ion	Product Ion
1. Spiramycin	1.32	844.21	174.28
2. Azithromycin	1.33	750.14	591.83
3. Dirithromycin	1.52	836.26	158.23
4. Tilmicosin	1.58	870.23	174.29
5. Erythromycin	1.87	735.09	158.23
6. Tylosin	1.98	917.26	174.28
7. Clarithromycin	2.22	749.11	158.22
8. Roxithromycin	2.26	838.21	158.23
9. Josamycin	2.40	829.15	109.18

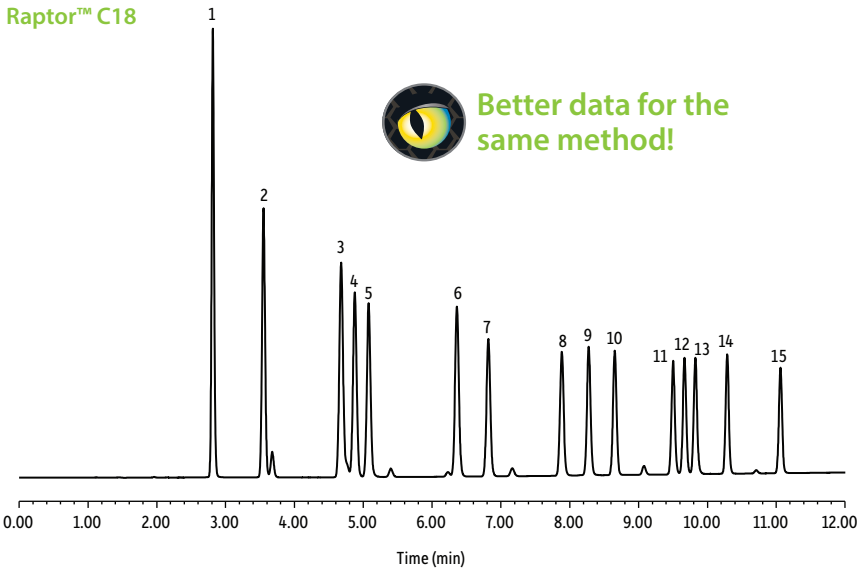
Column: Raptor™ C18 (cat.# 9304512); Dimensions: 100 mm x 2.1 mm ID; Particle Size: 5 µm; Pore Size: 90 Å; Temp.: 40 °C; **Sample:** Diluent: Water:acetonitrile (50:50); Conc.: 100 ng/mL; Inj. Vol.: 5 µL; **Mobile Phase:** A: 0.1% Formic acid in water; B: 0.1% Formic acid in acetonitrile; **Gradient (%B)** 0.00 min (20% B), 3.00 min (65% B), 3.01 min (20% B), 4.50 min (20% B), **Flow:** 0.4 mL/min; **Detector:** MS/MS; Ion Mode: ESI+; **Instrument:** UHPLC.

Improve Resolution on Your Current Methods

To quickly improve your data quality without altering conditions, add a Raptor™ C18 SPP column to your existing C18 methods. As exemplified in Figure 8 with EPA method TO-11A, which determines toxic compounds in ambient air, the Raptor™ C18 offers better peak separation than a traditional fully porous C18 under the same conditions. Going a step further, the improved analyte resolution of the Raptor™ C18 column gives you the freedom to further optimize your conditions and accelerate analysis times when permitted by method requirements.

Figure 8: Make a good method even better with improved resolution by switching your traditional fully porous C18 for a Raptor™ C18 column.

Raptor™ C18

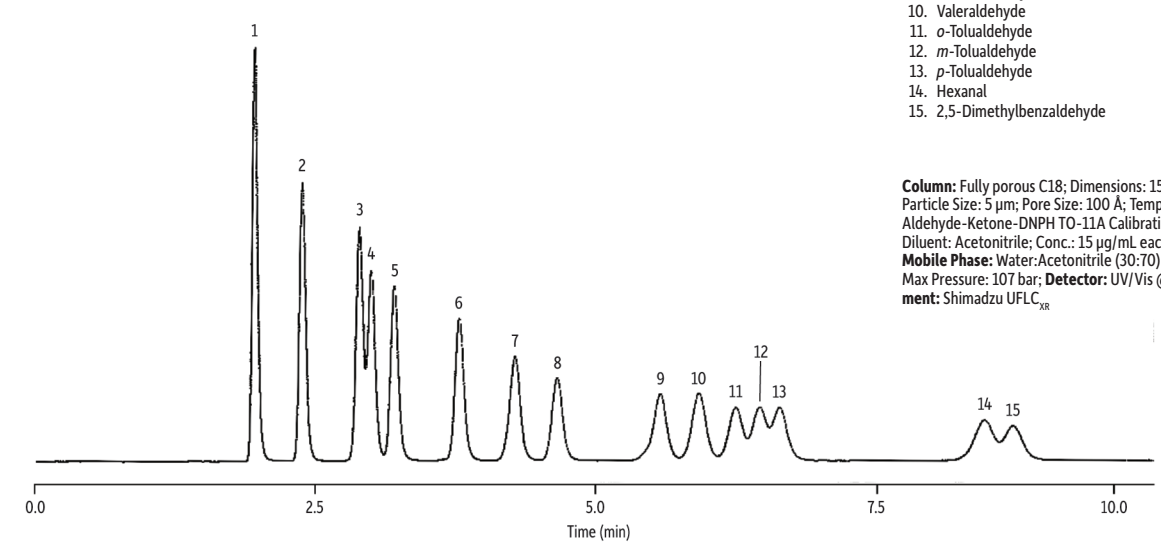


Peaks	t_R (min)
1. Formaldehyde	2.814
2. Acetaldehyde	3.551
3. Acrolein	4.678
4. Acetone	4.877
5. Propionaldehyde	5.078
6. Crotonaldehyde	6.361
7. Butyraldehyde	6.818
8. Benzaldehyde	7.884
9. Isovaleraldehyde	8.276
10. Valeraldehyde	8.653
11. *o*-Tolualdehyde	9.502
12. *m*-Tolualdehyde	9.667
13. *p*-Tolualdehyde	9.825
14. Hexanal	10.287
15. 2,5-Dimethylbenzaldehyde	11.064

Column: Raptor™ C18 (cat.# 9304A65); Dimensions: 150 mm x 4.6 mm ID; Particle Size: 2.7 µm; Pore Size: 90 Å; Temp.: 30 °C; **Sample:** Aldehyde-ketone-DNPH TO-11A calibration mix (cat.# 31808); Diluent: Acetonitrile; Conc.: 15 µg/mL; Inj. Vol.: 2 µL; **Mobile Phase:** A: Water; B: Methanol: acetonitrile (650:50)*; **Gradient (%B)** 0.00 min (70% B), 5.00 min (75% B), 11.00 min (90% B), 11.01 min (100% B), 12.00 min (100% B), 12.01 min (70% B), 14.00 min (70% B), **Flow:** 0.8 mL/min; **Detector:** UV/Vis @ 365, 4.8 nm; **Instrument:** UHPLC; **Notes:** *Mobile phase B was prepared by combining 650 mL methanol and 50 mL acetonitrile.

LC_EV0532

Fully porous C18



Peaks	t_R (min)
1. Formaldehyde	1.954
2. Acetaldehyde	2.376
3. Acrolein	2.884
4. Acetone	2.987
5. Propionaldehyde	3.190
6. Crotonaldehyde	3.777
7. Butyraldehyde	4.273
8. Benzaldehyde	4.653
9. Isovaleraldehyde	5.572
10. Valeraldehyde	5.919
11. *o*-Tolualdehyde	6.242
12. *m*-Tolualdehyde	6.454
13. *p*-Tolualdehyde	6.634
14. Hexanal	8.450
15. 2,5-Dimethylbenzaldehyde	8.715

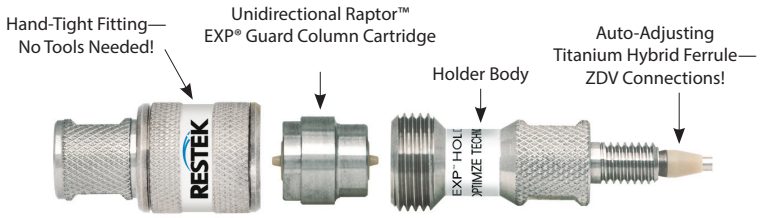
Column: Fully porous C18; Dimensions: 150 mm x 4.6 mm ID; Particle Size: 5 µm; Pore Size: 100 Å; Temp.: 25 °C; **Sample:** Aldehyde-Ketone-DNPH TO-11A Calibration Mix (cat.# 31808); Diluent: Acetonitrile; Conc.: 15 µg/mL each; Inj. Vol.: 10 µL; **Mobile Phase:** Water:Acetonitrile (30:70); Flow: 1.5 mL/min; Max Pressure: 107 bar; **Detector:** UV/Vis @ 365, 1 nm; **Instrument:** Shimadzu UFLC$_{XR}$

Lower Costs and Improve Profitability with the Only General-Purpose C18 That Gives You *Selectivity Accelerated*

Raptor™ C18 LC Columns

Length	2.1 mm cat.#	3.0 mm cat.#	4.6 mm cat.#
2.7 µm Columns			
30 mm	9304A32	9304A3E	9304A35
50 mm	9304A52	9304A5E	9304A55
100 mm	9304A12	9304A1E	9304A15
150 mm	9304A62	9304A6E	9304A65
5 µm Columns			
30 mm	—	930453E	—
50 mm	9304552	930455E	9304555
100 mm	9304512	930451E	9304515
150 mm	9304562	930456E	9304565
250 mm	—	—	9304575

Raptor™ EXP® Guard Cartridges



Protect your investment and extend the life of our already-rugged LC columns and change guard column cartridges by hand without breaking fluid connections—no tools needed!

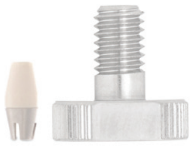
EXP® Direct Connect Holder

Description	qty.	cat.#
EXP Direct Connect Holder for EXP Guard Cartridges (includes hex-head fitting & 2 ferrules)	ea.	25808

EXP® Reusable Fittings for HPLC & UHPLC

for 10-32 fittings and 1/16" tubing

Effortlessly achieve 8,700+ psi HPLC seals by hand! (Wrench-tighten to 20,000+ psi.) Hybrid titanium/PEEK seal can be installed repeatedly without compromising your seal.



Description	qty.	cat.#
EXP Hand-Tight Fitting (Nut w/Ferrule)	ea.	25937
EXP Hand-Tight Fitting (Nut w/Ferrule)	10-pk.	25938
EXP Hand-Tight Nut (w/o Ferrule)	ea.	25939

Hybrid Ferrule U.S. Patent No. 8201854, Optimize Technologies. Optimize Technologies EXP Holders are Patent Pending. Other U.S. and Foreign Patents Pending. The EXP, Free-Turn, and the Opti- prefix are registered trademarks of Optimize Technologies, Inc.

Raptor™ EXP® Guard Column Cartridges

Description	Particle Size	qty.	5 x 2.1 mm cat.#	5 x 3.0 mm cat.#	5 x 4.6 mm cat.#
Raptor C18 EXP Guard Column Cartridge	2.7 µm	3-pk.	9304A0252	9304A0253	9304A0250
Raptor C18 EXP Guard Column Cartridge	5 µm	3-pk.	930450252	930450253	930450250

Maximum cartridge pressure: 600 bar / 8,700 psi (2.7 µm) or 400 bar / 5,800 psi (5 µm)

Raptor™ SPP LC columns combine the speed of SPP with the resolution of USLC® technology. Learn more at **www.restek.com/raptor**

Experience *Selectivity Accelerated.* Order the Raptor™ C18 today at **www.restek.com/raptor**

RESTEK®
Pure Chromatography

Questions about this or any other Restek® product?
Contact us or your local Restek® representative (www.restek.com/contact-us).

www.restek.com

ISO 9001 · 17025 · Guide 34

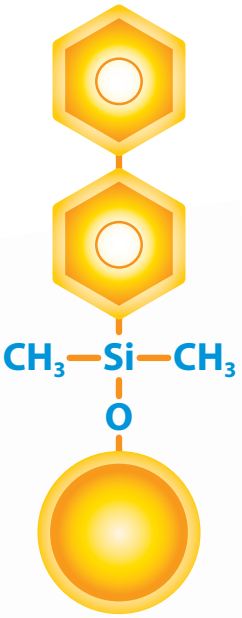
Lit. Cat.# GNBR2246-UNV

Stationary Phase: **Biphenyl**

Raptor™
LC Columns

Selectivity Accelerated

Fast, Rugged Raptor™ Columns with Time-Tested Selectivity



RESTEK® Pure Chromatography www.restek.com/raptor

The Raptor™ Biphenyl Column

With Raptor™ LC columns, Restek chemists became the first to combine the speed of superficially porous particles (also known as SPP or "core-shell" particles) with the resolution of highly selective USLC® technology. This new breed of chromatographic column allows you to more easily achieve peak separation and faster analysis times without expensive UHPLC instrumentation.

Our top priority when developing our new SPP line was to create a version of our innovative Biphenyl. The industry-leading Biphenyl is Restek's most popular LC stationary phase because it is particularly adept at separating compounds that are hard to resolve or that elute early on C18 and other phenyl chemistries. As a result, the rugged Raptor™ Biphenyl column is extremely useful for fast separations in bioanalytical testing applications like drug and metabolite analyses, especially those that require a mass spectrometer (MS). Increasing retention of early-eluting compounds can limit ionization suppression, and the heightened selectivity helps eliminate the need for complex mobile phases that are not well suited for MS detection.

In 2005, Restek was the first to bring you the benefits of the Biphenyl ligand, and we have the experience to maximize the SPP performance of this premier phenyl chemistry for today's challenging workflows.

Column Description:

Stationary Phase Category:
Phenyl (L11)

Ligand Type:
Biphenyl

Particle:
2.7 µm or 5 µm superficially porous silica (SPP or "core-shell")

Pore Size:
90 Å

Surface Area:
150 m^2/g (2.7 µm)
or 100 m^2/g (5 µm)

Recommended Usage:
pH Range: 1.5–8.0

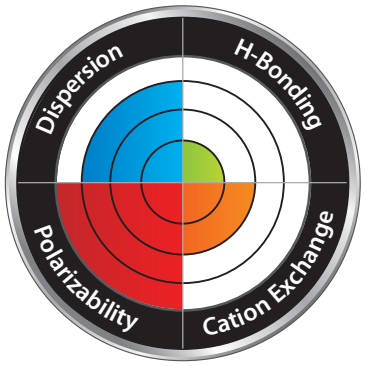
Maximum Temperature: 80 °C

Maximum Pressure: 600 bar / 8,700 psi (2.7 µm)
or 400 bar / 5,800 psi (5 µm)

Properties:
- Increased retention for dipolar, unsaturated, or conjugated solutes.
- Enhanced selectivity when used with methanolic mobile phase.
- Ideal for increasing sensitivity and selectivity in LC-MS analyses.

Switch to a Biphenyl when:
- Limited selectivity is observed on a C18.
- You need to increase retention of hydrophilic aromatics.

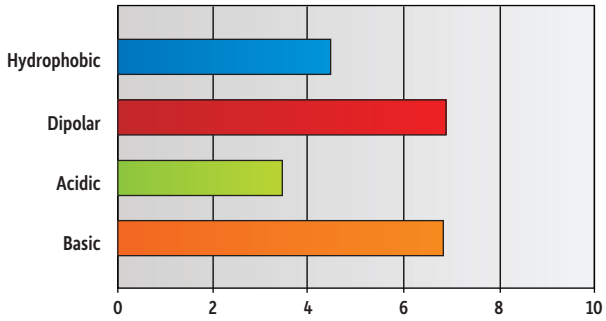
Column Interaction Profile:



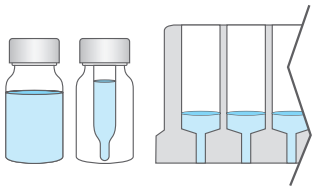
Defining Solute Interactions:
- Polarizability
- Dispersion

Complementary Solute Interaction:
- Cation exchange

Solute Retention Profile:



Target Analyte Structures:
- Aromatic
- Dipolar



Target Analyte Functionalities:
- Hydrophilic aromatics
- Strong dipoles
- Lewis acids
- Dipolar, unsaturated, or conjugated compounds
- Fused-ring compounds with electron withdrawing groups

More Aromatic Selectivity than Ordinary Phenyl-Hexyls

SPP core-shell columns commonly employ traditional phenyl-hexyl stationary phases, but the innovative Biphenyl ligand, developed by Restek's chemists, is the next generation of phenyl column chemistry. It provides greater aromatic selectivity than commercially available phenyl-hexyl columns [1] and a greater degree of dispersion than conventional phenyls. As a result, the Raptor™ Biphenyl allows you to more easily separate bioanalytical compounds like aromatics (Figures 1 and 2), which elute early or are hard to separate on C18 or other phenyl chemistries.

[1] In-house testing based on: M. R. Euerby, P. Petersson, W. Campbell, W. Roe, Chromatographic classification and comparison of commercially available reversed-phase liquid chromatographic columns containing phenyl moieties using principal component analysis, J. Chromatogr. A 1154 (2007) 138–151.

Figure 1: Raptor™ Biphenyl columns exhibit the highest aromatic selectivity compared to other SPP phenyl columns.

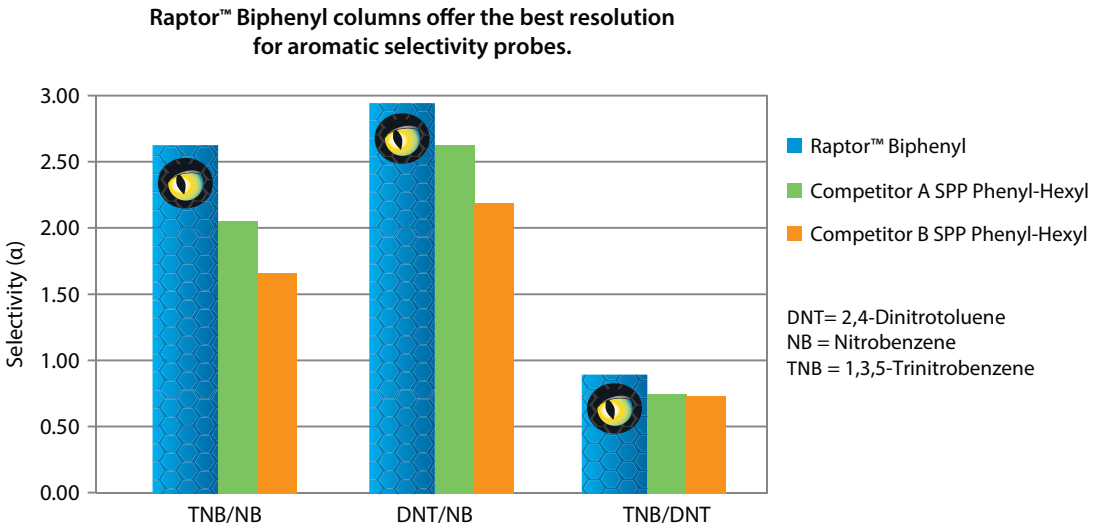
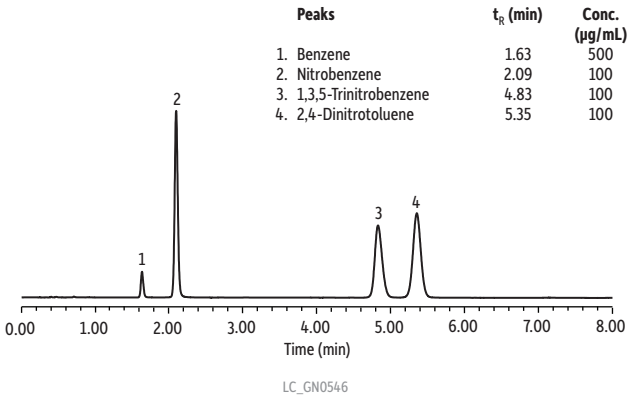


Figure 2: Raptor™ Biphenyl columns show increased retention for compounds containing electron withdrawing groups. Retention and elution order are dramatically different from a traditional C18.



Column: Raptor™ Biphenyl (cat.# 9309A55); Dimensions: 50 mm x 4.6 mm ID; Particle Size: 2.7 µm; Pore Size: 90 Å; Temp.: 40 °C; **Sample:** Diluent: acetonitrile; Conc.: 100-500 µg/mL; Inj. Vol.: 1 µL **Mobile Phase:** water: methanol (50:50); Flow: 1.2 mL/min; **Detector:** Waters Acquity® PDA @ 254 nm; **Instrument:** Waters Acquity® UPLC H-Class.

The New Standard for Performance and Durability for SPP Core-Shell Columns

Pressure Stability:

One of the greatest advantages of an SPP column is the ability to achieve fast, efficient separations by operating at higher linear velocities than are possible with a conventional fully porous particle column. However, these higher velocities can also result in higher back pressures. Raptor™ columns were designed to handle the increased pressures needed to achieve *Selectivity Accelerated*, and handle it far better than other SPP columns on the market (Figure 3).

Reproducibility:

To help keep your productivity high and your lab budget low, we know that Raptor™ Biphenyl columns must produce exceptional selectivity and fast analysis times not just once, but every time. Ruggedness and repeatability are essential, which is why from the silica and the bonding technique, to the packing process and upgraded hardware, every decision that went into creating this column was made to ensure superlative reproducibility, from injection to injection (Figure 4) and from lot to lot (Figure 5). We also adopted new quality control (QC) specifications to guarantee the retention time stability you need for worry-free MRM analyses.

Figure 3: At high pressures, competitor phenyl-hexyl columns experience a quick and sharp drop-off in efficiency, but Raptor™ Biphenyl columns are unaffected to at least 3,000 injections.

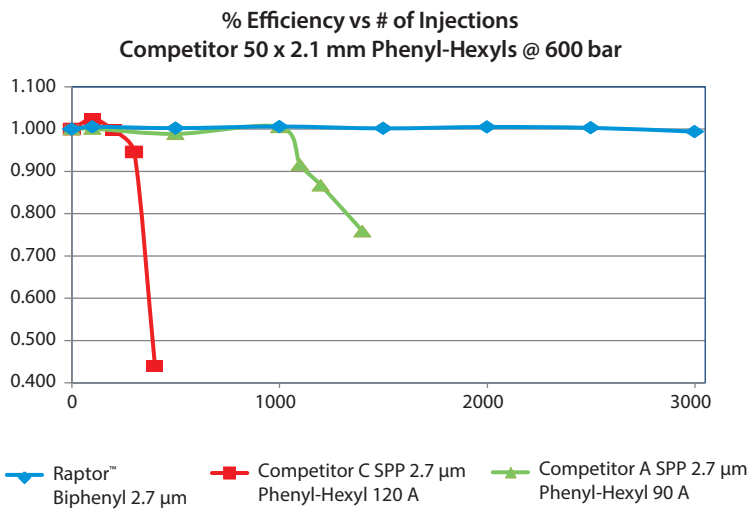
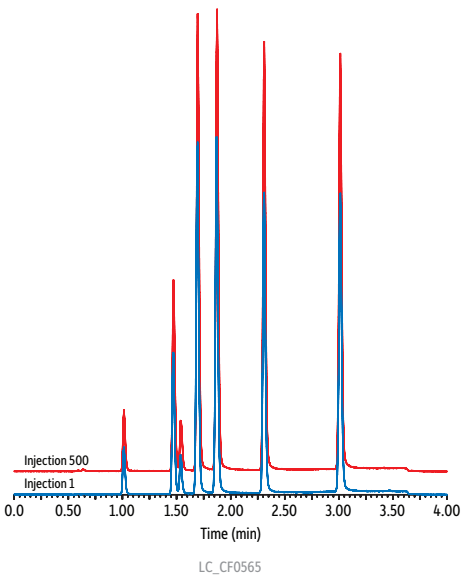


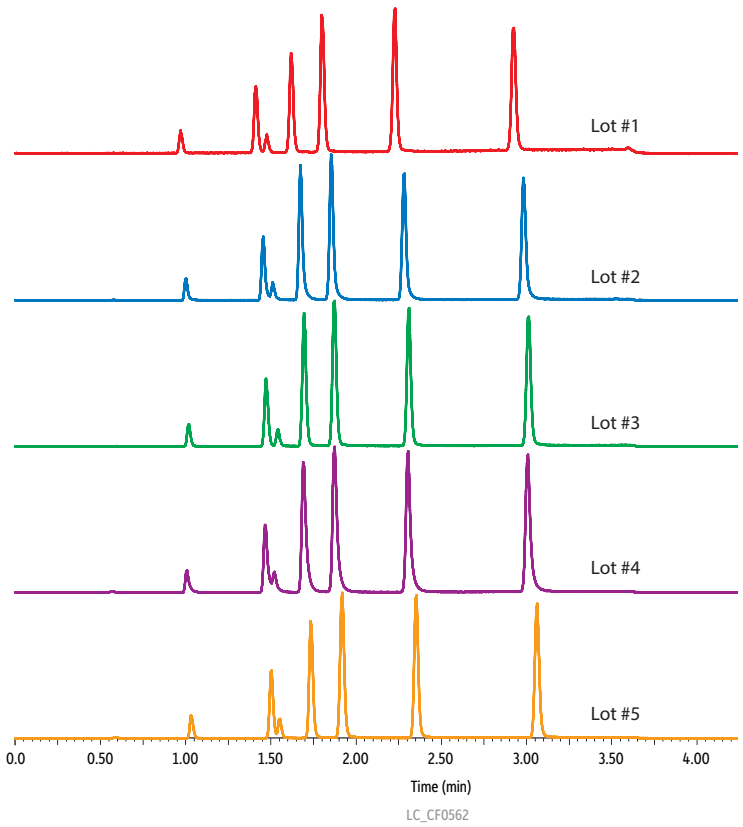
Figure 4: Even after hundreds of injections, a Raptor™ Biphenyl column will provide consistent, reliable data.



Peaks
1. Cortisol
2. 11-Deoxycortisol
3. Estradiol
4. Boldenone
5. Testosterone
6. Androstenedione
7. Progesterone

Column: Raptor™ Biphenyl (cat.# 9309A1E); Dimensions: 100 mm x 3.0 mm ID; Particle Size: 2.7 µm; Pore Size: 90 Å; Temp.: 30 °C; **Sample:** Diluent: initial mobile phase; Conc.: 50 ng/mL; Inj. Vol.: 5 µL **Mobile Phase:** A: 0.1% formic acid in water, B: 0.1% formic acid in acetonitrile; **Gradient (%B):** 0.00 min (40%), 3.00 min (80%), 3.01 min (40%), 5.00 min (40%); **Flow:** 0.700 mL/min; **Detector:** Waters Xevo TQ-S; Ion Mode: ESI+; **Instrument:** Waters.

Figure 5: From one lot to the next, every Raptor™ Biphenyl column you purchase will perform the same.



See Figure 4 for compound list and conditions.

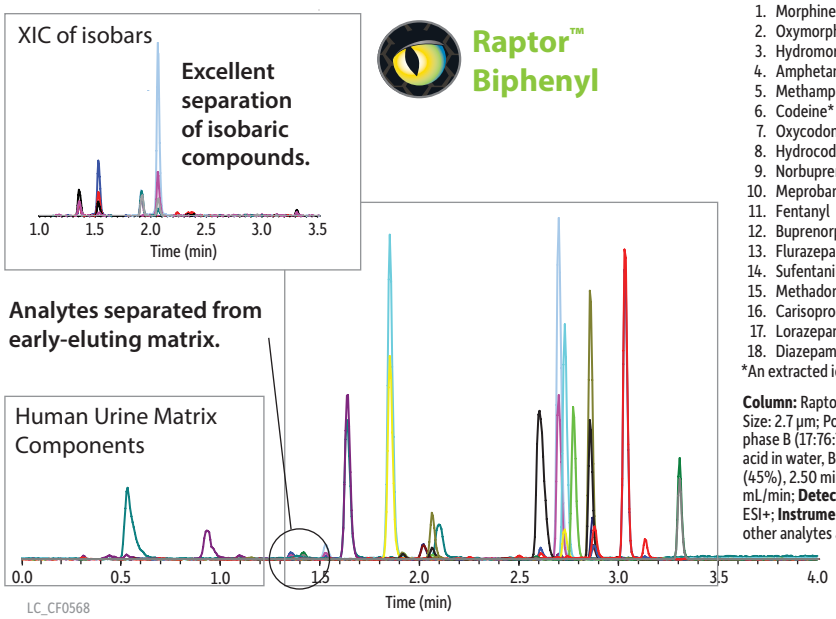
Clinically Proven to Optimize Your Bioanalytical Workflows

For over a decade, the Restek® Biphenyl has been the column of choice for clinical testing because of its ability to provide highly retentive, selective, and rugged reversed-phase separations of drugs and metabolites. By bringing the speed of SPP to the Biphenyl family, the Raptor™ Biphenyl provides clinical labs with an even faster option for a wide variety of clinical assays.

Rugged Pain Panels from Urine in Under 3.5 Minutes

Pain panels can be difficult to optimize and reproduce due to the limited selectivity of C18 and phenyl-hexyl phases, but not on the Raptor™ Biphenyl. Complete your pain panel analysis with a 5-minute cycle time and complete isobaric resolution using Raptor™ Biphenyl columns (Figure 6). Popular competitor columns offer tailing peaks, longer run times, and coelutions; the Raptor™ Biphenyl exhibits the selectivity and performance needed for this critical analysis.

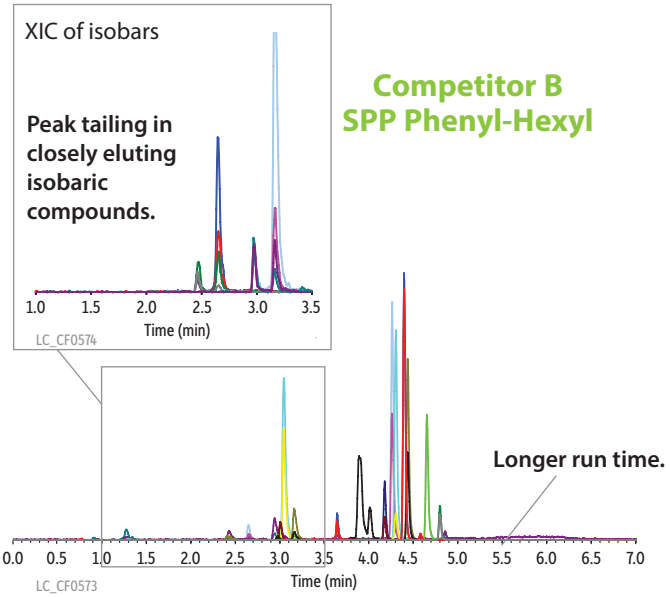
Figure 6: Raptor™ Biphenyl columns offer pain panel analyses with complete isobaric resolution in under 5 minutes!



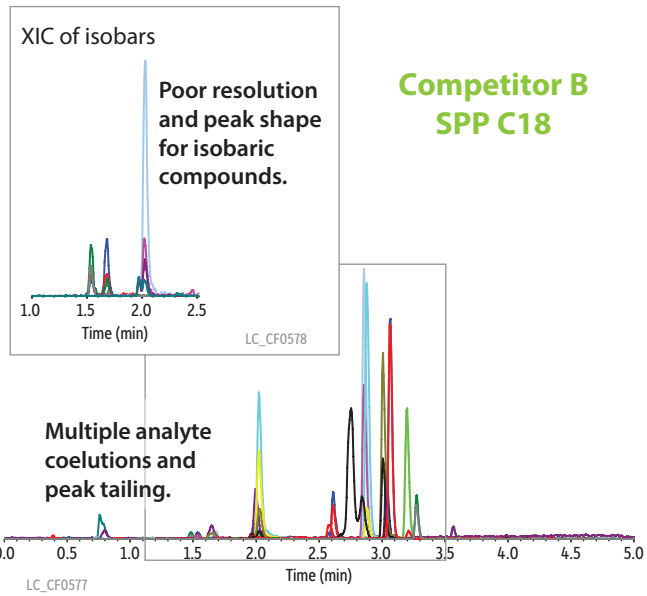
	Peaks	t_R (min)	Precursor ion	Product ion 1	Product ion 2
1.	Morphine*	1.34	286.2	152.3	165.3
2.	Oxymorphone	1.40	302.1	227.3	198.2
3.	Hydromorphone*	1.52	286.1	185.3	128.2
4.	Amphetamine	1.62	136.0	91.3	119.2
5.	Methamphetamine	1.84	150.0	91.2	119.3
6.	Codeine*	1.91	300.2	165.4	153.2
7.	Oxycodone	2.02	316.1	241.3	256.4
8.	Hydrocodone*	2.06	300.1	199.3	128.3
9.	Norbuprenorphine	2.59	414.1	83.4	101.0
10.	Meprobamate	2.61	219.0	158.4	97.2
11.	Fentanyl	2.70	337.2	188.4	105.2
12.	Buprenorphine	2.70	468.3	396.4	414.5
13.	Flurazepam	2.73	388.2	315.2	288.3
14.	Sufentanil	2.77	387.2	238.5	111.3
15.	Methadone	2.86	310.2	265.3	105.3
16.	Carisoprodol	2.87	261.2	176.3	158.1
17.	Lorazepam	3.03	321.0	275.4	303.1
18.	Diazepam	3.31	285.1	193.2	153.9

*An extracted ion chromatogram (XIC) of the isobars is presented in the inset.

Column: Raptor™ Biphenyl (cat.# 9309A5E); Dimensions: 50 mm x 3.0 mm ID; Particle Size: 2.7 µm; Pore Size: 90 Å; Temp.: 30 °C; **Sample:** Diluent: urine:mobile phase A:mobile phase B (17:76:7); Conc.: 10-100 ng/mL; Inj. Vol.: 10 µL **Mobile Phase:** A: 0.1% formic acid in water, B: 0.1% formic acid in methanol; **Gradient (%B):** 0.00 min (10%), 1.50 min (45%), 2.50 min (100%), 3.70 min (100%), 3.71 min (10%) 5.00 min (10%); **Flow:** 0.6 mL/min; **Detector:** AB SCIEX API 4000™ MS/MS; Ion Source: TurboIonSpray®; Ion Mode: ESI+; **Instrument:** API LC-MS/MS; **Notes:** Lorazepam was prepared at 100 ng/mL; all other analytes are 10 ng/mL.



Column: Competitor B SPP C18; Dimensions: 50 mm x 4.6 mm ID; Particle Size: 2.6 µm; Pore Size: 100 Å; Temp.: 22 °C; **Sample:** Diluent: urine:mobile phase A:mobile phase B (17:76:7); Conc.: 10-100 ng/mL; Inj. Vol.: 10 µL **Mobile Phase:** A: 10 mM ammonium formate in water, B: 0.1% formic acid in methanol; **Gradient (%B):** 0.00 min (5%), 4.00 min (100%), 5.00 min (100%), 5.10 min (5%), 7.00 min (5%); **Flow:** 0.6 mL/min; **Detector:** AB SCIEX API 4000™ MS/MS; Ion Source: TurboIonSpray®; Ion Mode: ESI+; **Instrument:** API LC-MS/MS; **Notes:** Lorazepam was prepared at 100 ng/mL; all other analytes are 10 ng/mL. **Note:** Column and conditions used were specifically recommended or published by the manufacturer for this assay.

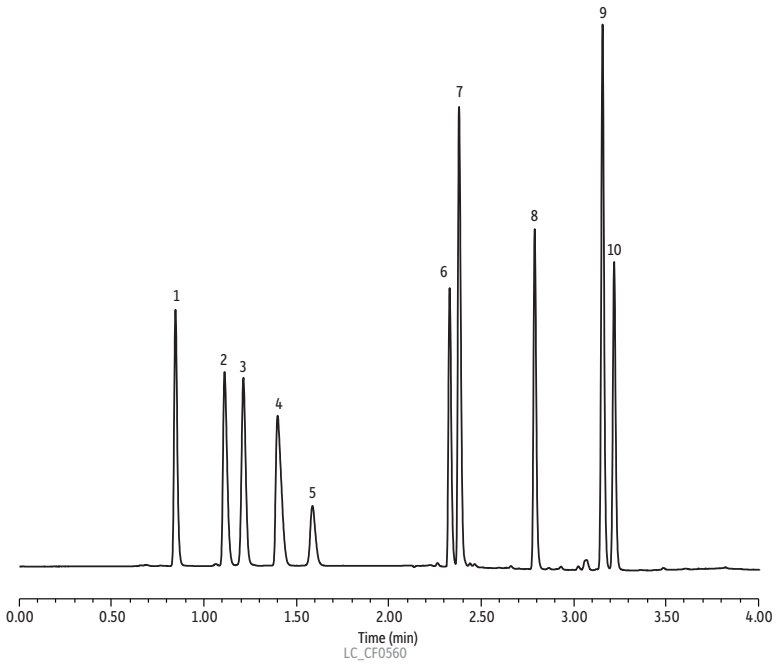


Column: Competitor B SPP C18; Dimensions: 50 mm x 3.0 mm ID; Particle Size: 2.6 µm; Pore Size: 100 Å; Temp.: 25 °C; **Sample:** Diluent: urine:mobile phase A:mobile phase B (17:76:7); Conc.: 10-100 ng/mL; Inj. Vol.: 10 µL **Mobile Phase:** A: 10 mM ammonium formate in water, B: 0.1% formic acid in methanol; **Gradient (%B):** 0.00 min (5%), 3.00 min (100%), 4.00 min (100%), 4.10 min (5%), 5.00 min (5%); **Flow:** 0.5 mL/min; **Detector:** AB SCIEX API 4000™ MS/MS; Ion Source: TurboIonSpray®; Ion Mode: ESI+; **Instrument:** API LC-MS/MS; **Notes:** Lorazepam was prepared at 100 ng/mL; all other analytes are 10 ng/mL. **Note:** Column and conditions used were specifically recommended or published by the manufacturer for this assay.

Catecholamines and NSAIDs Without Ion Pairing, HILIC, or Complex Mobile Phases

Analyzing catecholamine compounds can be problematic by liquid chromatography and often forces chemists to turn to aqueous normal phase / HILIC or ion-pairing reagents that are not well suited for mass spectrometry (MS). Raptor™ Biphenyl columns easily retain and separate these difficult compounds using simple, MS-friendly mobile phases in a time frame that maximizes your productivity (Figure 7). Raptor™ Biphenyl also offers fast, efficient analysis of nonsteroidal anti-inflammatory drugs (NSAIDs) with LC-MS friendly solvents.

Figure 7: Separate catecholamine and other neurotransmitter compounds fast without ion pairing or HILIC.

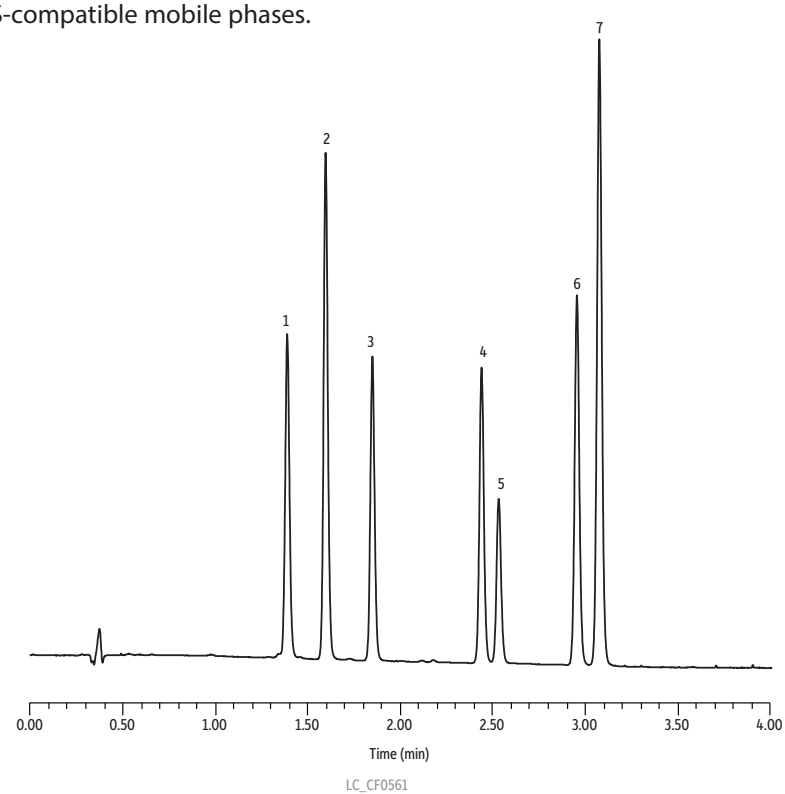


Peaks	t_R (min)
1. Norepinephrine	0.85
2. Epinephrine	1.11
3. L-Dihydroxyphenylalanine	1.21
4. Dopamine	1.40
5. Tyrosine	1.59
6. 3-Methoxytyramine*	2.33
7. Serotonin	2.38
8. (3,4-Dihydroxyphenyl)acetic acid*	2.79
9. 5-Hydroxyindoleacetic acid**	3.16
10. Homovanillic acid*	3.22

* Dopamine metabolite, ** serotonin metabolite

Column: Raptor™ Biphenyl (cat.# 9309A62); Dimensions: 150 mm x 2.1 mm ID; Particle Size: 2.7 µm; Pore Size: 90 Å; Temp.: 30 °C; **Sample:** Diluent: water; Conc.: 50 µg/mL; Inj. Vol.: 1 µL **Mobile Phase:** A: 0.1% formic acid in water, B: 0.1% formic acid in acetonitrile; **Gradient (%B):** 0.00 min (0%), 4.00 min (70%), 4.01 min (0%), 5.00 min (0%); **Flow:** 0.4 mL/min; **Detector:** Waters Acquity® PDA @ 280 nm; **Instrument:** Waters Acquity® UPLC H-Class.

Figure 8: Nonsteroidal anti-inflammatory drugs (NSAIDs) are also easily resolved with Raptor™ Biphenyl using UV- and MS-compatible mobile phases.



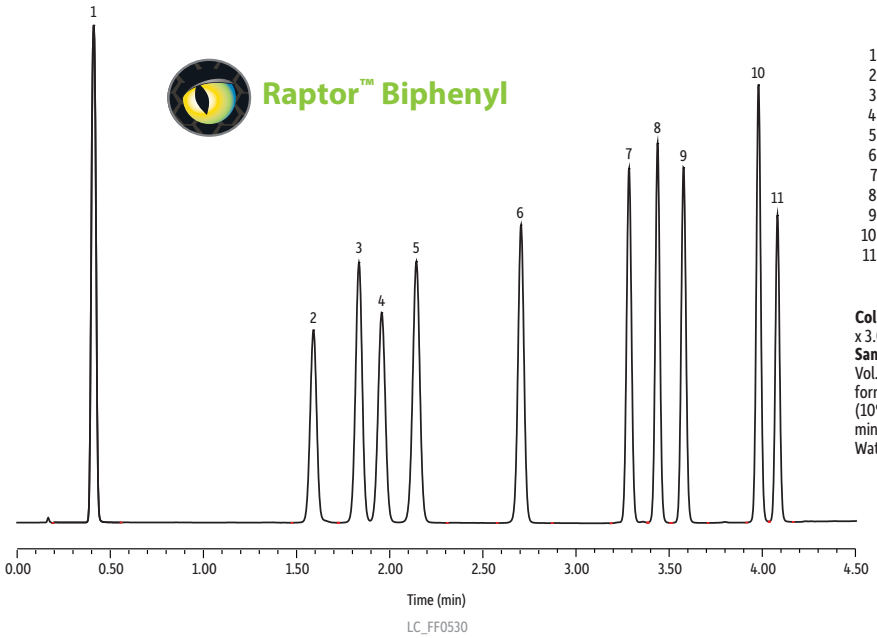
Peaks	t_R (min)	Conc. (µg/mL)
1. Piroxicam	1.39	25
2. Sulindac	1.60	25
3. Naproxen	1.85	25
4. Fenoprofen	2.44	100
5. Ibuprofen	2.54	200
6. Diclofenac	2.96	25
7. Indomethacin	3.08	25

Column: Raptor™ Biphenyl (cat.# 9309A12); Dimensions: 100 mm x 2.1 mm ID; Particle Size: 2.7 µm; Pore Size: 90 Å; Temp.: 40 °C; **Sample:** Diluent: water:acetonitrile (65:35); Conc.: 25-200 µg/mL; Inj. Vol.: 2 µL **Mobile Phase:** A: 0.1% formic acid in water, B: 0.1% formic acid in acetonitrile; **Gradient (%B):** 0.00 min (35%), 4.00 min (60%), 4.01 min (35%), 5.00 min (35%); **Flow:** 0.6 mL/min; **Detector:** Waters Acquity® PDA @ 270 nm; **Instrument:** Waters Acquity® UPLC H-Class.

Fast Analysis of Sulfur Antibiotics Without Coelutions

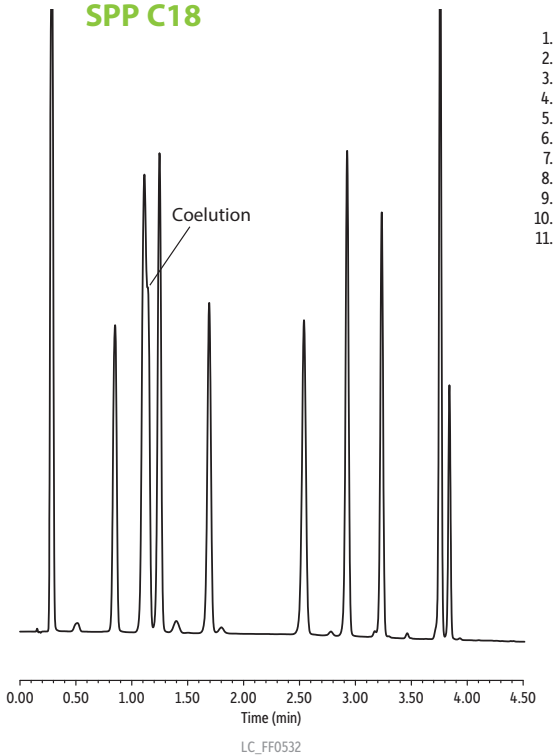
Even with high-efficiency UHPLC particles, C18 and ordinary phenyl columns fail to achieve baseline separation of sulfonamides. Not only does the Raptor™ Biphenyl have the selectivity to easily and completely separate these difficult compounds (Figure 9), it does so in well under 5 minutes!

Figure 9: Sulfonamides pose no problems for analysis, even at high linear velocities. Increased retention of early-eluting sulfanilamide also helps limit ionization suppression.

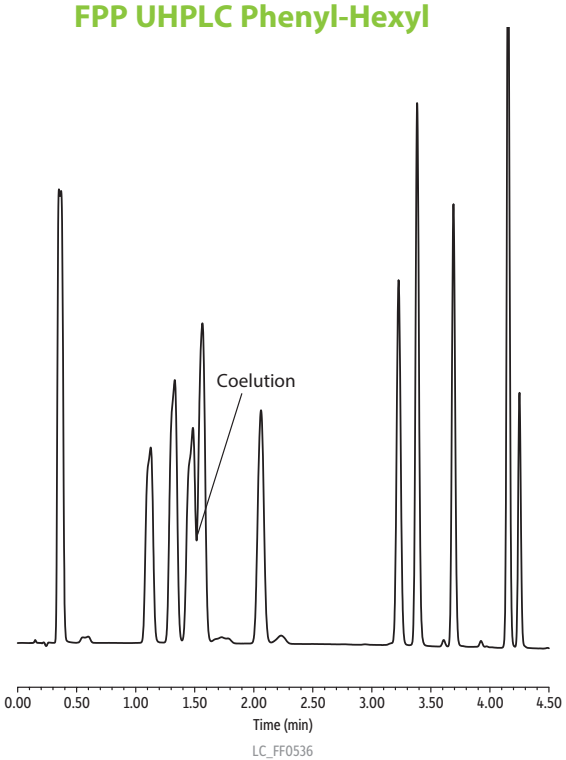


Peaks	t_R (min)
1. Sulfanilamide	0.41
2. Sulfadiazine	1.59
3. Sulfapyridine	1.84
4. Sulfathiazole	1.96
5. Sulfamerazine	2.14
6. Sulfamethazine	2.71
7. Sulfachlorpyridazine	3.29
8. Sulfadoxine	3.44
9. Sulfisoxazole	3.58
10. Sulfadimethoxine	3.98
11. Sulfaquinoxaline	4.08

Column: Raptor™ Biphenyl (cat.# 9309A5E); Dimensions: 50 mm x 3.0 mm ID; Particle Size: 2.7 µm; Pore Size: 90 Å; Temp.: 20 °C; **Sample:** Diluent: 0.1% formic acid in water; Conc.: 50 µg/mL; Inj. Vol.: 5 µL **Mobile Phase:** A: 0.1% formic acid in water, B: 0.1% formic acid in acetonitrile; **Gradient (%B):** 0.00 min (5%), 2.00 min (10%), 4.50 min (35%), 4.51 min (5%), 5.50 min (5%); **Flow:** 1.5 mL/min; **Detector:** Waters Acquity® PDA @ 260, 4.8 nm; **Instrument:** Waters Acquity® UPLC H-Class.



Peaks
1. Sulfanilamide
2. Sulfadiazine
3. Sulfapyridine
4. Sulfathiazole
5. Sulfamerazine
6. Sulfamethazine
7. Sulfachlorpyridazine
8. Sulfadoxine
9. Sulfisoxazole
10. Sulfadimethoxine
11. Sulfaquinoxaline



Column: Competitor B SPP C18; Dimensions: 50 mm x 3.0 mm ID; Particle Size: 2.6 µm; Pore Size: 100 Å; Temp.: 20 °C; **Sample:** Diluent: 0.1% formic acid in water; Conc.: 50 µg/mL; Inj. Vol.: 5 µL **Mobile Phase:** A: 0.1% formic acid in water, B: 0.1% formic acid in acetonitrile; **Gradient (%B):** 0.00 min (5%), 2.00 min (10%), 4.50 min (35%), 4.51 min (5%), 5.50 min (5%); **Flow:** 1.5 mL/min; **Detector:** Waters Acquity® PDA @ 260, 4.8 nm; **Instrument:** Waters Acquity® UPLC H-Class.

Column: Competitor D FPP Phenyl-Hexyl; Dimensions: 50 mm x 2.1 mm ID; Particle Size: 1.7 µm; Temp.: 20 °C; **Sample:** Diluent: 0.1% formic acid in water; Conc.: 50 µg/mL; Inj. Vol.: 5 µL **Mobile Phase:** A: 0.1% formic acid in water, B: 0.1% formic acid in acetonitrile; **Gradient (%B):** 0.00 min (5%), 2.00 min (10%), 4.50 min (35%), 4.51 min (5%), 5.50 min (5%); **Flow:** 0.75 mL/min; **Detector:** Waters Acquity® PDA @ 260, 4.8 nm; **Instrument:** Waters Acquity® UPLC H-Class. **Note:** Flow rate scaled to particle size

Accelerated Performance and Time-Tested Biphenyl Selectivity for Clinical Diagnostic, Pain, Pharma, and Environmental Labs

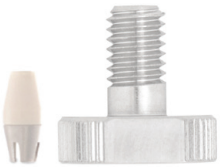
Raptor™ Biphenyl LC Columns

Length	2.1 mm cat.#	3.0 mm cat.#	4.6 mm cat.#
2.7 µm Columns			
30 mm	9309A32	9309A3E	9309A35
50 mm	9309A52	9309A5E	9309A55
100 mm	9309A12	9309A1E	9309A15
150 mm	9309A62	9309A6E	9309A65
5 µm Columns			
30 mm	—	930953E	—
50 mm	9309552	930955E	9309555
100 mm	9309512	930951E	9309515
150 mm	9309562	930956E	9309565
250 mm	—	—	9309575

EXP® Reusable Fittings for HPLC & UHPLC

for 10-32 fittings and 1/16" tubing

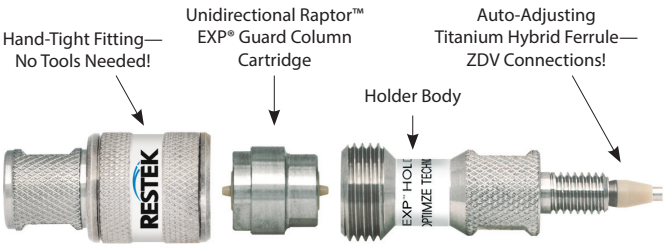
Effortlessly achieve 8,700+ psi HPLC seals by hand! (Wrench-tighten to 20,000+ psi.) Hybrid titanium/PEEK seal can be installed repeatedly without compromising your seal.



Description	qty.	cat.#
EXP Hand-Tight Fitting (Nut w/Ferrule)	ea.	25937
EXP Hand-Tight Fitting (Nut w/Ferrule)	10-pk.	25938
EXP Hand-Tight Nut (w/o Ferrule)	ea.	25939

Hybrid Ferrule U.S. Patent No. 8201854, Optimize Technologies. Optimize Technologies EXP Holders are Patent Pending. Other U.S. and Foreign Patents Pending. The EXP, Free-Turn, and the Opti- prefix are registered trademarks of Optimize Technologies, Inc.

Raptor™ EXP® Guard Cartridges



Protect your investment and extend the life of our already-rugged LC columns and change guard column cartridges by hand without breaking fluid connections—no tools needed!

EXP® Direct Connect Holder

Description	qty.	cat.#
EXP Direct Connect Holder for EXP Guard Cartridges (includes hex-head fitting & 2 ferrules)	ea.	25808

Raptor™ EXP® Guard Column Cartridges

Description	Particle Size	qty.	5 x 2.1 mm cat.#	5 x 3.0 mm cat.#	5 x 4.6 mm cat.#
Raptor Biphenyl EXP Guard Cartridge	2.7 µm	3-pk.	9309A0252	9309A0253	9309A0250
Raptor Biphenyl EXP Guard Cartridge	5 µm	3-pk.	930950252	930950253	930950250

Maximum cartridge pressure: 600 bar / 8,700 psi (2.7 µm) or 400 bar / 5,800 psi (5 µm)

Raptor™ SPP LC columns combine the speed of SPP with the resolution of USLC® technology. Learn more at **www.restek.com/raptor**

Experience *Selectivity Accelerated.* Order the Raptor™ Biphenyl today at **www.restek.com/raptor**

RESTEK®
Pure Chromatography

Questions about this or any other Restek® product?
Contact us or your local Restek® representative (www.restek.com/contact-us).

www.restek.com

Lit. Cat.# GNBR1891A-UNV

The Raptor™ Biphenyl Stationary Phase: Selectivity Accelerated

Landon Wiest, Ty Kahler, Vernon Bartlett, Sharon Lupo, Shun-Hsin Liang, Frances Carroll, Paul Connolly; Restek Corporation

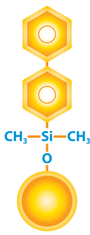
Abstract & Introduction

With Raptor™ LC columns, Restek chemists became the first to combine the speed of superficially porous particles (SPP) with the resolution of highly selective USLC® technology. This new breed of chromatographic column allows you to more easily achieve peak separation and faster analysis times without expensive UHPLC instrumentation.

Our top priority when developing our new SPP line was to create a version of our innovative Biphenyl phase. The Biphenyl ligand provides greater aromatic selectivity than commercially available phenyl-hexyl columns and a greater degree of dispersion than conventional phenyls. This unique selectivity mechanism allows greater retention of dipolar compounds, conjugated compounds, and compounds containing strong electron withdrawing groups. The industry-leading Biphenyl is Restek's most popular LC stationary phase because it is particularly adept at separating compounds that are hard to resolve or that elute early on C18 and other phenyl chemistries. Increasing retention of early-eluting compounds can limit ionization suppression, and the heightened selectivity helps eliminate the need for complex mobile phases that are not well-suited for MS detection.

Figure 1: Column Phase and Retention Properties

Column Description:



Stationary Phase Category:
Phenyl (L11)

Ligand Type:
Biphenyl

Particle:
2.7 µm superficially porous silica (SPP or "core-shell")

Pore Size:
90 Å

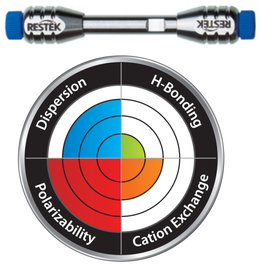
Surface Area:
150 m^2/g

Recommended Usage:
pH Range: 1.5–8.0
Maximum Temperature: 80 °C
Maximum Pressure: 600 bar (8,700 psi)

Properties:
- Increased retention for dipolar, unsaturated, or conjugated solutes.
- Enhanced selectivity when used with methanolic mobile phase.
- Ideal for increasing sensitivity and selectivity in LC-MS analyses.

Switch to a Biphenyl when:
- Limited selectivity is observed on a C18.
- You need to increase retention of hydrophilic aromatics.

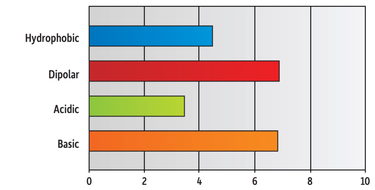
Column Interaction Profile:



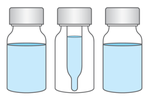
Defining Solute Interactions:
- Polarizability
- Dispersion

Complementary Solute Interaction:
- Cation exchange

Solute Retention Profile:



Target Analyte Structures:
- Aromatic
- Dipolar

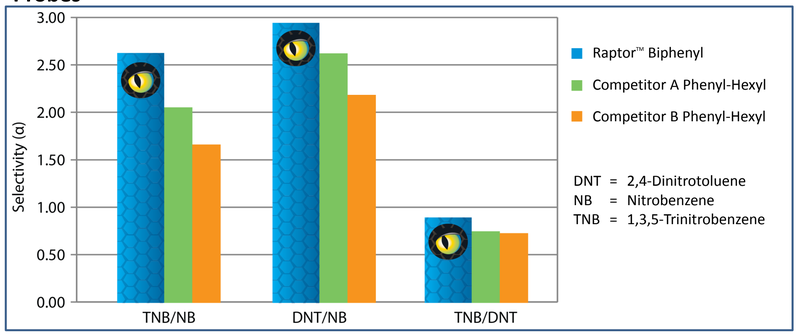


Target Analyte Functionalities:
- Hydrophilic aromatics
- Strong dipoles
- Lewis acids
- Dipolar, unsaturated, or conjugated compounds
- Fused-ring compounds with electron withdrawing groups

Why Biphenyl?

SPP core-shell columns commonly employ traditional phenyl-hexyl stationary phases, but the innovative Biphenyl ligand, developed by Restek's chemists, is the next generation of phenyl column chemistry. It provides greater aromatic selectivity than commercially available phenyl-hexyl columns and a greater degree of dispersion than conventional phenyls. As a result, the Raptor™ Biphenyl allows you to more easily separate compounds like aromatics, which elute early or are hard to separate on C18 or other phenyl chemistries.

Figure 2: Biphenyl Phase Offers The Best Resolution For Aromatic Selectivity Probes [1]

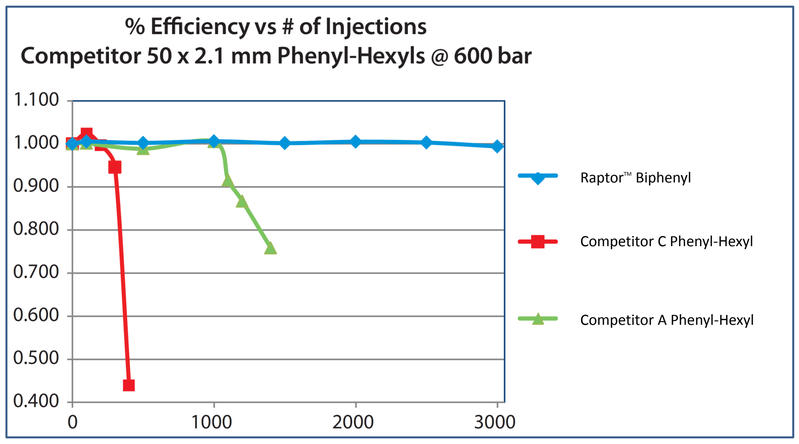


[1] In-house testing based on: M. R. Euerby, P. Petersson, W. Campbell, W. Roe, Chromatographic classification and comparison of commercially available reversed-phase liquid chromatographic columns containing phenyl moieties using principal component analysis, J. Chromatogr. A 1154 (2007) 138–151.

Mechanical Stability

One of the greatest advantages of an SPP column is the ability to achieve fast, efficient separations by operating at higher linear velocities than are possible with a conventional fully porous particle column. However, these higher velocities can also result in higher back pressures. Raptor™ columns were designed to handle the increased pressures needed to achieve *Selectivity Accelerated*, and handle it far better than other SPP columns on the market.

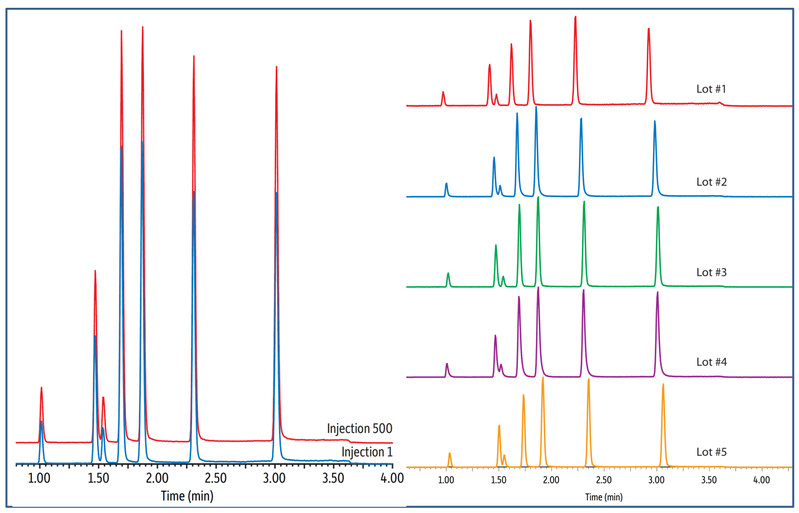
Figure 3: Raptor™ Biphenyl Columns Were Designed For Higher Pressure Applications



Reproducibility

To help keep your productivity high and your lab budget low, we know that Raptor™ Biphenyl columns must produce exceptional selectivity and fast analysis times not just once, but every time. Ruggedness and repeatability are essential, which is why from the silica and the bonding technique, to the packing process and hardware, every decision that went into creating this column was made to ensure superlative reproducibility, from injection to injection and from lot to lot. We also adopted stringent quality control (QC) specifications to guarantee the retention time stability you need.

Figure 4: Raptor™ Biphenyl Columns are Reproducible Injection to Injection and Lot to Lot

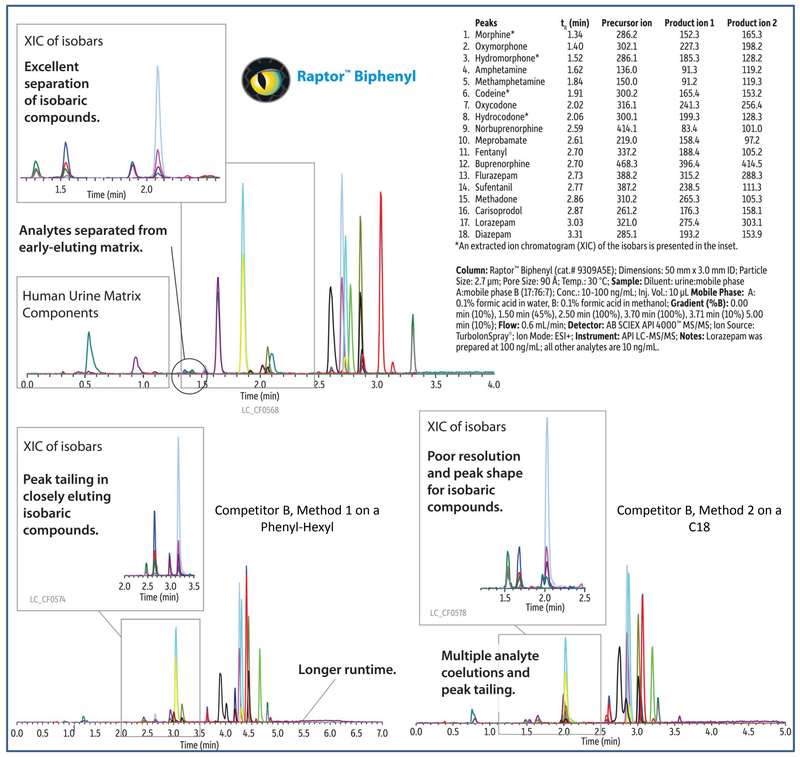


RAPTOR™ BIPHENYL COLUMNS COMBINE THE SELECTIVITY OF PHASE CHEMISTRY WITH THE SPEED OF SPP PARTICLES

For nearly a decade, the Restek® Biphenyl has been the column of choice for clinical testing because of its ability to provide highly retentive, selective, and rugged reversed-phase separations of drugs and metabolites. By bringing the speed of SPP to the Biphenyl family, the Raptor™ Biphenyl provides clinical labs with an even faster option for a wide variety of clinical assays.

Pain panel applications can be difficult to optimize and reproduce due to the limited selectivity of C18 and phenyl-hexyl phases, but not on the Raptor™ Biphenyl. Perform your pain panel analysis with a 5-minute cycle time and complete isobaric resolution using Raptor™ Biphenyl columns. Popular competitor methods have tailing peaks, longer run times, and co-elutions; only the Raptor™ Biphenyl exhibits the selectivity and performance needed for these critical analyses.

Figure 5: Selected Pain Panel Medications on Raptor™ Biphenyl



Peaks	t_R (min)	Precursor ion	Product ion 1	Product ion 2
1. Morphine*	1.34	286.2	152.3	165.3
2. Oxymorphone	1.40	302.1	227.3	198.2
3. Hydromorphone*	1.52	286.1	185.3	128.2
4. Amphetamine	1.62	136.0	91.3	119.2
5. Methamphetamine	1.84	150.0	91.2	119.3
6. Codeine*	1.91	300.2	165.4	153.2
7. Oxycodone	2.02	316.1	241.3	256.4
8. Hydrocodone*	2.06	300.1	199.3	128.3
9. Norbuprenorphine	2.59	414.1	83.4	101.0
10. Meprobamate	2.61	219.0	158.4	97.2
11. Fentanyl	2.70	337.2	188.4	105.2
12. Buprenorphine	2.70	468.3	396.4	414.5
13. Flurazepam	2.73	388.2	315.2	288.3
14. Sufentanil	2.77	387.2	238.5	111.3
15. Methadone	2.86	310.2	265.3	105.3
16. Carisoprodol	2.87	261.2	176.3	158.1
17. Lorazepam	3.03	321.0	275.4	303.1
18. Diazepam	3.31	285.1	193.2	153.9

*An extracted ion chromatogram (XIC) of the isobars is presented in the inset.

Column: Raptor™ Biphenyl (cat.# 9309A5E); Dimensions: 50 mm x 3.0 mm ID; Particle Size: 2.7 µm; Pore Size: 90 Å; Temp.: 30 °C; **Sample:** Diluent: urine:mobile phase A:mobile phase B (1T:76:7); Conc.: 10–100 ng/mL; Inj. Vol.: 10 µL **Mobile Phase:** A: 0.1% formic acid in water, B: 0.1% formic acid in methanol; **Gradient (%B):** 0.00 min (10%), 1.50 min (45%), 2.50 min (100%), 3.70 min (100%), 3.71 min (10%) 5.00 min (10%); **Flow:** 0.6 mL/min; **Detector:** AB SCIEX API 4000™ MS/MS; Ion Source: TurbolonSpray®; Ion Mode: ESI+; **Instrument:** API LC-MS/MS; **Notes:** Lorazepam was prepared at 100 ng/mL; all other analytes are 10 ng/mL.

Analyzing catecholamine compounds can be problematic by liquid chromatography and often forces chemists to turn to aqueous normal phase, HILIC, or ion-pairing reagents that are not well-suited for mass spectrometry. Raptor™ Biphenyl columns easily retain and separate these difficult compounds using simple, MS-friendly mobile phases in a time frame that maximizes your productivity. Raptor™ Biphenyl also offers fast, efficient analysis of non-steroidal anti-inflammatory drugs (NSAIDs) with LC-MS friendly solvents.

Figure 6: Catecholamines and NSAIDs Show Retention and Selectivity on Raptor™ Biphenyl

Peaks	t_R (min)
1. Norepinephrine	0.85
2. Epinephrine	1.11
3. L-Dihydroxyphenylalanine	1.21
4. Dopamine	1.40
5. Tyrosine	1.59
6. 3-Methoxytyramine*	2.33
7. Serotonin	2.38
8. (3,4-Dihydroxyphenyl)acetic acid*	2.79
9. 5-Hydroxyindoleacetic acid**	3.16
10. Homovanillic acid*	3.22

* Dopamine metabolite, ** serotonin metabolite

Column: Raptor™ Biphenyl (cat.# 9309A62); Dimensions: 150 mm x 2.1 mm ID; Particle Size: 2.7 µm; Pore Size: 90 Å; Temp.: 30 °C; **Sample:** Diluent: water; Conc.: 50 µg/mL; Inj. Vol.: 1 µL **Mobile Phase:** A: 0.1% formic acid in water, B: 0.1% formic acid in acetonitrile; **Gradient (%B):** 0.00 min (0%), 4.00 min (70%), 4.01 min (0%), 5.00 min (0%); **Flow:** 0.4 mL/min; **Detector:** Waters Acquity® PDA @ 280 nm; **Instrument:** Waters Acquity® UPLC H-Class.

Peaks	t_R (min)	Conc. (µg/mL)
1. Piroxicam	1.39	25
2. Sulindac	1.60	25
3. Naproxen	1.85	25
4. Fenoprofen	2.44	100
5. Ibuprofen	2.54	200
6. Diclofenac	2.96	25
7. Indomethacin	3.08	25

Column: Raptor™ Biphenyl (cat.# 9309A12); Dimensions: 100 mm x 2.1 mm ID; Particle Size: 2.7 µm; Pore Size: 90 Å; Temp.: 40 °C; **Sample:** Diluent: water:acetonitrile (65:35); Conc.: 25-200 µg/mL; Inj. Vol.: 2 µL **Mobile Phase:** A: 0.1% formic acid in water, B: 0.1% formic acid in acetonitrile; **Gradient (%B):** 0.00 min (35%), 4.00 min (60%), 4.01 min (35%), 5.00 min (35%); **Flow:** 0.6 mL/min; **Detector:** Waters Acquity® PDA @ 270 nm; **Instrument:** Waters Acquity® UPLC H-Class.

Conclusions

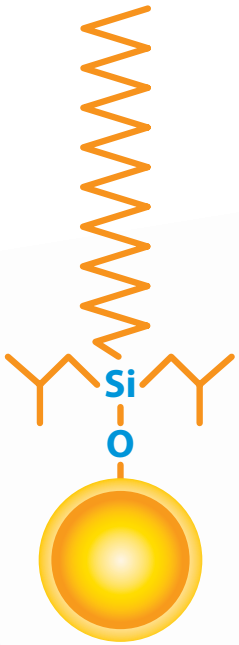
Raptor™ LC columns offer the speed of superficially porous particles with the resolution of the highly selective Biphenyl stationary phase. This new breed of chromatographic column allows you to more easily achieve peak separation and faster analysis times without expensive UHPLC instrumentation.

Stationary Phase: **ARC-18**

Raptor™ LC Columns

Selectivity Accelerated

Ahead of the Curve for Large, Multiclass Lists by Mass Spec



RESTEK® Pure Chromatography **www.restek.com/raptor**

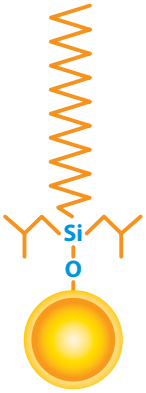
The Raptor™ ARC-18 Column

With Raptor™ LC columns, Restek chemists became the first to combine the speed of superficially porous particles (also known as SPP or "core-shell" particles) with the resolution of highly selective USLC® technology. This new breed of chromatographic column allows you to more easily achieve peak separation and faster analysis times without expensive UHPLC instrumentation.

The birth of Restek's Raptor™ SPP LC column line began with the innovative Biphenyl phase, but it has quickly grown to include a new Restek® phase: the ARC-18. Designed and intended specifically for use on LC-MS/MS systems, the Raptor™ ARC-18 column features a well-balanced retention profile without the drawbacks of using an ordinary C18 in the harsh, acidic mobile phases needed for mass spectrometry (MS). Even after extended use in these low-pH (≤ 2.0) conditions, the sterically protected ARC-18 offers consistent retention, peak shape, and response for charged bases, neutral acids, small polar compounds, and more.

For the rapid analysis of large, multiclass assays by LC-MS/MS, the acid-resistant Raptor™ ARC-18 truly is *ahead of the curve.*

Column Description:



Stationary Phase Category:
C18, octadecylsilane (L1)

Ligand Type:
Sterically protected C18

Particle:
2.7 µm or 5 µm superficially porous silica (SPP or "core-shell")

Pore Size:
90 Å

Surface Area:
150 m^2/g (2.7 µm)
or 100 m^2/g (5 µm)

Recommended Usage:
pH Range: 1.0–8.0

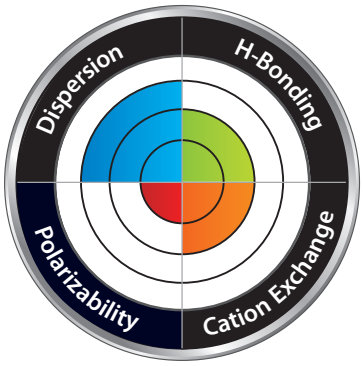
Maximum Temperature: 80 °C

Maximum Pressure: 600 bar / 8,700 psi (2.7 µm)
or 400 bar / 5,800 psi (5 µm)

Properties:
- Well-balanced retention profile.
- Sterically protected to resist harsh, low-pH mobile phases.
- Ideal for use with sensitive detectors like mass spec.

Switch to an ARC-18 when:
- You are analyzing large, multiclass lists by LC-MS/MS.
- Strongly acidic (pH 1–3) mobile phases are required.

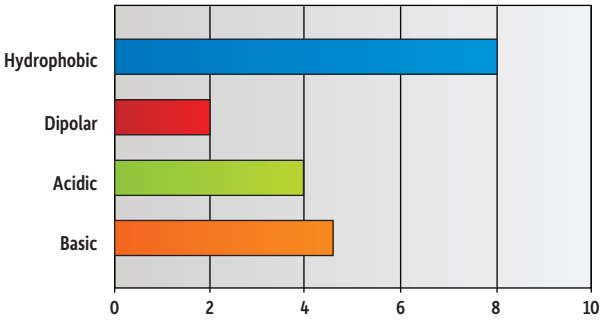
Column Interaction Profile:



Defining Solute Interaction:
- Dispersion

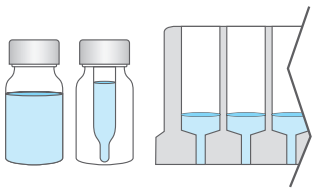
Complementary Solute Interactions:
- Hydrogen bonding
- Cation exchange

Solute Retention Profile:



Target Analyte Structure:
- Hydrocarbons

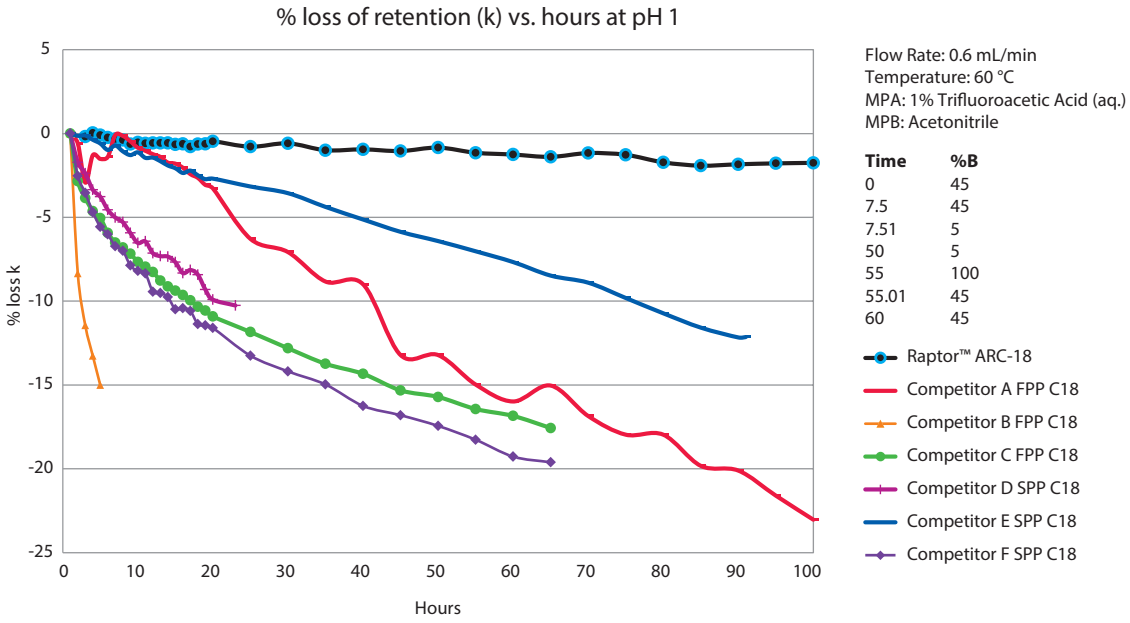
Target Analyte Functionalities:
- Hydrophobic compounds
- Protonated bases



A New Proprietary Bonded Phase Born for LC-MS/MS

The new Raptor™ ARC-18 column was designed to stand up to even the harshest acidic MS conditions. It utilizes a proprietary bonding procedure that arranges our sterically protected ligand to resist acid hydrolysis and, therefore, also resist phase degradation and bleed. This cutting-edge column lets you increase ionization and boost sensitivity in your mass spec by using low-pH mobile phases—without the fear of retention drift over time. ARC-18 columns maintain a stable retention profile (Figure 1) in mobile phases well under pH 2.0.

Figure 1: Steric protection helps the Raptor™ ARC-18 column endure low-pH MS mobile phases without sacrificing retention.

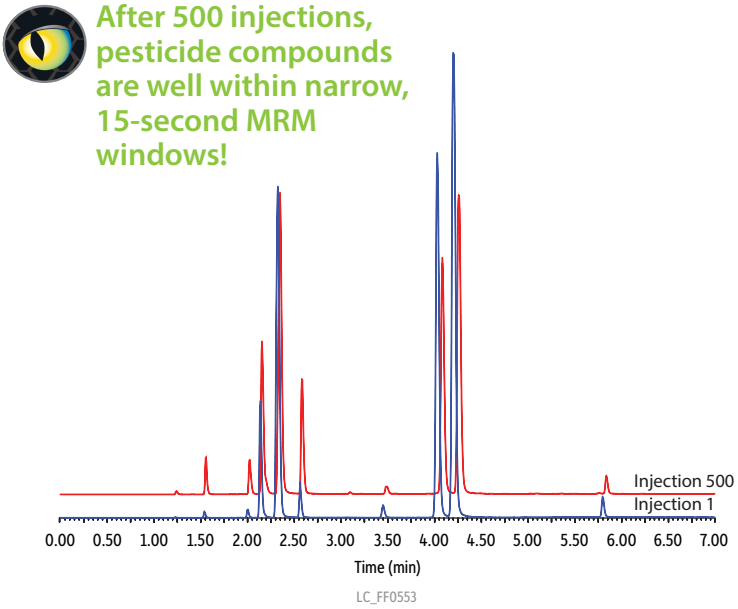


The New Standard for Reproducibility for SPP Core-Shell Columns

To keep your productivity high and your lab expenses low, we know that Raptor™ ARC-18 columns must produce exceptional selectivity and fast analysis times not just once, but every time. Ruggedness and repeatability are essential, which is why from the silica and the bonding technique, to the packing process and upgraded hardware, every decision that went into creating this column was made to ensure superlative reproducibility, from injection to injection (Figure 2) and from lot to lot (Figure 3). We also adopted new quality control (QC) specifications to guarantee the retention time stability you need for worry-free analyses.

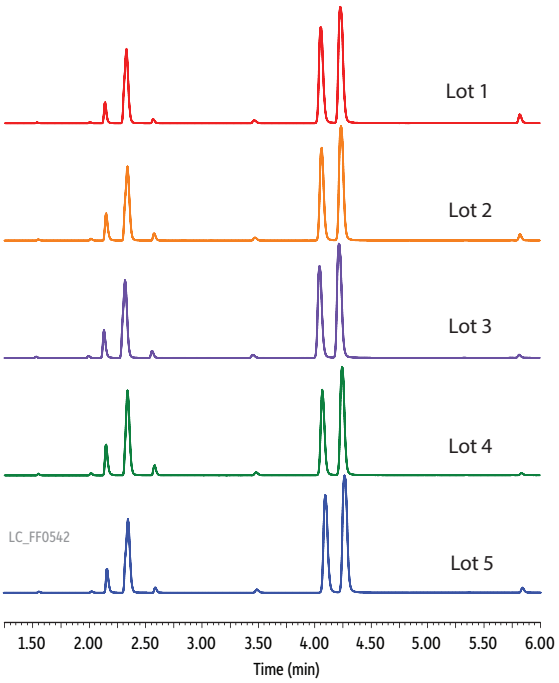
One of the greatest advantages of an SPP column is the ability to operate at higher linear velocities without losing efficiency as you would with a conventional fully porous particle column. But, these higher velocities can also generate higher backpressures that rob you of performance. Like all Raptor™ columns, our new ARC-18 can handle increased pressures, and handle them longer than other manufacturers' SPP columns, to help you achieve ***Selectivity Accelerated*** while offering outstanding reproducibility and maintaining efficiency—even in aggressive MS conditions.

Figure 2: Even after hundreds of injections with a highly acidic mobile phase like 0.2% formic acid, a Raptor™ ARC-18 column will provide consistent, reliable data.



Column: Raptor™ ARC-18 (cat.# 9314A12); Dimensions: 100 mm x 2.1 mm ID; Particle Size: 2.7 µm; Temp.: 50 °C; **Sample:** LC multiresidue pesticide standard #1 (cat.# 31972); Diluent: Water; Conc.: 20 ng/mL; Inj. Vol.: 5 µL; **Mobile Phase:** A: Water + 2 mM ammonium formate + 0.2% formic acid, B: Methanol + 2 mM ammonium formate + 0.2% formic acid; **Gradient (%B):** 0.00 min (5%), 2.00 min (60%), 4.00 min (75%), 6.00 min (100%), 7.00 (100%), 7.01 min (5%), 9.50 (5%); **Flow:** 0.4 mL/min; **Detector:** Waters Xevo TQ-S; Ion Source: Waters Zspray™ ESI; Ion Mode: ESI+; Mode: MRM; **Instrument:** Waters ACQUITY UPLC® I-Class

Figure 3: From one lot to the next, every Raptor™ ARC-18 column you purchase will perform the same.



Excellent lot-to-lot reproducibility helps ensure longevity for critical workflows.

Column: Raptor™ ARC-18 (cat.# 9314A12); Dimensions: 100 mm x 2.1 mm ID; Particle Size: 2.7 µm; Temp.: 50 °C; **Sample:** LC multiresidue pesticide standard #1 (cat.# 31972); Diluent: Water; Conc.: 20 ng/mL; Inj. Vol.: 5 µL; **Mobile Phase:** A: Water + 2 mM ammonium formate + 0.2% formic acid, B: Methanol + 2 mM ammonium formate + 0.2% formic acid; Max Pressure: 525 bar; **Gradient (%B):** 0.00 min (5%), 2.00 min (60%), 4.00 min (75%), 6.00 min (100%), 7.00 (100%), 7.01 min (5%), 9.50 (5%); **Flow:** 0.4 mL/min; **Detector:** Waters Xevo TQ-S; Ion Source: Waters Zspray™ ESI; Ion Mode: ESI+; Mode: MRM; **Instrument:** Waters ACQUITY UPLC® I-Class

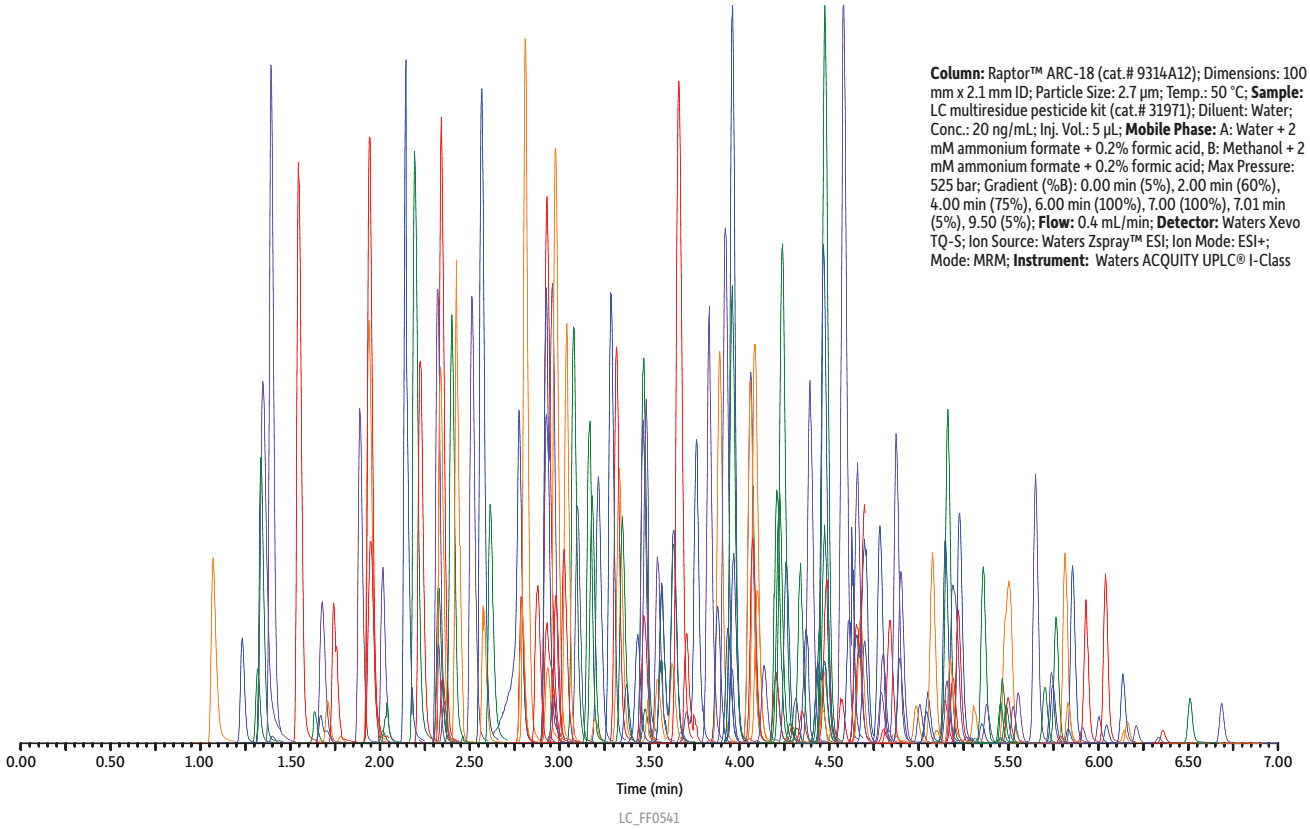
Well-Balanced Retention to Quickly Separate Large, Multiclass Analyte Lists

In order to analyze large lists of compounds, especially across multiple classes, your column must be capable of spreading analytes out over the gradient to ensure accurate detector response and quantitation. In designing the Raptor™ ARC-18 column, we adjusted our bonding procedures to form an ideal ligand density that offers balanced retention for the rapid analysis of large, multiclass assays. As shown in Figure 4, even a 204-compound pesticide screen can be reliably completed in just 9.5 minutes. The Raptor™ ARC-18 column exhibits the balanced retention, selectivity, and performance needed for critical multiclass workflows in any industry or lab.

Figure 4: With its balanced retention profile, the Raptor™ ARC-18 column is ideally suited to analyze large, cross-class compound lists.

204 pesticides in just 9.5 minutes!

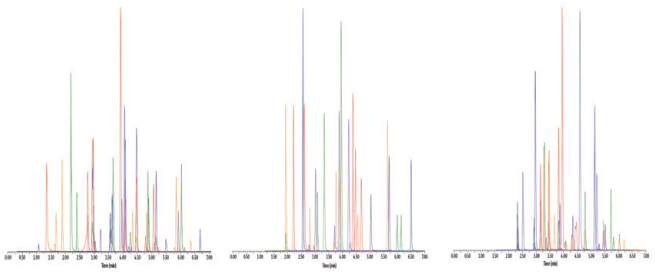
For a complete compound list, visit **www.restek.com/lc-multiresidue** select the LC Multiresidue Pesticide Kit (cat.# 31971).



Column: Raptor™ ARC-18 (cat.# 9314A12); Dimensions: 100 mm x 2.1 mm ID; Particle Size: 2.7 µm; Temp.: 50 °C; **Sample:** LC multiresidue pesticide kit (cat.# 31971); Diluent: Water; Conc.: 20 ng/mL; Inj. Vol.: 5 µL; **Mobile Phase:** A: Water + 2 mM ammonium formate + 0.2% formic acid, B: Methanol + 2 mM ammonium formate + 0.2% formic acid; Max Pressure: 525 bar; Gradient (%B): 0.00 min (5%), 2.00 min (60%), 4.00 min (75%), 6.00 min (100%), 7.00 (100%), 7.01 min (5%), 9.50 (5%); **Flow:** 0.4 mL/min; **Detector:** Waters Xevo TQ-S; Ion Source: Waters Zspray™ ESI; Ion Mode: ESI+; Mode: MRM; **Instrument:** Waters ACQUITY UPLC® I-Class

Note:
When combining a large number of compounds with different chemical functionalities, mix stability can be an issue. In formulating our LC multiresidue pesticide standard kit (cat.# 31971), we extensively studied the 204 compounds involved, then grouped them into as few mixes as possible while still ensuring maximum long-term stability and reliability. For quantitative analysis, we recommend analyzing each mix separately to ensure accurate results for every compound.

To view separate chromatograms of each mix, visit **www.restek.com/lc-multiresidue**



Speed Up Challenging Analyses with Simple Mobile Phases and Methods

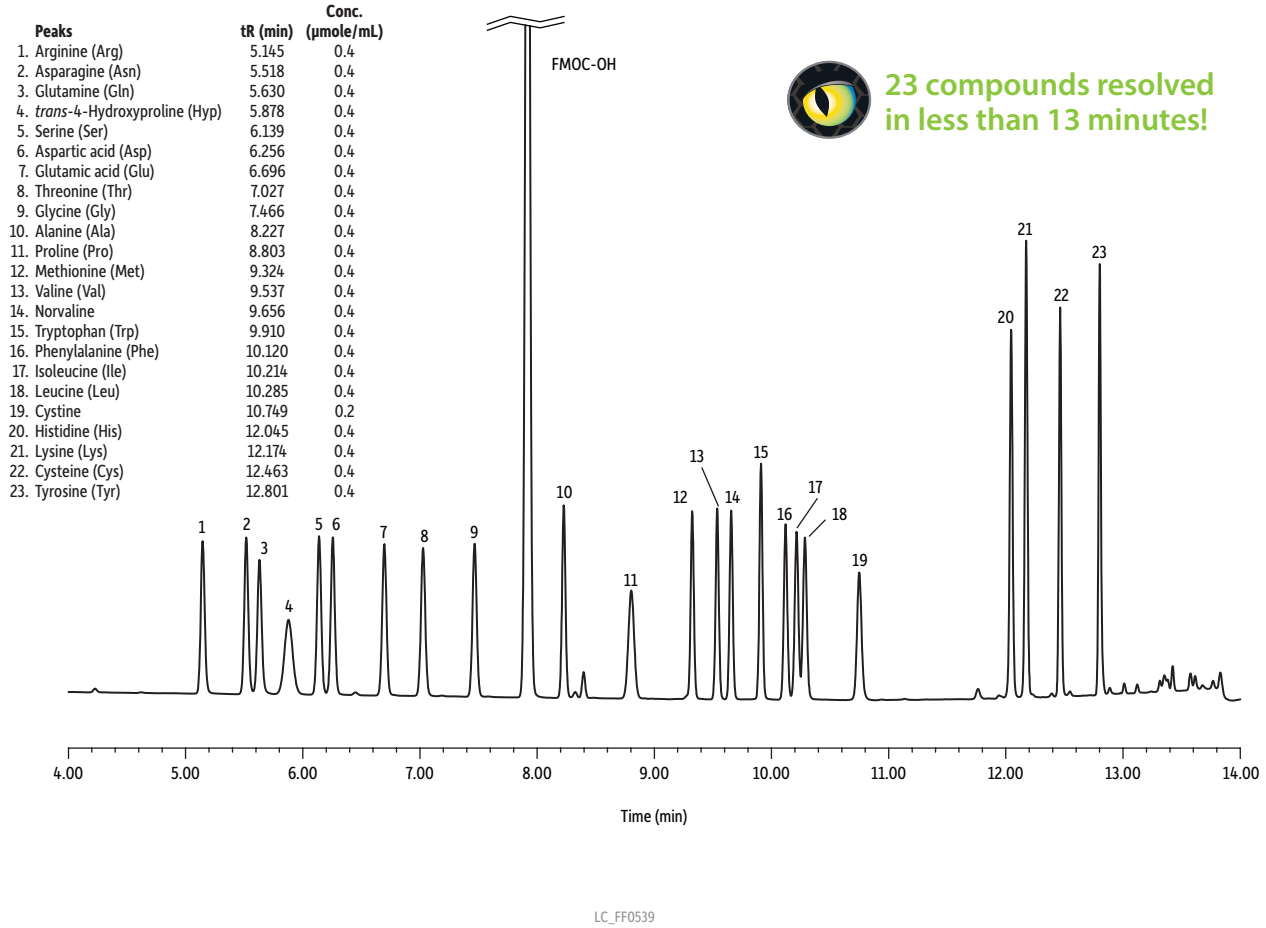
From food safety to bioanalytical work, getting reliable, reproducible data by LC often requires specialty instrumentation or columns, complex mobile phases, or long runs. Instead of wasting time and resources—and making your job harder in the process—you can greatly improve your productivity by selecting a better column for your existing instrumentation. By switching to a Raptor™ ARC-18 column for your LC-MS/MS analyses, you can increase your sample throughput and make your job easier by maintaining, or even improving, your data quality using simple mobile phases and a typical HPLC system. Put the ARC-18 to work in your lab today to experience ***Selectivity Accelerated!***

Amino Acids with Standard Columns on UV or Mass Spec

Instead of purchasing specialty amino acid columns or dedicated analyzers, use Raptor™ ARC-18 columns with your standard HPLC and UV detector to perform routine analyses of 23 common amino acids. Using 9-fluorenylmethyl-chloroformate (FMOC) derivatization and simple mobile phases, you can separate, detect, and quantitate amino acids without specialty instrumentation (Figure 5). Because of the ARC-18's compatibility with MS-friendly mobile phases, these UV methods can also be easily transferred to your mass spectrometer. And since it is a Raptor™ column, it will hold up to extended use without losing selectivity or performance.

Figure 5: Raptor™ ARC-18 columns exhibit excellent retention and resolution of amino acids derivatized with FMOC, including isomers leucine and isoleucine.

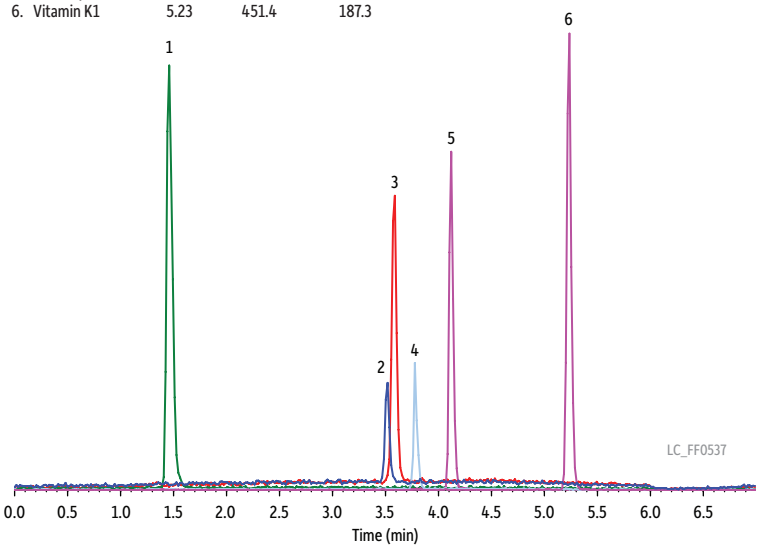
Peaks	tR (min)	Conc. (µmole/mL)
1. Arginine (Arg)	5.145	0.4
2. Asparagine (Asn)	5.518	0.4
3. Glutamine (Gln)	5.630	0.4
4. *trans*-4-Hydroxyproline (Hyp)	5.878	0.4
5. Serine (Ser)	6.139	0.4
6. Aspartic acid (Asp)	6.256	0.4
7. Glutamic acid (Glu)	6.696	0.4
8. Threonine (Thr)	7.027	0.4
9. Glycine (Gly)	7.466	0.4
10. Alanine (Ala)	8.227	0.4
11. Proline (Pro)	8.803	0.4
12. Methionine (Met)	9.324	0.4
13. Valine (Val)	9.537	0.4
14. Norvaline	9.656	0.4
15. Tryptophan (Trp)	9.910	0.4
16. Phenylalanine (Phe)	10.120	0.4
17. Isoleucine (Ile)	10.214	0.4
18. Leucine (Leu)	10.285	0.4
19. Cystine	10.749	0.2
20. Histidine (His)	12.045	0.4
21. Lysine (Lys)	12.174	0.4
22. Cysteine (Cys)	12.463	0.4
23. Tyrosine (Tyr)	12.801	0.4



Column: Raptor™ ARC-18 (cat.# 9314A1E); Dimensions: 100 mm x 3 mm ID; Particle Size: 2.7 µm; Temp.: 30 °C; **Sample:** Diluent: 0.1 N HCl; Conc.: 0.4 µmole/mL for each amino acid (0.2 µmole/mL for cystine); Inj. Vol.: 1 µL; **Mobile Phase:** A: 0.1% Formic acid + 20 mM ammonium formate in water, B: 0.1% Formic acid + 10 mM ammonium formate in 90:10 acetonitrile:water; **Gradient (%B):** 0.00 min (20%), 6.25 min (40%), 9.00 min (60%), 10.00 min (60%), 13.00 (100%), 13.01 min (20%), 15.00 (20%); **Flow:** 0.8 mL/min; **Detector:** UV/Vis @ 265, 4.8 nm; **Instrument:** Waters Acquity® UPLC H-Class; **Notes:** Derivatization reaction: 50 µL amino acid mix + 100 µL 0.2 N borate buffer (pH 10.0) + 50 µL 15 mM 9-fluorenylmethyl-chloroformate solution + 50 µL acetonitrile; The injection can be performed after 5 minutes of reaction time.

Figure 6: The ARC-18 makes quick work of fat-soluble vitamins A, D, E, and K by LC-MS/MS

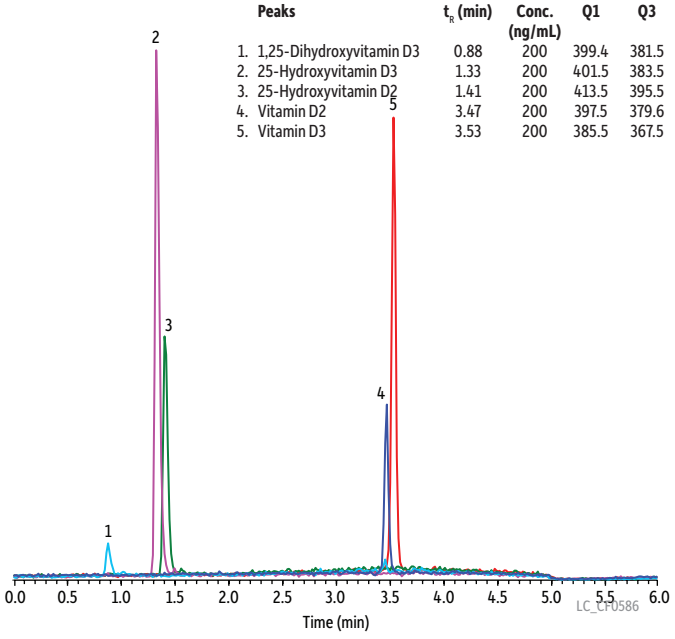
	Peaks	t_R (min)	Precursor Ion	Product Ion
1.	Retinol	1.46	269.4	93.3
2.	Vitamin D2	3.52	397.5	379.6
3.	Vitamin D3	3.58	385.5	367.5
4.	γ-Tocopherol	3.78	417.6	151.4
5.	α-Tocopherol	4.12	431.7	165.4
6.	Vitamin K1	5.23	451.4	187.3



Column: Raptor™ ARC-18 (cat.# 9314A12); Dimensions: 100 mm x 2.1 mm ID; Particle Size: 2.7 µm; Temp.: 40 °C; **Sample:** Diluent: Methanol; Conc.: 100 ng/mL; Inj. Vol.: 5 µL; **Mobile Phase:** A: 0.1% Formic acid + 5 mM ammonium formate in water, B: 0.1% Formic acid + 5 mM ammonium formate in methanol; Max Pressure: 190 bar; **Gradient (%B):** 0.00 min (90%), 4.0 min (100%), 5.0 min (100%), 5.01 min (90%), 7.0 (90%); **Flow:** 0.5 mL/min; **Detector:** ABSCIEX API 4000™; Ion Source: TurboIonSpray®; Ion Mode: ESI+; Mode: MRM; **Instrument:** Shimadzu UFLCXR

Figure 7: The ARC-18 also resolves vitamin D metabolites by LC-MS/MS with the same column and mobile phases

	Peaks	t_R (min)	Conc. (ng/mL)	Q1	Q3
1.	1,25-Dihydroxyvitamin D3	0.88	200	399.4	381.5
2.	25-Hydroxyvitamin D3	1.33	200	401.5	383.5
3.	25-Hydroxyvitamin D2	1.41	200	413.5	395.5
4.	Vitamin D2	3.47	200	397.5	379.6
5.	Vitamin D3	3.53	200	385.5	367.5



Column: Raptor™ ARC-18 (cat.# 9314A12); Dimensions: 100 mm x 2.1 mm ID; Particle Size: 2.7 µm; Temp.: 40 °C; **Sample:** Diluent: Methanol; Conc.: 200 ng/mL; Inj. Vol.: 5 µL; **Mobile Phase:** A: 0.1% Formic acid + 5 mM ammonium formate in water B: 0.1% Formic acid + 5 mM ammonium formate in methanol; **Gradient (%B):** 0.00 min (90%), 4.00 min (100%), 4.01 min (90%), 6.00 (90%); **Flow:** 0.5 mL/min; **Detector:** ABSCIEX API 4000™; Ion Source: TurboIonSpray®; Ion Mode: ESI+; **Instrument:** Shimadzu UFLCXR

Fat-Soluble Vitamins and Metabolites with Accelerated Run Times

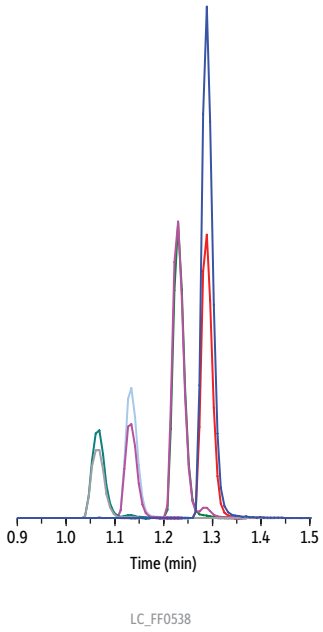
Separating fat-soluble vitamins by LC can be time-consuming. The Raptor™ ARC-18 column, however, can analyze these difficult compounds using reversed-phased chromatography (RPC) in less time than traditional columns to increase productivity. The ARC-18 also stands up to the low-pH, MS-friendly mobile phases that promote ionization and fast separation while providing the balanced retention profile necessary for this important food safety workflow (Figure 6). Plus, in the bioanalytical arena, the ARC-18 can quantitate the metabolites of vitamin D using the same column and mobile phases (Figure 7).

Toxic Substances in Agricultural Matrices Using LC

When it comes to analyzing toxic substances in agricultural matrices (e.g., aflatoxins in wheat), speed is of paramount importance. A Raptor™ ARC-18 column retains *and* separates these compounds with simple mobile phases—in a rapid time frame that maximizes your productivity (Figure 8).

Figure 8: The ARC-18 elutes four common aflatoxins in under 1.5 minutes with an overall cycle time of 2.5 minutes!

	Peaks	t_R (min)	Q1	Q3 Quantifier	Q3 Qualifier
1.	Aflatoxin G2	1.07	331.1	245.1	189.1
2.	Aflatoxin G1	1.13	329.0	243.1	200.1
3.	Aflatoxin B2	1.23	315.0	259.1	287.1
4.	Aflatoxin B1	1.29	313.0	285.1	241.1



Column: Raptor™ ARC-18 (cat.# 9314A5E); Dimensions: 50 mm x 3.0 mm ID; Particle Size: 2.7 µm; Temp.: 45 °C; **Sample:** Diluent: Acetonitrile:water (50:50); Conc.: 100 ng/mL; Inj. Vol.: 10 µL; **Mobile Phase:** A: 5 mM Ammonium formate + 0.1% formic acid in water; B: 0.1% Formic acid in methanol; Gradient (%B): 0.00 min (35%), 1.50 min (95%), 1.51 min (35%), 2.50 (35%); **Flow:** 0.700 mL/min; **Detector:** Applied Biosystems/MDS Sciex LC-MS/MS; Ion Source: TurboIonSpray®; Ion Mode: ESI+; **Instrument:** Shimadzu UFLCXR

For Consistent Retention, Peak Shape, and Response with Mass Spec, Grab the Column that Thrives in Low pH Conditions

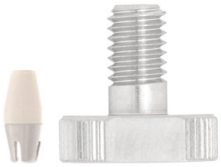
Raptor™ ARC-18 LC Columns

Length	2.1 mm cat.#	3.0 mm cat.#	4.6 mm cat.#
2.7 µm Columns			
30 mm	9314A32	9314A3E	9314A35
50 mm	9314A52	9314A5E	9314A55
100 mm	9314A12	9314A1E	9314A15
150 mm	9314A62	9314A6E	9314A65
5 µm Columns			
30 mm	—	931453E	—
50 mm	9314552	931455E	9314555
100 mm	9314512	931451E	9314515
150 mm	9314562	931456E	9314565
250 mm	—	—	9314575

EXP® Reusable Fittings for HPLC & UHPLC

for 10-32 fittings and 1/16" tubing

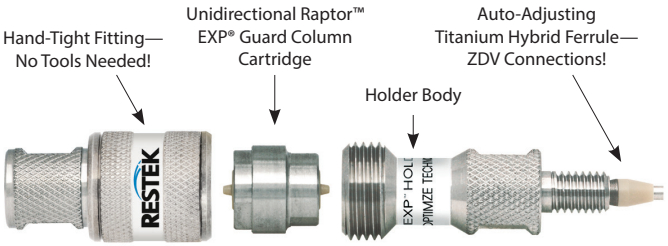
Effortlessly achieve 8,700+ psi HPLC seals by hand! (Wrench-tighten to 20,000+ psi.) Hybrid titanium/PEEK seal can be installed repeatedly without compromising your seal.



Description	qty.	cat.#
EXP Hand-Tight Fitting (Nut w/Ferrule)	ea.	25937
EXP Hand-Tight Fitting (Nut w/Ferrule)	10-pk.	25938
EXP Hand-Tight Nut (w/o Ferrule)	ea.	25939

Hybrid Ferrule U.S. Patent No. 8201854, Optimize Technologies. Optimize Technologies EXP Holders are Patent Pending. Other U.S. and Foreign Patents Pending. The EXP, Free-Turn, and the Opti- prefix are registered trademarks of Optimize Technologies, Inc.

Raptor™ EXP® Guard Cartridges



Protect your investment and extend the life of our already-rugged LC columns and change guard column cartridges by hand without breaking fluid connections—no tools needed!

EXP® Direct Connect Holder

Description	qty.	cat.#
EXP Direct Connect Holder for EXP Guard Cartridges (includes hex-head fitting & 2 ferrules)	ea.	25808

Raptor™ EXP® Guard Column Cartridges

Description	Particle Size	qty.	5 x 2.1 mm cat.#	5 x 3.0 mm cat.#	5 x 4.6 mm cat.#
Raptor ARC-18 EXP Guard Cartridge	2.7 µm	3-pk.	9314A0252	9314A0253	9314A0250
Raptor ARC-18 EXP Guard Cartridge	5 µm	3-pk.	931450252	931450253	931450250

Maximum cartridge pressure: 600 bar / 8,700 psi (2.7 µm) or 400 bar / 5,800 psi (5 µm)

Raptor™ SPP LC columns combine the speed of SPP with the resolution of USLC® technology. Learn more at **www.restek.com/raptor**

Experience *Selectivity Accelerated.* Order the Raptor™ ARC-18 today at **www.restek.com/raptor**

RESTEK®
Pure Chromatography

Questions about this or any other Restek® product?
Contact us or your local Restek® representative (www.restek.com/contact-us).

www.restek.com

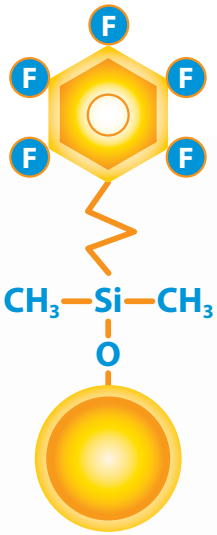
Lit. Cat.# GNBR1970B-UNV

Stationary Phase: **FluoroPhenyl**

Raptor™ LC Columns

Selectivity Accelerated

Get the Power of HILIC and RP Modes in One LC Column



RESTEK® Pure Chromatography www.restek.com/raptor

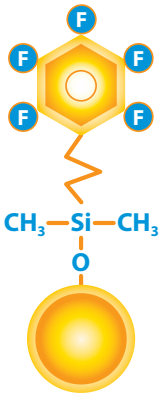
The Raptor™ FluoroPhenyl Column

Restek chemists became the first to combine the speed of superficially porous particles (also known as SPP or "core-shell" particles) with the resolution of highly selective USLC® technology. This new breed of chromatographic column allows you to more easily achieve peak separation and faster analysis times without expensive UHPLC instrumentation. Learn more about Raptor™ LC columns at **www.restek.com/raptor**

Restek has now extended the speed and reliability of Raptor™ column technology into the HILIC realm with the addition of Raptor™ FluoroPhenyl columns. Restek's Raptor™ FluoroPhenyl phase offers chromatographers the ability to run in reversed-phase or HILIC mode for a variety of compounds. The Restek® Raptor™ FluoroPhenyl column is also amenable to LC-MS because it is extremely reliable and efficient with acidic mobile phases.

Switch to a Raptor™ FluoroPhenyl LC column for reliable performance in *both* reversed-phase and HILIC modes.

Column Description:



Stationary Phase Category:
Pentafluorophenyl propyl (L43)

Ligand Type:
Fluorophenyl

Particle:
2.7 µm or 5 µm superficially porous silica (SPP or "core-shell")

Pore Size:
90 Å

Surface Area:
150 m^2/g (2.7 µm) or 100 m^2/g (5 µm)

Recommended Usage:
pH Range: 2.0–8.0

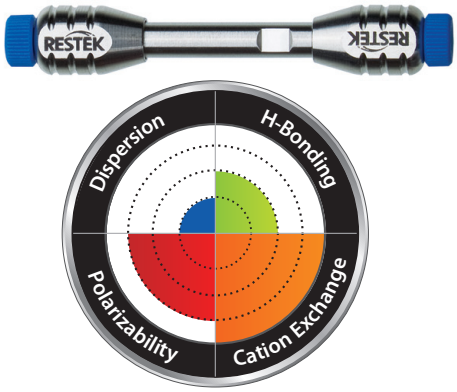
Maximum Temperature: 80 °C

Maximum Pressure: 600 bar/8,700 psi (2.7 µm)
or 400 bar/5,800 psi (5 µm)

Properties:
- Capable of both reversed-phase and HILIC separations.
- Ideal for increasing sensitivity and selectivity in LC-MS analyses.
- Offers increased retention for charged bases.

Switch to a Raptor™ FluoroPhenyl LC column when:
- Limited retention and selectivity are observed on a C18 for basic compounds.
- You need increased retention of hydrophilic compounds.

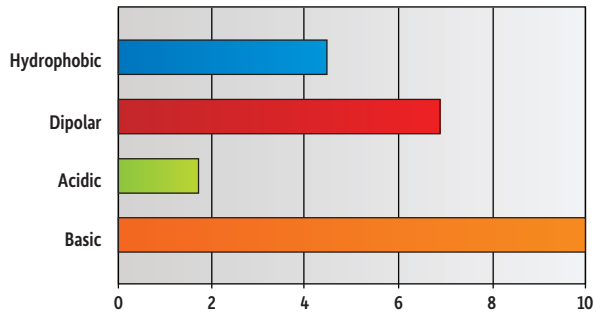
Column Interaction Profile:



Defining Solute Interaction:
- Cation exchange

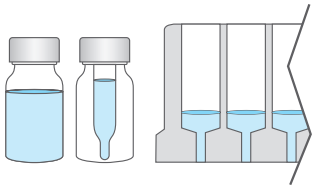
Complementary Solute Interactions:
- Polarizability
- Dispersion

Solute Retention Profile:



Target Analyte Structures:
- Nitrogen

Target Analyte Functionalities:
- Protonated amines
- Quaternary ammonium compounds
- Positively charged moieties
- Lewis bases



Raptor™ FluoroPhenyl Columns: Rugged, Check—Reproducible, Double Check.

Of course, Raptor™ FluoroPhenyl columns are rugged, that is to be expected. And they are exceptionally reproducible as well. Reproducibility can be an issue for fluorinated phenyl phases, which is why we engineered all our columns for dependable performance. Lot to lot, column to column, and injection to injection, every Raptor™ FluoroPhenyl column gives a consistent performance that you can count on. Consider it done.

Figure 1: Raptor™ FluoroPhenyl columns maintain efficiency in any dimension—even at the maximum recommended operating pressure of 600 bar—so you can run at high linear velocities with confidence.

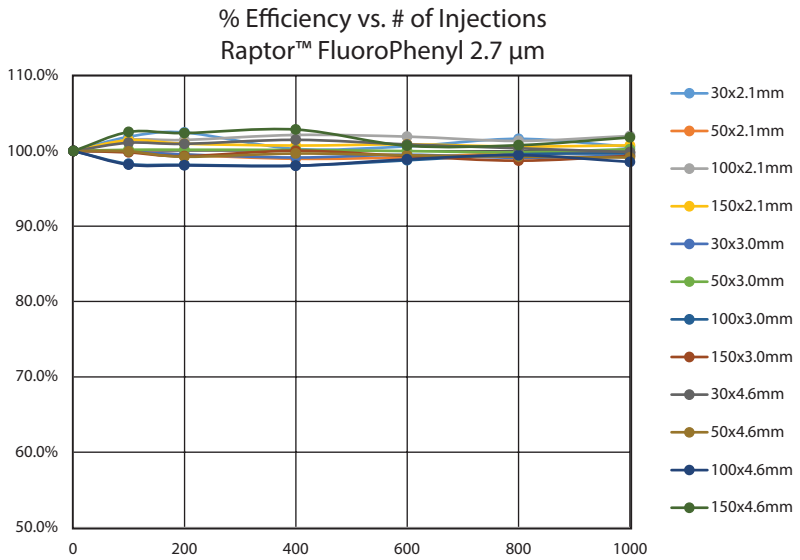
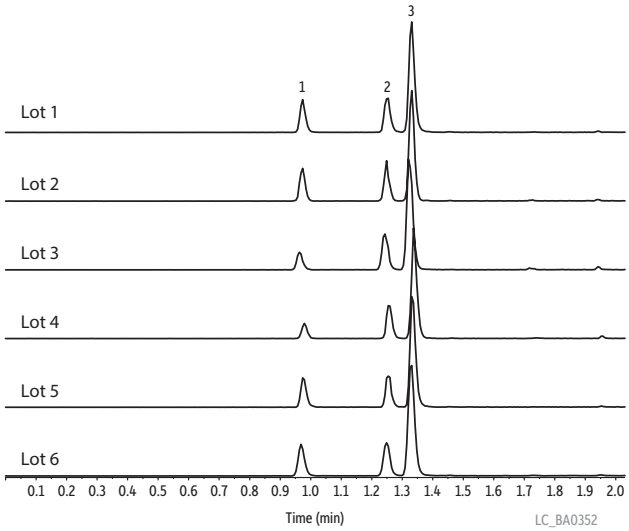


Figure 2: Strict quality control ensures Raptor™ FluoroPhenyl columns are exceptionally reproducible, so you get predictable performance from every column.

Reliable, reproducible fluorophenyl column performance.

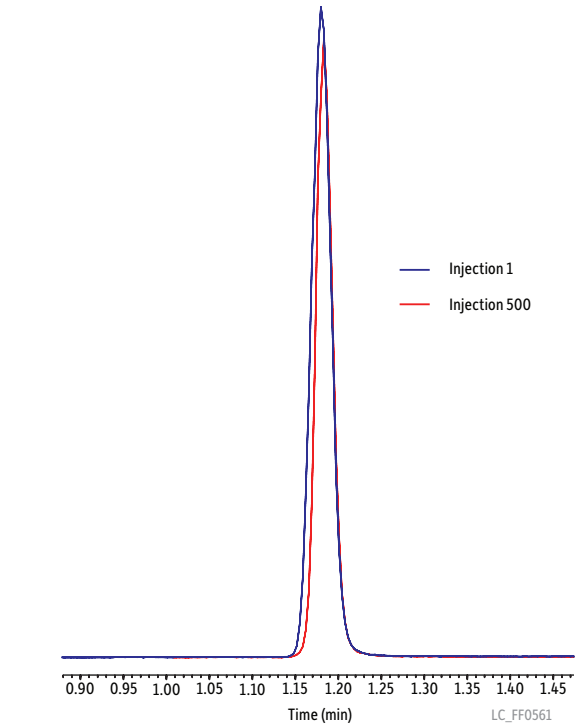
Peaks	t_R (min)	Precursor Ion	Product Ion 1	Product Ion 2
1. Baccatin III	0.97	587.0	405.1	105.0
2. Docetaxel	1.25	808.1	527.3	226.1
3. Paclitaxel	1.33	854.1	569.3	286.2



Column: Raptor™ FluoroPhenyl (cat.# 931955E); Dimensions: 50 mm x 3 mm ID, Particle Size: 5 µm; Temp.: 35 °C; **Sample:** Diluent: Water; Conc.: 100 ng/mL; Inj. Vol.: 5 µL; **Mobile Phase:** A: 0.1% Formic acid in water; B: 0.1% Formic acid in acetonitrile; **Gradient (%B):** 0.00 min (25% B), 2.00 (95% B), 2.01 (25% B), 3.50 (25% B); **Flow:** 0.8 mL/min; **Detector:** MS/MS; Ion Mode: ESI+; Mode: MRM; **Instrument:** UHPLC

Figure 3: From start to finish, Raptor™ FluoroPhenyl columns provide accurate, reproducible results.

Peaks	t_R (min)	Precursor Ion	Product Ion
1. 4-Methylimidazole (4-MEI)	1.19	83	56

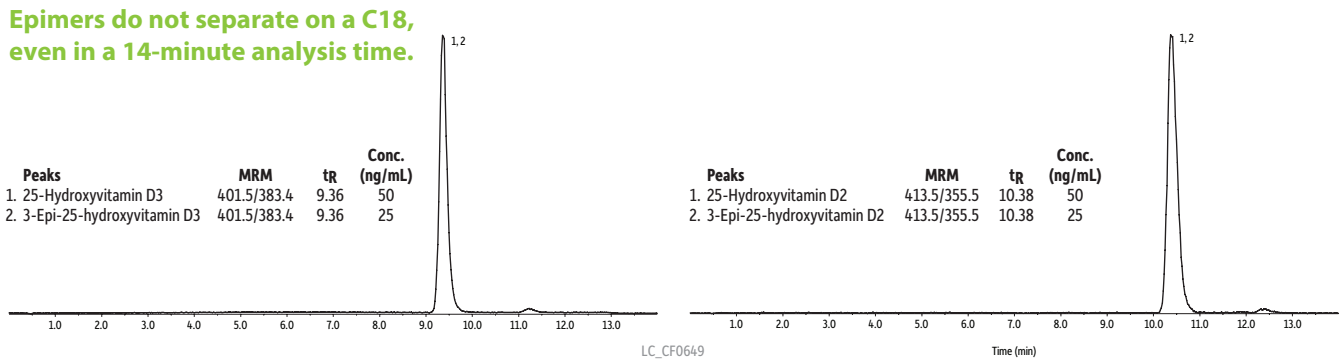


Column: Raptor™ FluoroPhenyl (cat.# 9319A52); Dimensions: 50 mm x 2.1 mm ID, Particle Size: 2.7 µm; Temp.: 35 °C; **Sample:** Diluent: Acetonitrile; Conc.: 100 ng/mL; Inj. Vol.: 5 µL; **Mobile Phase:** A: 0.1% Formic acid in water; B: 0.1% Formic acid in acetonitrile; **Gradient (%B):** 0.00 min (95% B), 2.00 (30% B), 2.01 (95% B), 3.50 (95% B); Flow: 0.6 mL/min; **Detector:** MS/MS; Ion Mode: ESI+; Mode: MRM; **Instrument:** UHPLC

More Separating Power than a C18

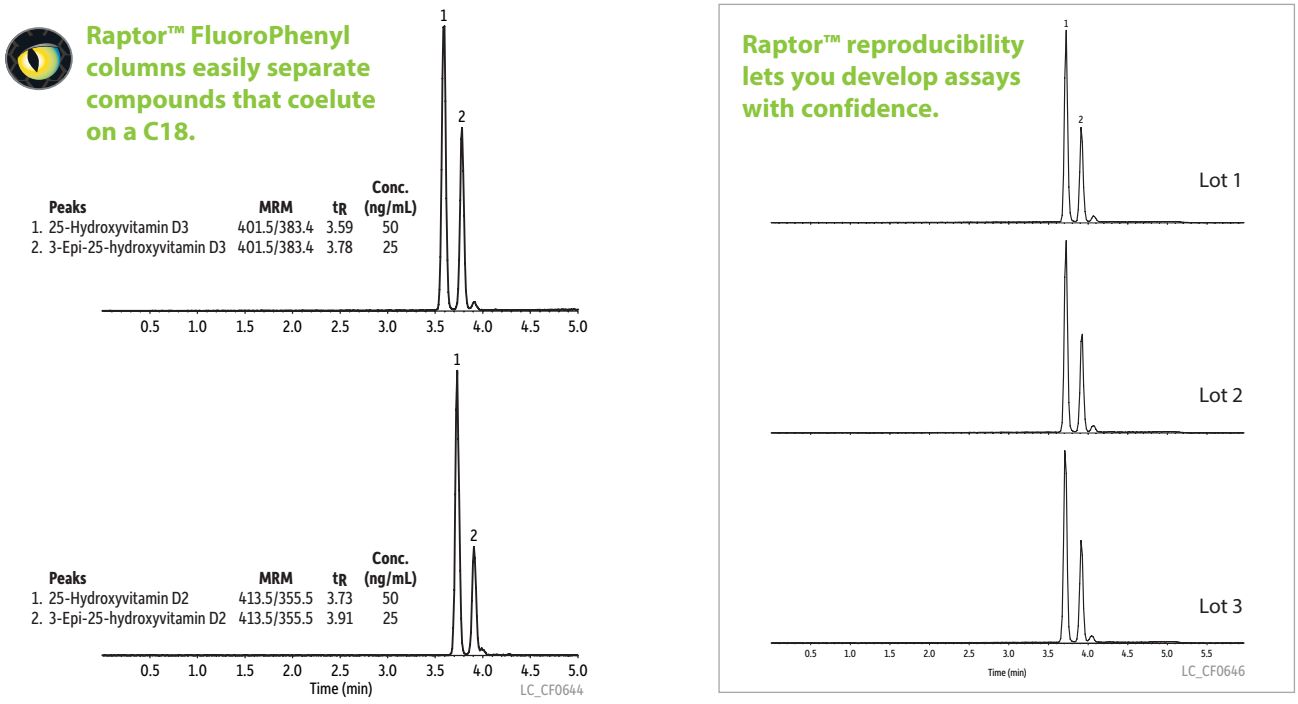
C18 columns work well for many compounds, but they just don't work for everything. Raptor™ FluoroPhenyl columns can provide greater selectivity and retention for analytes that are not easily separated by C18 phase chemistry. For example, interest in vitamin D status is on the rise in clinical diagnostics, but accurate analysis is only possible if the epimeric forms of both vitamin D2 and D3 25-hydroxy metabolites can be distinguished. Typical reversed-phase C18 columns cannot separate these isobaric epimers, which differ in bioactivity, but the new Raptor™ FluoroPhenyl column provides adequate chromatographic resolution so accurate results are generated and the proper diagnosis can be made.

Figure 4: Reversed-phase C18 columns do not have the right selectivity or retention mechanism to separate the epimers of vitamin D2 and D3 25-hydroxy metabolites.



Column: Raptor™ ARC-18 (cat.# 9314A12); Dimensions: 100 mm x 2.1 mm ID, Particle Size: 2.7 µm; Temp.: 30 °C; **Sample:** Diluent: Water:methanol (50:50); Conc.: 25-50 ng/mL; Inj. Vol.: 5 µL; **Mobile Phase:** A: 0.1% Formic acid in water; B: Methanol; **Gradient (%B):** 0.00 min (75% B), 4.00 (80% B), 12.00 (80% B), 12.10 (75% B); 14.00 (75% B); **Flow:** 0.5 mL/min; **Detector:** MS/MS; Ion Mode: ESI+; Mode: MRM; **Instrument**: HPLC

Figure 5: Raptor™ FluoroPhenyl columns have the selectivity and retention you need to quickly and easily separate compounds that coelute on a C18, such as the epimeric forms of vitamin D2 and D3 25-hydroxy metabolites.



Column: Raptor™ FluoroPhenyl (cat.# 9319A1E); Dimensions: 100 mm x 3 mm ID, Particle Size: 2.7 µm; Temp.: 30 °C; **Sample:** Diluent: Water:methanol (50:50); Conc.: 25-50 ng/mL; Inj. Vol.: 5 µL; **Mobile Phase:** A: 0.1% Formic acid in water; B: Methanol; **Gradient (%B):** 0.00 min (75% B), 4.00 (85% B), 4.10 (100% B), 5.00 (100% B), 5.01 (75% B), 7.00 (75% B); **Flow:** 0.6 mL/min; **Detector:** MS/MS; Ion Mode: ESI+; Mode: MRM; **Instrument**: HPLC

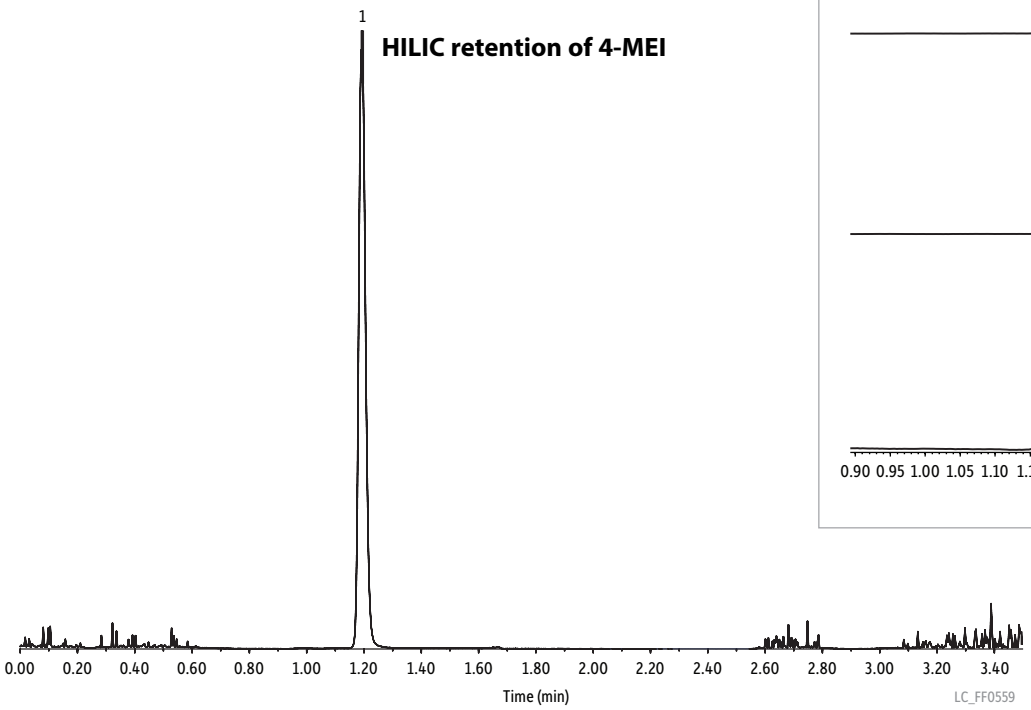
Get the Power of HILIC and RP Modes in One LC Column

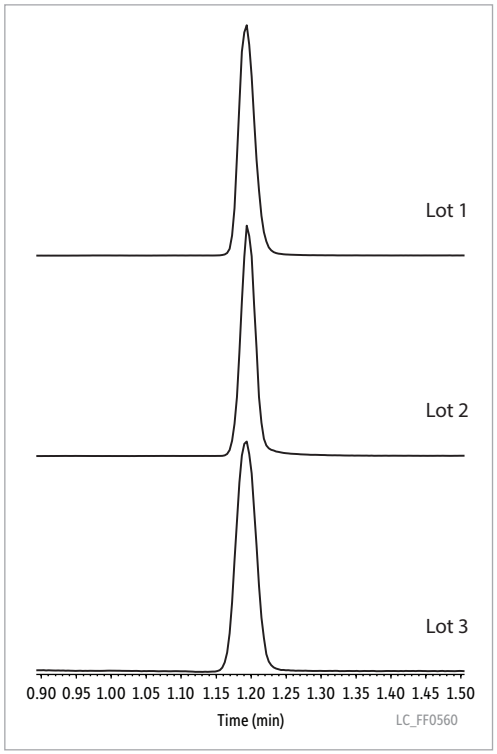
HILIC chromatography is becoming the go-to solution for compounds that are difficult to retain on a C18. The Raptor™ FluoroPhenyl column gives chromatographers the flexibility to evaluate compound retention in both reversed-phase and HILIC modes. The analysis of 4-methylimidazole (4-MEI), which is a byproduct of caramel coloring in foods and beverages, can be problematic by reversed-phase chromatography due to very limited retention. However, 4-MEI is well retained on a Raptor™ FluoroPhenyl column and can easily be analyzed using HILIC mode and simple LC and LC-MS/MS compatible mobile phases.

Figure 6: Sometimes adequate retention cannot be obtained with a C18. The Raptor™ FluoroPhenyl column performs dependably in either HILIC or RP mode, so you can use the mode that is best for your analytes.

Raptor™ FluoroPhenyl columns give you the flexibility to work in both reversed-phase and HILIC modes.

Peaks	t_R (min)	Precursor Ion	Product Ion
1. 4-Methylimidazole (4-MEI)	1.19	83	56





Column: Raptor™ FluoroPhenyl (cat.# 9319A52); Dimensions: 50 mm x 2.1 mm ID; Particle Size: 2.7 µm; Temp.: 35 °C; **Sample:** Diluent: Acetonitrile; Conc.: 100 ng/mL; Inj. Vol.: 5 µL; **Mobile Phase:** A: 0.1% Formic acid in water; B: 0.1% Formic acid in acetonitrile; **Gradient (%B):** 0.00 min (95% B), 2.00 (30% B), 2.01 (95% B), 3.50 (95% B); **Flow:** 0.6 mL/min; **Detector:** MS/MS; Ion Mode: ESI+; Mode: MRM; **Instrument:** UHPLC

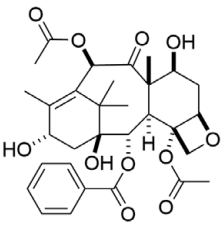
Fast, Accurate Analysis of Basic Compounds

Taxane drugs—such as paclitaxel, docetaxel, and their precursor baccatin III—are early chemotherapy treatment options. Accurate analysis is critical because these drugs are used for many types of metastatic cancers. As shown here, the selectivity of the Raptor™ FluoroPhenyl column provides excellent retention and resolution of these structurally similar compounds. Reliable results for these basic compounds can be obtained in fast analysis times using LC-MS/MS friendly solvents.

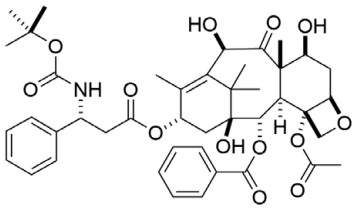
Figure 7: Raptor™ FluoroPhenyl columns allow taxane drugs and other basic compounds to be separated quickly and effectively.

Raptor™ FluoroPhenyl columns have the retention needed for fast, accurate analysis of basic compounds.

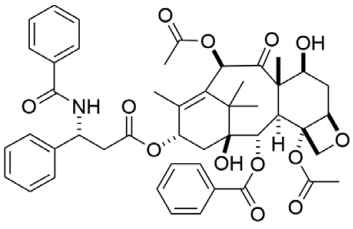
Peaks	t_R (min)	Precursor Ion	Product Ion 1	Product Ion 2
1. Baccatin III	0.97	587.0	405.1	105.0
2. Docetaxel	1.25	808.1	527.3	226.1
3. Paclitaxel	1.33	854.1	569.3	286.2



Baccatin III



Docetaxel



Paclitaxel

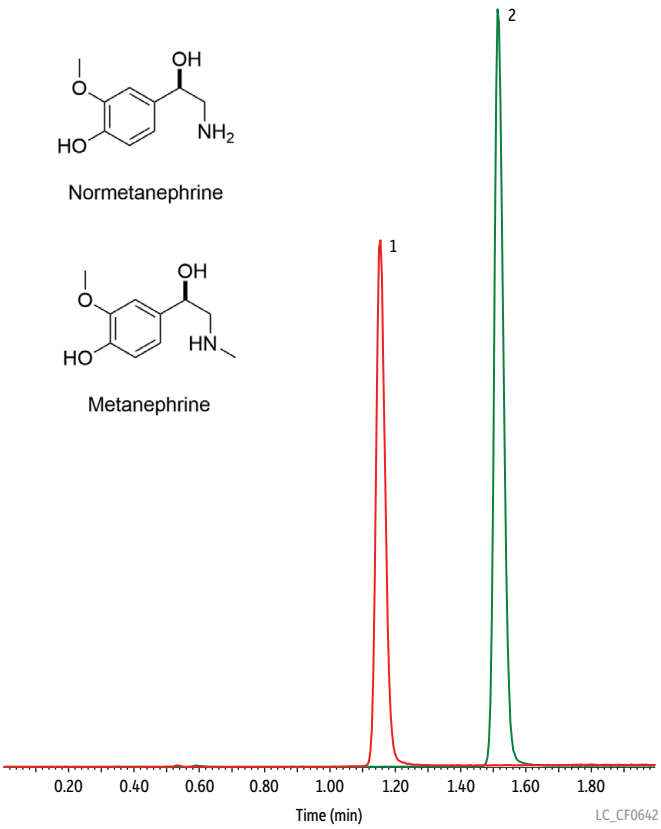
Column: Raptor™ FluoroPhenyl (cat.# 931955E); Dimensions: 50 mm x 3 mm ID, Particle Size: 5 µm; Temp.: 35 °C; **Sample:** Diluent: Water; Conc.: 100 ng/mL; Inj. Vol.: 5 µL; **Mobile Phase:** A: 0.1% Formic acid in water; B: 0.1% Formic acid in acetonitrile; **Gradient (%B):** 0.00 (25% B), 2.00 (95% B), 2.01 (25% B), 3.50 (25% B); **Flow:** 0.8 mL/min; **Detector:** MS/MS; Ion Mode: ESI+; Mode: MRM; **Instrument**: UHPLC

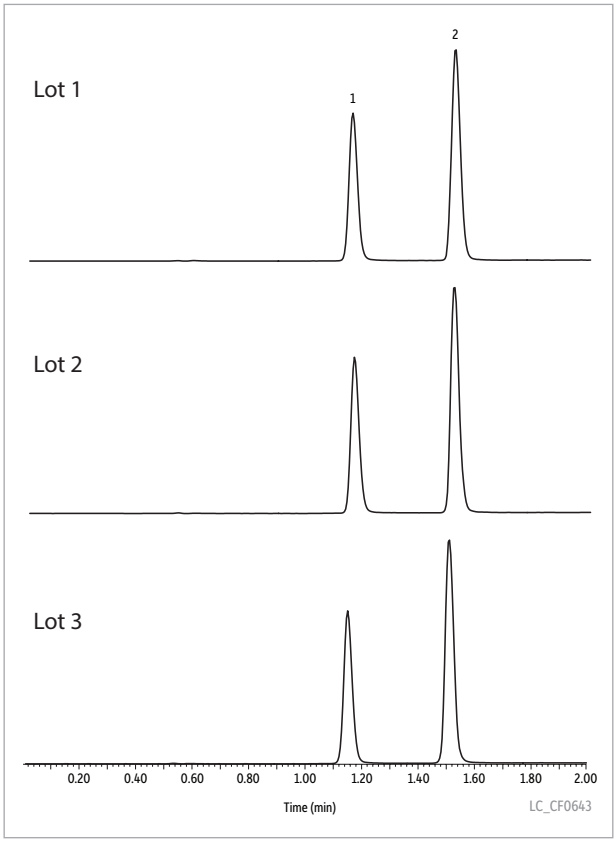
Exceptional Selectivity for Clinical Analyses

The analysis of normetanephrine and metanephrine provides another example of the power of Raptor™ FluoroPhenyl columns for analyzing basic compounds. Accurately determining these metabolites of epinephrine/norepinephrine in plasma or urine is one of the best diagnostic tests for neuroendocrine tumors (pheochromocytomas). Normetanephrine and metanephrine are difficult to retain by typical C18 reversed-phase chromatography; however, the Raptor™ FluoroPhenyl column provides a simple, fast chromatographic solution to this challenging assay. The Raptor™ FluoroPhenyl column's unique combination of aromatic retention and cation exchange mechanisms are not provided by a C18 column and result in reliable, high-quality separations.

Figure 8: Rapid analysis of metanephrine and normetanephrine on a Raptor™ FluoroPhenyl column.

Peaks	t_R (min)	Precursor Ion	Product Ion 1	Product Ion 2
1. Normetanephrine	1.15	166.1	121.1	134.0
2. Metanephrine	1.52	180.1	165.1	148.3





Column: Raptor™ FluoroPhenyl (cat.# 9319A12); Dimensions: 100 mm x 2.1 mm ID; Particle Size: 2.7 µm; Temp.: 30 °C; **Sample:** Diluent: Water; Conc.: 20 ng/mL; Inj. Vol.: 5 µL; **Mobile Phase:** A: 0.2% Formic acid in water; B: Methanol; **Gradient (%B):** 0.00 min (2% B), 2.00 (40% B), 2.01 (2% B), 6.00 (2% B); Flow: 0.4 mL/min; **Detector:** MS/MS; Ion Mode: ESI+; Mode: MRM; **Instrument**: UHPLC

Dependable Raptor™ FluoroPhenyl Columns Give You the Flexibility to use both HILIC and RP Modes

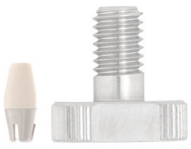
Raptor™ FluoroPhenyl LC Columns (USP L43)

Length	2.1 mm cat.#	3.0 mm cat.#	4.6 mm cat.#
2.7 µm Columns			
30 mm	9319A32	9319A3E	9319A35
50 mm	9319A52	9319A5E	9319A55
100 mm	9319A12	9319A1E	9319A15
150 mm	9319A62	9319A6E	9319A65
5 µm Columns			
30 mm	—	931953E	—
50 mm	9319552	931955E	9319555
100 mm	9319512	931951E	9319515
150 mm	9319562	931956E	9319565
250 mm	—	—	9319575

EXP® Reusable Fittings for HPLC & UHPLC

for 10-32 fittings and 1/16" tubing

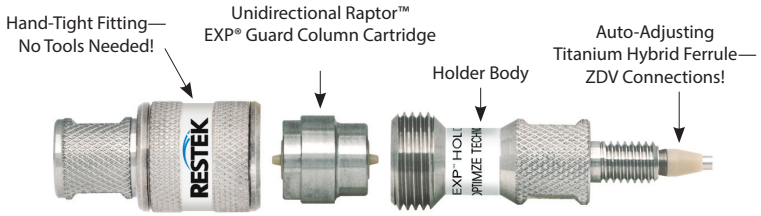
Effortlessly achieve 8,700+ psi HPLC seals by hand! (Wrench-tighten to 20,000+ psi.) Hybrid titanium/PEEK seal can be installed repeatedly without compromising your seal.



Description	qty.	cat.#
EXP Hand-Tight Fitting (Nut w/Ferrule)	ea.	25937
EXP Hand-Tight Fitting (Nut w/Ferrule)	10-pk.	25938
EXP Hand-Tight Nut (w/o Ferrule)	ea.	25939

Hybrid Ferrule U.S. Patent No. 8201854, Optimize Technologies. Optimize Technologies EXP Holders are Patent Pending. Other U.S. and Foreign Patents Pending. The Opti- prefix is a registered trademark of Optimize Technologies, Inc.

Raptor™ EXP® Guard Cartridges



Protect your investment and extend the life of our already-rugged LC columns and change guard column cartridges by hand without breaking fluid connections—no tools needed!

EXP® Direct Connect Holder

Description	qty.	cat.#
EXP Direct Connect Holder for EXP Guard Cartridges (includes hex-head fitting & 2 ferrules)	ea.	25808

Maximum holder pressure: 20,000 psi (1,400 bar)

Raptor™ EXP® Guard Column Cartridges

Description	Particle Size	qty.	5 x 2.1 mm cat.#	5 x 3.0 mm cat.#	5 x 4.6 mm cat.#
Raptor FluoroPhenyl EXP Guard Column Cartridges	2.7 µm	3-pk.	9319A0252	9319A0253	9319A0250
Raptor FluoroPhenyl EXP Guard Column Cartridges	5 µm	3-pk.	931950252	931950253	931950250

Maximum cartridge pressure: 600 bar/8,700 psi (2.7 µm) or 400 bar/5,800 psi (5 µm).
Raptor™ SPP LC columns combine the speed of SPP with the resolution of USLC® technology. Learn more at **www.restek.com/raptor**

Experience *Selectivity Accelerated.* Order the Raptor™ FluoroPhenyl today at **www.restek.com/raptor**

RESTEK®
Pure Chromatography

Questions about this or any other Restek® product?
Contact us or your local Restek® representative (www.restek.com/contact-us).

www.restek.com

Lit. Cat.# GNBR2368-UNV

raptor

184 result(s)

Products (15)
Resources (89)
Chromatograms (80)

Advanced Search

Reference Standards
Chromatograms
SDS, Certificates of Analysis and Data Packs

Resources

Showing 1 to 25 of 89

The Raptor Biphenyl Stationary Phase: Selectivity Accelerated (PDF)

.....

Infographic: Judging Raptor SPP Core-Shell Particles—2.7 vs. 5 µm Particle Sizes (PDF)

... effciency and sensitivity with a moderate increase in backpressure. Order your **Raptor**™ columns today and experience Selectivity Accelerated. 2.7 vs.5µmDiameter**Raptor**™ Particles—WhichDoYouChoose? The Verdict ... infographic, **Raptor**, particle size...

The Raptor ARC-18 Stationary Phase: Selectivity Accelerated (PDF)

.....

Raptor™ SPP C18 Columns Sales Sheet (PDF)

...Stationary Phase: C18 Si TMSTMSO **Raptor**™ Speed, Efficiency, and Ruggedness—in C18 Every LC lab , don't just grab any C18. Choose the speed, efficiency, and long-lasting ruggedness of the **Raptor**™ C18 ... **Raptor**, SPP, core-shell, bioanalytical, drug, metabolite, Biphenyl...

An Evaluation of Biphenyl Chemistry to Aid in High-Throughput Bioanalytical LC-MS/MS Analyses (PDF)

.....

Raptor™ Biphenyl LC Columns Sales Sheet (PDF)

...Stationary Phase: Biphenyl Fast, Rugged **Raptor**™ Columns with Time-Tested Selectivity The industry chemistries. As a result, the rugged **Raptor**™ Biphenyl column is extremely useful for fast separations ... **Raptor**, SPP, core-shell, bioanalytical, drug, metabolite, Biphenyl...

The Effects of LC Particle Choice on Column Performance: 2.7 vs. 5 µm Diameter Superficially Porous Particles (SPP) (PDF)

... porous particles. Restek's **Raptor**™ SPP LC columns are available in both 2.7 and 5 µm diameter particle the differences in efficiency, sensitivity, and pressure between **Raptor**™ LC columns packed with 2.7 vs. 5 µm...

Raptor Biphenyl LC Columns Brochure (PDF)

...Stationary Phase: Biphenyl Selectivity Accelerated Fast, Rugged **Raptor**™ Columns with Time is observed on a C18. • You need to increase retention of hydrophilic aromatics. With **Raptor** LC columns ... **Raptor**, SPP, core-shell, bioanalytical, drug, metabolite, Biphenyl...

Raptor ARC-18 LC Columns Brochure (PDF)

...The **Raptor** ARC-18 Column With **Raptor** LC columns, Restek chemists became the first to combine . The birth of Restek's **Raptor**™ SPP LC column line began with the innovative Biphenyl phase, but it has ... ARC-18, "mass spectrometry", low-pH, "acidic mobile phase", multiclass, **Raptor**, SPP, core-shell...

Raptor™ FluoroPhenyl LC Columns Sales Sheet (PDF)

... more with a **Raptor**™ FluoroPhenyl LC column—a rugged, reliable fluorinated phenyl that allows you to operate with confidence in either HILIC or RP mode. www.restek.com/**raptor** Pure Chromatography...

Dissecting Raptor LC Columns: A closer look at a new species (PDF)

...Dissecting **Raptor** LC Columns A closer look at a new species Adaptive Traits: **Raptor** LC Column each and every **Raptor** LC column. • Higher efficiency for drastically faster analysis times. • Better...

Raptor™ FluoroPhenyl LC Columns Brochure (PDF)

...www.restek.com/**raptor** 1 Stationary Phase: FluoroPhenyl Get the Power of HILIC and RP Modes in One LC Column TM Selectivity Accelerated Pure Chromatography www.restek.com/**raptor** CH3 Si CH3 O...

Raptor™ ARC-18 LC Columns Sales Sheet (PDF)

... and intended specifically for use on LC-MS/MS systems, the **Raptor**™ ARC-18 SPP LC column offers a well for mass spectrometry (MS). www.restek.com/**raptor** Pure Chromatography TM Selectivity Accelerated Si O...

The Effects of LC Particle Choice on Column Performance: Switching from 3 and 5 µm Fully Porous Particles (FPP) to 5 µm Superficially Porous Particles (SPP) (PDF)

..., we will compare the performance of **Raptor**™ 5 µm SPP LC columns to traditional 3 and 5 µm FPP LC .2 to 2 mL/min) when switching from a 3 µm FPP column to a **Raptor**™ 5 µm SPP column. Although the 5 µm FPP...

Raptor™ C18 LC Columns Brochure (PDF)

...www.restek.com/**raptor** 1 Stationary Phase: C18 Si TMS O TMS **Raptor**™ Speed, Efficiency , and Ruggedness—in C18 TM Selectivity Accelerated Pure Chromatography www.restek.com/**raptor** 2 www.restek.com/**raptor**...

Reliable HILIC LC-MS/MS Analysis of 4-Methylimidazole (4-MEI) on Raptor FluoroPhenyl Columns (PDF)

...www.restek.com Reliable HILIC LC-MS/MS Analysis of 4-Methylimidazole (4-MEI) on **Raptor** Fluoro Phenyl Columns Featured Application: LC Analysis of 4-MEI on **Raptor** FluoroPhenyl Columns • Increased retention...

4-Minute Bisphenol A (BPA) Analysis Increases Sample Throughput (PDF)

... Application: Fast Analysis of Bisphenol A on a **Raptor**™ Biphenyl LC Column • Bisphenol A elutes in less than 2 times can be long and peak shape often is not ideal. Restek's **Raptor**™ Biphenyl column is a better...

Fast, Accurate LC-MS/MS Analysis of the C3 Epimer of 25-Hydroxyvitamin D on Raptor FluoroPhenyl Columns (PDF)

...www.restek.com Fast, Accurate LC-MS/MS Analysis of the C3 Epimer of 25-Hydroxyvitamin D on **Raptor** FluoroPhenyl Columns Featured Application: LC Analysis of Vitamin D Epimers on **Raptor** Fluoro...

The Analysis of Synthetic Cannabinoids and Their Metabolites in Human Urine by LC-MS/MS (PDF)

... when developing an efficient method for validation. The **Raptor**™ Biphenyl LC column combines the speed transitions Analytical Column: **Raptor**™ Biphenyl 50 mm x 3.0 mm ID, 2.7 µm Polarity: ES+ Guard Column...

Featured Application: Aldehydes and Ketones in Air Samples on Raptor™ ARC-18 and C18 LC Columns (PDF)

... Accurate Methodology Featured Application: Aldehydes and Ketones in Air Samples on **Raptor**™ ARC-18 and C18 - tolualdehyde isomers cannot be fully separated. In contrast, using a **Raptor**™ C18 column under the conditions...

Featured Application: Multiclass Veterinary Antibiotics on Raptor™ C18 by LC-MS/MS (PDF)

... on **Raptor**™ Biphenyl. [Figure 6]) The use of antibiotics on food-producing animals is a public health for different classes of antibiotics is necessary to meet this regulation, and the **Raptor**™ C18 LC column...

A Rapid and Sensitive LC-MS/MS Method for the Analysis of Three Forms of Thyroid Hormones Using Raptor™ Biphenyl LC Columns (PDF)

... efficient and selective **Raptor**™ Biphenyl LC column. The clinical applicability of this method for the Analysis of Three Forms of Thyroid Hormones Using **Raptor**™ Biphenyl LC Columns By Shun-Hsin Liang, Paul...

The Analysis of Vitamin D Metabolites in Serum/Plasma by LC-MS/MS (PDF)

... them from major matrix interferences. In this method, the **Raptor**™ ARC-18 column combines the speed -soluble vitamins by LC can be time consuming. The **Raptor**™ ARC- 18 column, however, can analyze these difficult...

Rapid Perfluorinated Alkyl Acid Analysis by LC-MS/MS Increases Sample Throughput (PDF)

...www.restek.com Column: **Raptor**™ C18 (cat.# 9304512); Dimensions: 100 mm x 2.1 mm ID; Particle Size in chromatographic performance. • **Raptor**™ C18 SPP 5 µm core-shell silica particle columns offer excellent...

A Fast Dilute-And-Shoot Method for Simultaneous 5-Hydroxyindoleacetic Acid (5-HIAA), Vanillylmandelic Acid (VMA), and Homovanillic Acid (HVA) LC-MS/MS Analysis in Human Urine (PDF)

...-and-shoot LC-MS/MS method using a **Raptor**™ Biphenyl column for the simultaneous analysis of 5 -and-shoot method for accurate and specific 5-HIAA, VMA, and HVA LC-MS/MS analysis in urine using a **Raptor**™ Biphenyl...

raptor

184 result(s)

Products (15)
Resources (89)
Chromatograms (80)

Advanced Search

Reference Standards
Chromatograms
SDS, Certificates of Analysis and Data Packs

Resources

Showing 26 to 50 of 89

The Analysis of Common Drugs of Abuse in Human Urine by LC - MS/MS (PDF)

... and their metabolites. The samples were diluted and analyzed by LC-MS/MS equipped with a Restek **Raptor**™ Biphenyl 5 µm LC column. Results: By using the **Raptor**™ Biphenyl 5 µm LC column, a linear, accurate, and precise...

Resprep PPT 96-Well Plates Sales Sheet (PDF)

... all falling well within acceptable limits (Table III). When paired with Restek's **Raptor** SPP LC : Androgen Hormones in Beagle Serum (LOQ) on **Raptor** C18 by LC-MS/MS. Testosterone-D3* 2. Testosterone 3...

Rapid and Accurate LC-MS/MS Analysis of Nicotine and Related Compounds in Urine Using Raptor™ Biphenyl LC Columns and MS-Friendly Mobile Phases (PDF)

... that a fast and highly efficient analysis of these basic compounds can be achieved with the **Raptor**™ Biphenyl that are "friendly" to LC-MS/MS systems. A **Raptor**™ Biphenyl column was chosen as the analytical column because...

Restek Essentials 2015.2 (PDF)

... with **Raptor**™ columns at www.restek.com/**raptor** General-Purpose Restek® C18 Phase: **Raptor**™ speed, efficiency , and long-lasting ruggedness in C18 ALSO AVAILABLE **Raptor**™ Biphenyl and ARC-18 phases. Patented Titanium...

"The Big Pain": Development of Pain-Free Methods for Analyzing 231 Multiclass Drugs and Metabolites by LC-MS/MS (PDF)

... and retentive **Raptor**™ Biphenyl column—can provide definitive results for a wide range of compounds. Typically and difficult matrices require more advanced retention mechanisms. **Raptor**™ Biphenyl columns exploit the pi...

Featured Application: Fast Analysis of Bisphenol A on a Raptor™ Biphenyl LC Column 4-Minute Bisphenol A (BPA) Analysis Increases Sample Throughput

... be long and peak shape often is not ideal. Restek's **Raptor**™ Biphenyl column is a better alternative than a C18 column for BPA analysis. As shown in the chromatogram below, a **Raptor**™ Biphenyl column ... A **Raptor**™ Biphenyl column is a better choice for BPA analysis than a conventional C18 column . On a **Raptor**™ Biphenyl column, narrow, symmetrical bisphenol A peaks elute in less than 2 minutes, providing...

Featured Application: 231 Pain Management and Drugs of Abuse Compounds in under 10 Minutes by LC-MS/MS (PDF)

...-MS/MS Big Pain Assays Aren't a Big Pain with the **Raptor**™ Biphenyl LC Column • 231 compounds, 40+ isobars , 10 drug classes, 22 ESI- compounds in 10 minutes with 1 column. • A **Raptor**™ SPP LC column with time...

Analysis of Fentanyl and Its Analogues in Human Urine by LC-MS/MS (PDF)

... urine by LC-MS/MS using the **Raptor**TM Biphenyl column. Analysis of Fentanyl and Its Analogues in Human as described above. Analytical Column **Raptor**™ Biphenyl 50 mm x 2.1 mm, 5 µm (Restek Part No. 9309552...

The Effects of LC Particle Choice on Column Performance: 2.7 vs. 5 µm Diameter Superficially Porous Particles (SPP)

... porous particles. Restek's **Raptor**™ SPP LC columns are available in both 2.7 and 5 µm diameter particle the differences in efficiency, sensitivity, and pressure between **Raptor**™ LC columns packed with 2.7 vs. 5 µm ... Restek's **Raptor**™ LC columns feature superficially porous particles (commonly referred to as SPP will examine the differences in efficiency, sensitivity, and pressure between **Raptor**™ LC columns packed with 2...

Featured Application: LC Analysis of 4-MEI on Raptor FluoroPhenyl Columns Reliable HILIC LC-MS/MS Analysis of 4-Methylimidazole (4-MEI) on Raptor FluoroPhenyl Columns

... retention for 4-MEI compared to a C18. Flexible **Raptor** FluoroPhenyl columns can be used in both using HILIC mode and a **Raptor** FluoroPhenyl column is a much better strategy that yields strong retention ... **Raptor** FluoroPhenyl columns perform well in both HILIC and reversed phase modes, giving method we use a **Raptor** Fluorophenyl column in HILIC mode for LC analysis of 4-methylimidazole (4-MEI...

Featured Application: Multiclass Veterinary Antibiotics on Raptor™ C18 by LC-MS/MS One Analysis, One Column, Less than 9 Minutes for Over 60 Multiclass Antibiotics

...) - Sulfonamide (Figure 5) (For Ionophore, use on **Raptor**™ Biphenyl. [Figure 6 classes of antibiotics is

necessary to meet this regulation, and the **Raptor**™ C18 LC column is the ideal ... tissue and food products. The **Raptor**™ C18 LC column is the ideal choice....

News: New Raptor™ FluoroPhenyl Phase: the Power of HILIC and RP Modes in One LC Column

Restek has now extended the speed and reliability of Raptor™ column technology into the HILIC realm with the addition of Raptor™ FluoroPhenyl columns. Restek's Raptor™ FluoroPhenyl phase offers chromatographers the ability to run in reversed-phase or HILIC mode for a … Continue reading →

"The Big Pain": Development of Pain-Free Methods for Analyzing 231 Multiclass Drugs and Metabolites by LC-MS/MS

... and retentive **Raptor**™ Biphenyl column—can provide definitive results for a wide range of compounds and difficult matrices require more advanced retention mechanisms. **Raptor**™ Biphenyl columns exploit the pi ... -MS/MS for its increased speed, sensitivity, and specificity. The methods shown here use a **Raptor**™ Biphenyl...

Featured Application: LC Analysis of Vitamin D Epimers on Raptor FluoroPhenyl Columns Fast, Accurate LC-MS/MS Analysis of the C3 Epimer of 25-Hydroxyvitamin D on Raptor FluoroPhenyl Columns

... ensures accurate results. Long-lasting, rugged **Raptor** FluoroPhenyl LC columns reduce cost per times of 10 minutes or more. The **Raptor** FluoroPhenyl column is a better choice as it provides alternate ... , but these compounds cannot be distinguished from their epimeric forms on a C18 column. The **Raptor** FluoroPhenyl column...

Raptor™ SPP Core-Shell LC Columns

Raptor™ SPP LC columns offer higher efficiency for drastically faster analysis times, better selectivity for substantially improved resolution, incr...

Featured Application: Aldehydes and Ketones in Air Samples on Raptor™ ARC-18 and C18 LC Columns Improve Analysis of Aldehydes and Ketones in Air Samples with Faster, More Accurate Methodology

.... **Raptor**™ LC columns give you results in minutes—not hours—for increased sample throughput - tolualdehyde isomers cannot be fully separated. In contrast, using a **Raptor**™ C18 column under the conditions...

The Effects of LC Particle Choice on Column Performance: Switching from 3 and 5 µm Fully Porous Particles (FPP) to 5 µm Superficially Porous Particles (SPP)

... the performance of **Raptor**™ 5 µm SPP LC columns to traditional 3 and 5 µm FPP LC columns. We will demonstrate how L/min) when switching from a 3 µm FPP column to a **Raptor**™ 5 µm SPP column. Although the 5 µm FPP column ... In this technical note, we will compare the performance of **Raptor**™ 5 µm superficially porous...

Featured Application: 231 pain management and drugs of abuse compounds in under 10 minutes by LC-MS/MS Big Pain Assays Aren't a Big Pain with the Raptor™ Biphenyl LC Column

.... A **Raptor**™ SPP LC column with time-tested Restek® Biphenyl selectivity is the most versatile . As shown in the analysis below, Restek's **Raptor**™ Biphenyl column is ideal for developing successful LC ... be performed in under 10 minutes with just one column: The **Raptor**™ Biphenyl....

News: New Raptor™ ARC-18 Columns Are Born for LC-MS/MS

The birth of Restek's new Raptor™ SPP LC column line began with the innovative Biphenyl phase, and it has now grown to include a new Restek® phase: the ARC-18. Designed and intended specifically for use on LC-MS/MS systems, the Raptor™ … Continue reading →

News: Experience Selectivity Accelerated With New Raptor™ SPP LC Columns and Guards

Restek is excited to announce the evolution of superficially porous particles with the introduction of Raptor™ LC columns. Superficially porous particles (commonly referred to as SPP or "core-shell" particles) changed the world of LC by dramatically boosting column efficiency and … Continue reading →

News: Raptor™ Speed, Efficiency, and Ruggedness is Now Available in C18

Every LC lab has a cache of C18s, but every C18 is not created equal. Because the chemistry tends to be similar, the silica support that carries this ubiquitous octadecylsilane phase becomes vitally important. When you need a general-purpose LC … Continue reading →

ChromaBLOGraphy: What is SPP and when should I use a Raptor column?

While this sounds like a very broad question, I'm sure it is crossing some of your minds. To start out, SPP stands for superficially porous particles. It has also been called "core-shell". If you are a veteran in the world of HPLC, this term is old hat for you. If you are new to the […]

ChromaBLOGraphy: Should I use a 2.7 or 5 µm Raptor™ column?

"When you come to a fork in the road, take it." Maybe that advice worked for Yogi Berra, but does not help much in decisions about your lab equipment. If you are not certain whether you should use a Raptor™ column, please click on the title below to read my previous blog post before proceeding. […]

ChromaBLOGraphy: The Raptor Biphenyl blows away a conventional C18 in this gunpowder assay

A very enjoyable aspect of my position within Restek is the opportunity to work with an experienced and

raptor

184 result(s)

Products (15)
Resources (89)
Chromatograms (80)

Advanced Search

Reference Standards
Chromatograms
SDS, Certificates of Analysis and Data Packs

Resources

Showing 51 to 75 of 89

Featured Application: Decrease Analysis Time for Fluorochemicals with no Sacrifice in Chromatographic Performance. Rapid Perfluorinated Alkyl Acid Analysis by LC-MS/MS Increases Sample Throughput

... ul { list-style-type: none; padding: 0px; margin: 0px; } ul li { color: #000; font-family: Verdana,Arial,Helvetica,sans-serif; font-size: 12px; font-weight: normal; line-height: 20px; padding: 0px; text-decoration: none;} #main_article .article_title { color: #555; text-align: left; line-height: 22px; } h1 { font-family: arial,helvetica,verdana,sans; font-size: 14px; font-weight: normal; line-height: 32px; margin-bottom: 10px; font-style: italic; } #main_article .article_subtitle { text-align: left; color: #555; } h2 { font-family: Verdana,Arial,Helvetica,sans-serif; font-size: 24px; font-weight: normal; line-height: 32px; margin: 0; padding: 0; } **Raptor** . Meets EPA Method 537 requirements. Unique, robust **Raptor**™ C18 column design increases ... in consistent, accurate quantification in much faster analysis times. By switching to **Raptor**™ C18 column, labs...

ChromaBLOGraphy: Analysis of Nicotine and Related Compounds in Urine Using Raptor™ Biphenyl

As Applications Chemists in the LC lab, one of the most exciting parts of our jobs is the variety of analyses we are exposed to. One day you are developing a method for potency analysis in cannabis samples, the next you are looking at anti-epileptic drugs in urine. We're regularly challenged to think outside the […]

A Rapid and Sensitive LC-MS/MS Method for the Analysis of Three Forms of Thyroid Hormones Using Raptor™ Biphenyl LC Columns

... at the free form levels using the highly efficient and selective **Raptor**™ Biphenyl LC column. The clinical " > **Analytical Column Raptor** Biphenyl 2.7 µm, 100 mm x 2.1 mm ... The **Raptor**™ Biphenyl column is excellent for rapid and sensitive analysis of thyroid hormones...

Growing Analytical Solutions for Cannabis Testing (PDF)

... analytical challenges every step of the way. **Raptor**™ LC COLUMNS Maximize Analytical Performance and Minimize Your Capital Investment **Raptor**™ LC columns combine the speed of a superficially porous particle...

Rapid and Accurate LC-MS/MS Analysis of Nicotine and Related Compounds in Urine Using Raptor™ Biphenyl LC Columns and MS-Friendly Mobile Phases

... and highly efficient analysis of these basic compounds can be achieved with the **Raptor**™ Biphenyl column using . A **Raptor**™ Biphenyl column was chosen as the analytical column because it provides good retention and peak ... that a fast and highly efficient analysis of these basic compounds can be achieved with the **Raptor**™ Biphenyl...

A Fast Dilute-And-Shoot Method for Simultaneous 5-Hydroxyindoleacetic Acid (5-HIAA), Vanillylmandelic Acid (VMA), and Homovanillic Acid (HVA) LC-MS/MS Analysis in Human Urine

... of a fast dilute-and-shoot LC-MS/MS method using a **Raptor**™ Biphenyl column for the simultaneous analysis in urine using a **Raptor**™ Biphenyl column. The **Raptor**™ Biphenyl column was selected for this work because ... Using Restek's dilute-and-shoot method and a **Raptor**™ Biphenyl column, serotonin and catecholamine...

Mobile Phase Additives

Mobile phase additives such as triethylamine, trifluoroacetic acid, and ion-pairing reagents can compete with sample ions, decreasing sensitivity and, in some cases, reducing sample ion intake into the MS. To obtain symmetric peaks and/or sufficient retention, use base deactivated silica, like Pinnacle® DB or high purity silicas like Ultra or Raptor™, that minimize the need for additives...

News: Breathe New Life Into Your Old HPLC With Restek's 5 µm Raptor™ Columns

With the advent of superficially porous particles (SPP or "core-shell" particles), the analytical community found the ability to gain far more efficiency and speed out of existing HPLC instrumentation. However, with these efficiency gains came higher pressures that exceeded the … Continue reading →

News: A Rapid and Sensitive LC-MS/MS Method for the Analysis of Three Forms of Thyroid Hormones Using Raptor™ Biphenyl LC Columns

Author(s): Shun-Hsin Liang, Paul Connolly, and Ty Kahler Restek Corporation Published By: Restek Corporation Year of Publication: 2014 Link: http://www.restek.com/Technical-Resources/Technical-Library/Bioanalytical/bio_BAAN2112-UNV Abstract: The Raptor™ Biphenyl column is excellent for rapid and sensitive analysis of thyroid hormones. With the method described here, concentrations … Continue reading →

How to Select the Right LC Guard Column

...) as your analytical column. For example, the best LC guard column to use with a **Raptor** Biphenyl analytical column is a **Raptor** Biphenyl guard cartridge housed in an EXP direct connect holder. Once you...

News: Our MSACL U.S. 2015 Presentations Are Now Online

During MSACL U.S. 2015, we featured Restek's Raptor™ Biphenyl column in our booth, corporate workshop, and posters. With ten years of unrivaled performance, Restek's time-tested Biphenyl has long been the ideal column for clinical diagnostic, pain, and pharma labs alike. … Continue reading →

ChromaBLOGraphy: Choosing a guard cartridge holder for LC

If you need help choosing one of the Trident guard cartridge holders, check out our information found in the HPLC and UHPLC FAQs section of our website. The FAQs contain a lot of good information and are often overlooked. For most of our columns we prefer the Trident Direct Guard holder system, because of its […]

ChromaBLOGraphy: Mass Overload on Superficially Porous Particles

The benefits of superficially porous particles are without question. Who wouldn't want to perform faster separations without the need for expensive UHPLC instrumentation? It sounds too good to be true. There must be some drawback – right? The solid, impermeable core present in Raptor™ particles increases column efficiency by decreasing the diffusion path at the […]

Frequently Asked Questions: HPLC and UHPLC

...? **Raptor™ LC Columns** How does the new **Raptor**™ Biphenyl column conditioning needed for the **Raptor**™ Biphenyl column prior to its first use, or if it has been sitting...

News: Rapid and Accurate LC-MS/MS Analysis of Nicotine and Related Compounds in Urine Using Raptor™ Biphenyl LC Columns and MS-Friendly Mobile Phases

Author(s): Shun-Hsin Liang Restek Corporation Published By: Restek Corporation Year of Publication: 2015 Link: http://www.restek.com/Technical-Resources/Technical-Library/Clinical-Forensic-Toxicology/cft_CFAN2216-UNV Abstract: A rapid, accurate, and reproducible method was developed for high-throughput testing of nicotine, cotinine, trans-3′-hydroxycotinine, nornicotine, norcotinine, and anabasine in urine. Data show that … Continue reading →

News: The Effects of LC Particle Choice on Column Performance: 2.7 vs. 5 µm Diameter Superficially Porous Particles (SPP)

Author(s): Sharon Lupo, Ty Kahler, and Paul Connolly Restek Corporation Published By: Restek Corporation Year of Publication: 2014 Link: http://www.restek.com/Technical-Resources/Technical-Library/General-Interest/generic_GNAR2079-UNV Abstract: Restek's Raptor™ LC columns feature superficially porous particles (commonly referred to as SPP or "core-shell" particles) and are available in … Continue reading →

MSACL EU

ChromaBLOGraphy: Choosing a guard cartridge for LC

So you have a guard cartridge holder of some sort, and you don't have the guard cartridge to put inside. If you happen to have missed that last blog post about the holder, click on the following link. Choosing a guard cartridge holder for LC Let's determine what type of guard cartridge you need. A […]

News: The Effects of LC Particle Choice on Column Performance: Switching from 3 and 5 µm Fully Porous Particles (FPP) to 5 µm Superficially Porous Particles (SPP)

Author(s): Sharon Lupo, Ty Kahler, and Paul Connolly Restek Corporation Published By: Restek Corporation Year of Publication: 2014 Link: http://www.restek.com/Technical-Resources/Technical-Library/General-Interest/general_GNAR2109-UNV Abstract: In this technical note, we will compare the performance of Raptor™ 5 µm superficially porous particle (SPP) LC columns … Continue reading →

ChromaBLOGraphy: Which LC column should I use for Method 8330B explosives analysis?

Over the years, Restek has run applications on a long list of columns for this analysis. It does require a primary and secondary column for analysis, since there is not one column that perfectly separates all compounds on the list simultaneously. Keep in mind that EPA Method 8330B allows for alternate columns versus the ones […]

News: A Fast Dilute-And-Shoot Method for Simultaneous 5-Hydroxyindoleacetic Acid (5-HIAA), Vanillylmandelic Acid (VMA), and Homovanillic Acid (HVA) LC-MS/MS Analysis in Human Urine

Author(s): Shun-Hsin Liang and Sue Steinike Restek Corporation Published By: Restek Corporation Year of Publication: 2016 Link: http://www.restek.com/Technical-Resources/Technical-Library/Clinical-Forensic-Toxicology/cft_CFAN2465-UNV Abstract: In this partial validation study, we demonstrated the performance of a fast dilute-and-shoot LC-MS/MS method using a Raptor™ Biphenyl column for the simultaneous analysis … Continue reading →

SOFT 2015

Come see Restek at SOFT 2015!

MSACL 2016 U.S.

News: "The Big Pain": Development of Pain-Free Methods for Analyzing 231

interesting network of chromatographers throughout Europe. This includes the talented scientists at ALSAC in Uppsala, Sweden, who recently evaluated a Raptor Biphenyl column in a customer assay of gunpowder materials. ALSAC (Addtech Life Science Applications Center) has […]

ChromaBLOGraphy: Raptor Biphenyl LC Columns provide the data needed for global antibiotic testing

Because the widespread use of preventative veterinary antibiotics has resulted in increased antimicrobial resistance in humans, the US Food and Drug Administration (FDA) released guidelines to address the issue in food animals (December 11, 2013). Similar constraints are also prevalent in the European Union. Recently, European Researchers1 developed a validated method for the determination of […]

First Previous 1 2 3 4 Next Last

Multiclass Drugs and Metabolites by LC-MS/MS

Author(s): Sharon Lupo Restek Corporation Published By: Restek Corporation Year of Publication: 2015 Link: http://www.restek.com/Technical-Resources/Technical-Library/Clinical-Forensic-Toxicology/cft_CFAR2309-UNV Abstract: As the demand for testing of pain management drugs increases, many laboratories are turning to LC-MS/MS for its increased speed, sensitivity, and specificity. The … Continue reading →

ChromaBLOGraphy: A C18 is a C18, right?

Sorry, that actually is not true. Although many methods only list the USP code L1 for all C18 HPLC columns, there are many different varieties of C18 columns available from Restek. Here are some of the ways they may differ: Differences in Silica Depending on the silica particle that the C18 phase […]

raptor

184 result(s)

Products (15)
Resources (89)
Chromatograms (80)

Advanced Search
Reference Standards
Chromatograms
SDS, Certificates of Analysis and Data Packs

Resources

Showing 76 to 89 of 89

ASMS 2016

Learn more about what we'll be doing at the 64th American Society for Mass Spectrometry Conference on Mass Spectrometry and Allied Topics

ChromaBLOGraphy: Technical Service "Red Flags" – LC

This post is an extension of a series of posts pertaining to "Red Flags" my colleague has written, pertaining to GC analysis. These are situations and symptoms that tell us in the Tech Service group that something is just not right. So what are examples of some "Red Flags" that we commonly see for HPLC? […]

HPLC 2016

Visit Restek at HPLC 2016

The Restek® Biphenyl: Leading Resolution in LC since 2005

With ten years of unrivaled performance, Restek's time-tested Biphenyl has been proven to be the ideal LC column for clinical diagnostic, pain, pharm...

ChromaBLOGraphy: How to decrease run time for reversed phase LC

There are several ways to accomplish this, although it boils down to roughly 4 possibilities. Use a shorter column length. This may be appropriate if you have plenty of retention for your analyte(s), if you only have one or a few analytes AND if you do not have interference peaks in your chromatogram. It does, […]

ChromaBLOGraphy: Shifting Analyte Retention Times or Matrix Interferences?

Occasionally, we will get a Technical Service call about peak retention times moving during a customer analysis. Early eluting compounds are especially prone to this shifting, but the issue can often be attributed to matrix interferences that are also not well retained. Pregabalin and Gabapentin are two antiepileptic drugs typically analyzed by LC-MS/MS. Because of […]

ChromaBLOGraphy: Fast Screening Method for the Determination and Quantification of Pharmacologically Active Substances

Introduction Pharmacologically active substances are recognized as an emerging problem for surface water quality and for the handling of waste water plants in Europe. Several researchers have shown that these compounds are able to disturb ecologic balances in surface water (e.g. Kümmerer, K., The presence of pharmaceuticals in the environment due to human use – […]

ChromaBLOGraphy: 50th Anniversary of Rachel Carson's Silent Spring: DDT, Birds, Mosquitoes, Malaria, and Man

As I flew to Frankfurt yesterday, an intermediate stop on my way to South Africa, I opened my September 2012 National Geographic and read the blurb, "Spring Awakening", which noted that 50 years ago Rachel Carson published Silent Spring, the classic book that documented the harmful effects of pesticide overuse on the environment. The words […]

ChromaBLOGraphy: Resurrecting an old reverse phase LC column- should I, could I, how would I???

Well, if we had an Easter egg hunt and you found an egg that was from last year or the year before, you could probably tell the difference and you would know pretty quickly if it had gone bad. Let's just say that is not so easy with HPLC columns. If you've dealt with this […]

ChromaBLOGraphy: All of my peaks are tailing… What should I do?

I get quite a few customer questions concerning peak tailing during LC analysis, and how to best troubleshoot this issue. Peak tailing may be attributed to a variety of different causes including secondary interactions, contamination, column loading, etc. This list goes on and on. I usually ask a few key questions, and generally can give […]

NEMC 2016

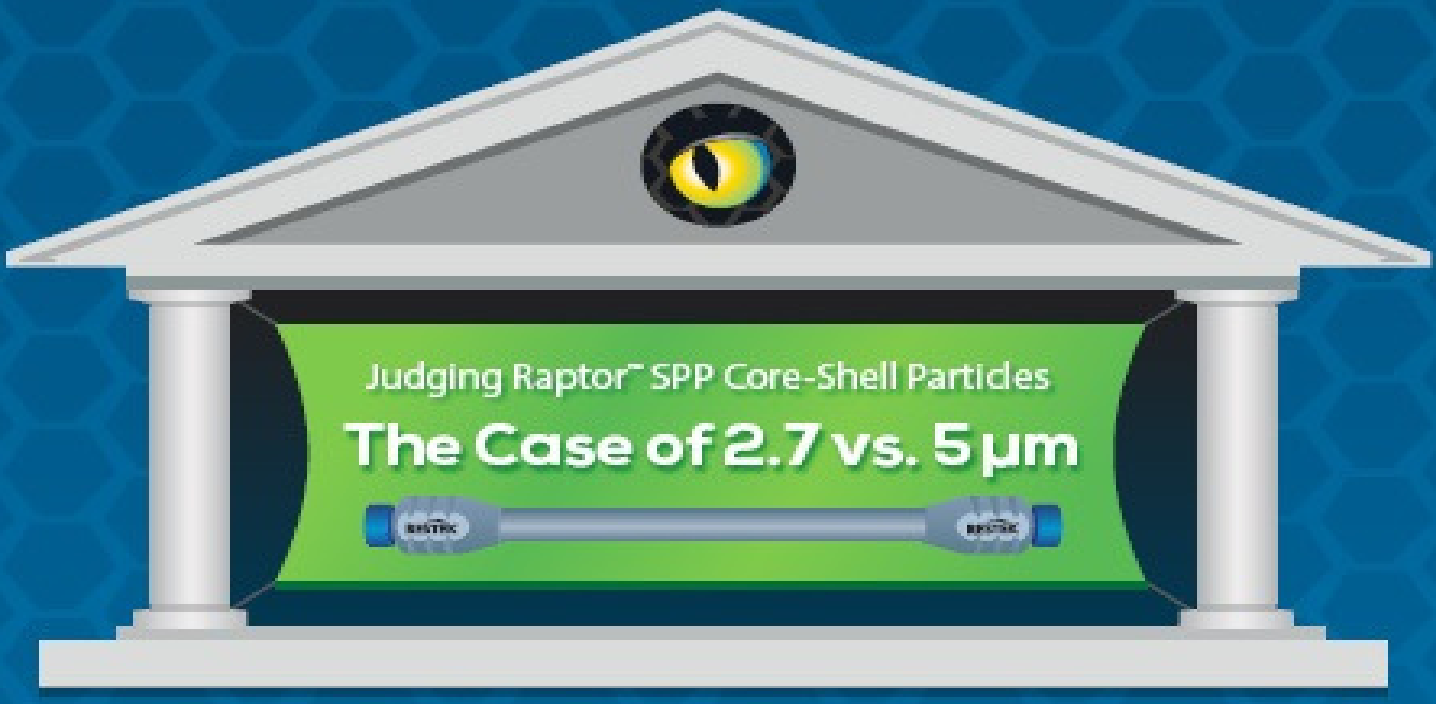
NACRW 2016

Here's a sneak peek at what we'll be up to during this year's show.

ChromaBLOGraphy: More Technical Service "Red Flags" – LC

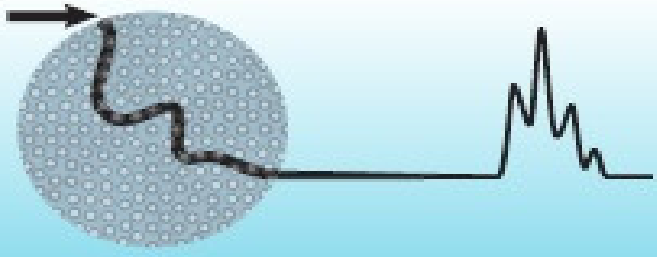
This post is the second of its kind pertaining to LC analysis, all of which are an extension of a series pertaining to "Red Flags" for GC analysis. These are situations and symptoms that tell us in the Tech Service group that something is just not right. As we discussed in the first post, Technical […]

Raptor LC Columns



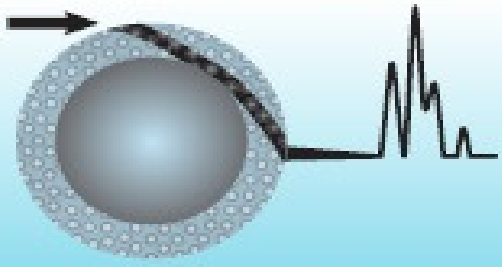
With traditional fully porous particles, the sample must take a slow journey through the entire particle.

Fully Porous
Slower; Poor Resolution



But with superficially porous particles (a.k.a. SPP or "core-shell" particles), your sample skips past a solid, impenetrable core and sprints for your detector.

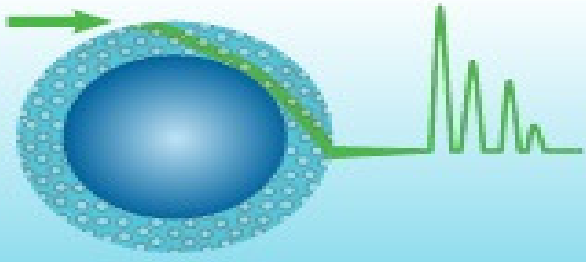
Superficially Porous
Faster; Better Resolution



Add USLC® selectivity into the mix, and you get the shorter retention times and excellent resolution of a Raptor™ SPP column.

Raptor LC Columns

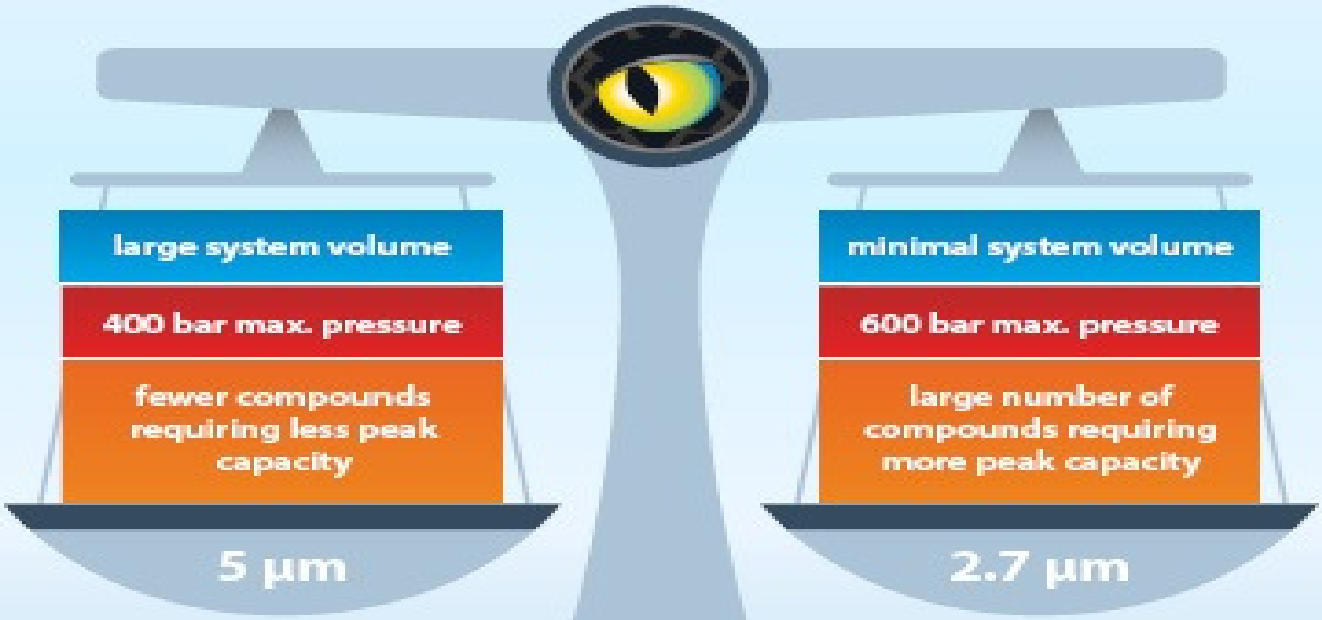
Raptor™
Superficially Porous
w/USLC® Technology
Faster; Excellent Resolution:
Selectivity Accelerated!



So, Raptor™ columns are an excellent choice for your methods, but you still have a decision to make: particle size. The right answer for you comes down to what's under the hood of your instrument, and what you're injecting into it...

2.7 vs. 5 µm Diameter Raptor™ Particles – Which Do You Choose?

Both 2.7 and 5 µm particles have a place in your laboratory—they are each great choices, but are ideal under different conditions.



Raptor LC Columns

RESTEK 2016

The Verdict

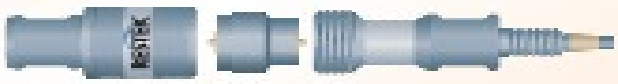
5 µm:
Boost analysis speed for existing methods on traditional LCs.

2.7 µm:
Supercharge efficiency and sensitivity with a moderate increase in backpressure.

Order your Raptor™ columns today and experience *Selectivity Accelerated.*

TECH TIP: PROTECT YOUR INVESTMENT

Raptor™ EXP® guards help your analytical columns last longer. Better yet, you can change cartridges without breaking inlet/outlet fluid connections—and without tools.

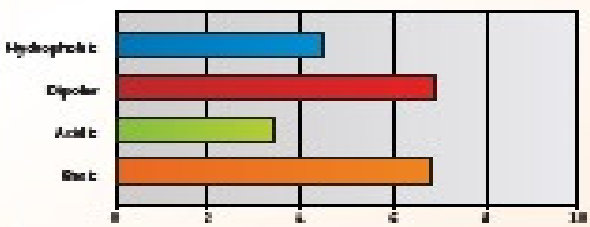


Want the details and data? Check out our technical note on this subject at

www.restek.com/raptor

TECH TIP: CHOOSE WISELY

USLC® phases are optimized for different chemical interactions and solute types. Our easy-to-follow profiles make choosing the right Raptor™ column a snap.



RESTEK Pure Chromatography www.restek.com

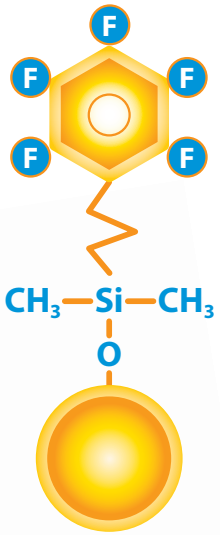
Stationary Phase: **FluoroPhenyl**

Raptor™ LC Columns

Selectivity Accelerated

Get the Power of HILIC and RP Modes in One LC Column

Reversed-phase (RP) analysis on a C18 column is a common approach, but it isn't always the best strategy. You can do more with a Raptor™ FluoroPhenyl LC column—a rugged, reliable fluorinated phenyl that allows you to operate with confidence in either HILIC or RP mode.



RESTEK Pure Chromatography www.restek.com/raptor

Raptor™ FluoroPhenyl Columns

- Powerful performance for both reversed-phase and HILIC separations.
- Ideal for increasing sensitivity and selectivity in LC-MS analyses.
- Offers increased retention for charged bases compared to a C18.
- Rugged and reliable—fluorophenyl chemistry that gives reproducible results.

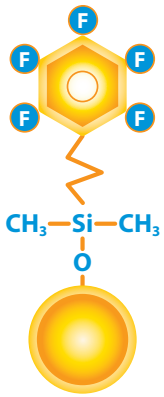
Switch to a Raptor™ FluoroPhenyl LC column when you need more retention and selectivity for basic and hydrophilic compounds than you can achieve on a C18.

Order yours today at **www.restek.com/raptor**

Part of Restek's Raptor™ LC column line featuring 2.7 and 5 µm SPP core-shell silica:

- *Higher efficiency and resolution for drastically faster analysis times.*
- *Increased sample throughput with existing HPLC instrumentation.*
- *Long-lasting ruggedness for dependable reproducibility.*

Column Description:



Stationary Phase Category:
Pentafluorophenyl propyl (L43)

Ligand Type:
Fluorophenyl

Particle:
2.7 µm or 5 µm superficially porous silica (SPP or "core-shell")

Pore Size:
90 Å

Surface Area:
150 m^2/g (2.7 µm) or 100 m^2/g (5 µm)

Recommended Usage:
pH Range: 2.0–8.0

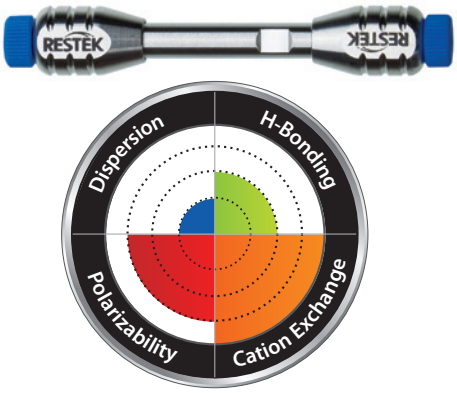
Maximum Temperature: 80 °C

Maximum Pressure: 600 bar/8,700 psi (2.7 µm)
or 400 bar/5,800 psi (5 µm)

Properties:
- Capable of both reversed-phase and HILIC separations.
- Ideal for increasing sensitivity and selectivity in LC-MS analyses.
- Offers increased retention for charged bases.

Switch to a Raptor™ FluoroPhenyl LC column when:
- Limited retention and selectivity are observed on a C18 for basic compounds.
- You need increased retention of hydrophilic compounds.

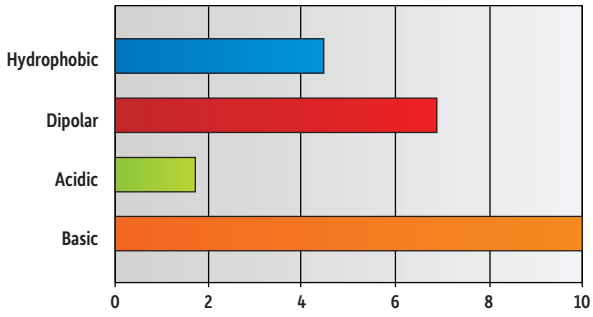
Column Interaction Profile:



Defining Solute Interactions:
• Cation exchange

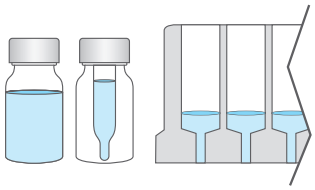
Complementary Solute Interaction:
• Polarizability
• Dispersion

Solute Retention Profile:



Target Analyte Structures:
• Nitrogen

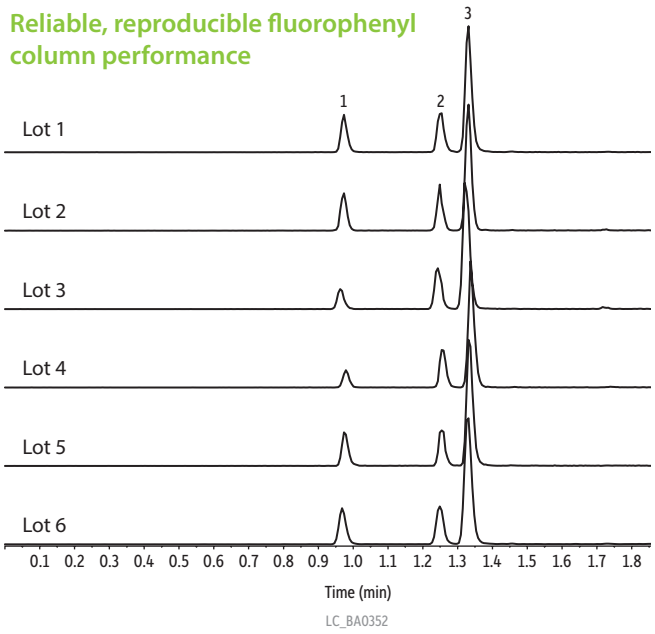
Target Analyte Functionalities:
• Protonated amines
• Quaternary ammonium compounds
• Positively charged moieties
• Lewis bases



Get the Power of HILIC and RP Modes in One Raptor™ FluoroPhenyl Column

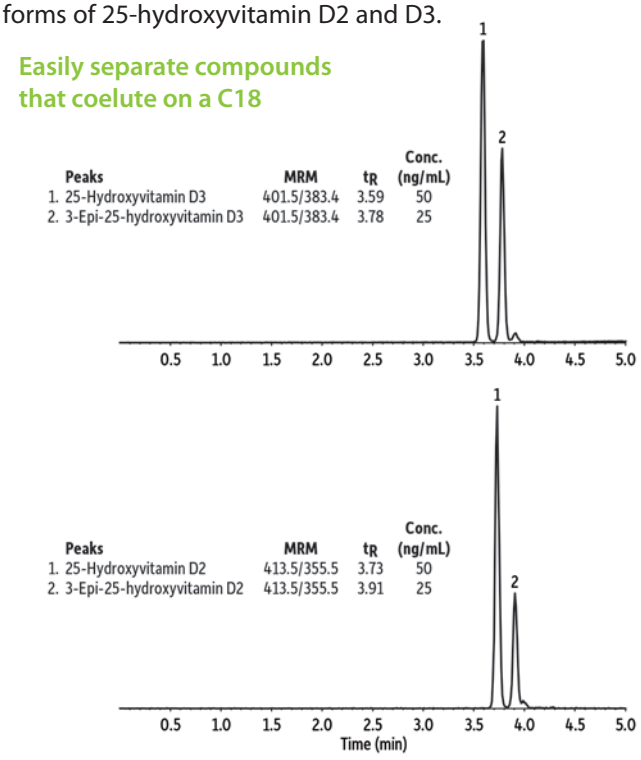
Figure 1: Strict quality control ensures Raptor™ FluoroPhenyl columns are exceptionally reproducible, ensuring you get predictable performance from every column.

Peaks	t_R (min)	Precursor Ion	Product Ion 1	Product Ion 2
1. Baccatin III	0.97	587.0	405.1	105.0
2. Docetaxel	1.25	808.1	527.3	226.1
3. Paclitaxel	1.33	854.1	569.3	286.2



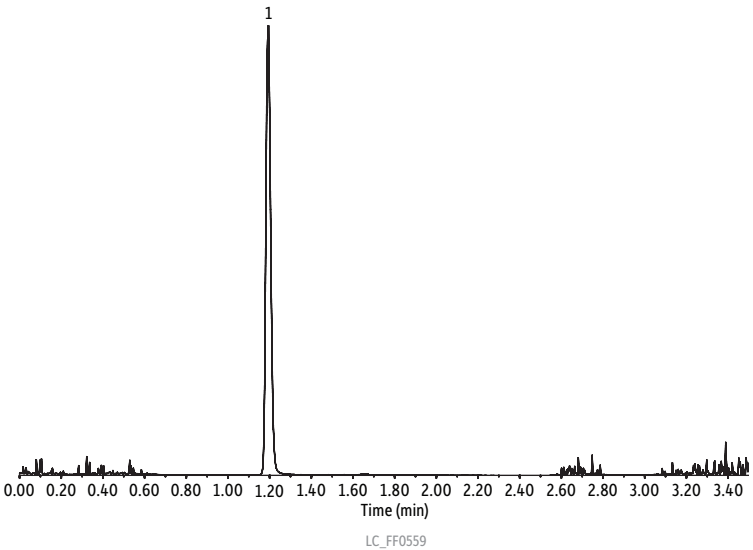
Column: Raptor™ FluoroPhenyl (cat.# 931955E); Dimensions: 50 mm x 3 mm ID, Particle Size: 5 µm; Temp.: 35 °C; **Sample:** Diluent: Water; Conc.: 100 ng/mL; Inj. Vol.: 5 µL; **Mobile Phase:** A: 0.1% Formic acid in water; B: 0.1% Formic acid in acetonitrile; **Gradient (%B):** 0.00 min (25% B), 2.00 (95% B), 2.01 (25% B), 3.50 (25% B); **Flow:** 0.8 mL/min; **Detector:** MS/MS; Ion Mode: ESI+; Mode: MRM; **Instrument:** UHPLC.

Figure 2: Raptor™ FluoroPhenyl columns have the retention and selectivity you need to quickly and easily separate compounds that coelute on a C18, such as the epimeric forms of 25-hydroxyvitamin D2 and D3.



Column: Raptor™ FluoroPhenyl (cat.# 9319A1E); Dimensions: 100 mm x 3 mm ID, Particle Size: 2.7 µm; Pore Size: 100 Å; Temp.: 30 °C; **Sample:** Diluent: Water:methanol (50:50); Conc.: 25–50 ng/mL; Inj. Vol.: 5 µL; **Mobile Phase:** A: 0.1% Formic acid in water; B: Methanol; **Gradient (%B):** 0.00 min (75% B), 4.00 (85% B), 4.10 (100% B), 5.00 (100% B); 5.01 (75% B); 7.00 (75% B); **Flow:** 0.6 mL/min; **Detector:** MS/MS; Ion Mode: ESI+; Mode: MRM; **Instrument:** HPLC.

Figure 3: Sometimes adequate retention just can't be obtained in reversed-phase mode. The Raptor™ FluoroPhenyl column lets you operate in either HILIC or RP mode, so you have options when you need to analyze compounds like caramel coloring byproduct 4-methylimidazole (4-MEI).



Raptor™ FluoroPhenyl columns give you the flexibility to work in both reversed-phase and HILIC modes

Peaks	t_R (min)	Precursor Ion	Product Ion
1. 4-Methylimidazole (4-MEI)	1.19	83	56

Column: Raptor™ FluoroPhenyl (cat.# 9319A52); Dimensions: 50 mm x 2.1 mm ID, Particle Size: 2.7 µm; Temp.: 35 °C; **Sample:** Diluent: Acetonitrile; Conc.: 100 ng/mL; Inj. Vol.: 5 µL; **Mobile Phase:** A: 0.1% Formic acid in water; B: 0.1% Formic acid in acetonitrile; **Gradient (%B):** 0.00 min (95% B), 2.00 (30% B), 2.01 (95% B), 3.50 (95% B); **Flow:** 0.6 mL/min; **Detector:** MS/MS; Ion Mode: ESI+; Mode: MRM; **Instrument:** UHPLC.

Dependable Raptor™ FluoroPhenyl Columns Give You the Flexibility to use both HILIC and RP Modes

Raptor™ FluoroPhenyl LC Columns

Length	2.1 mm cat.#	3.0 mm cat.#	4.6 mm cat.#
2.7 µm Columns			
30 mm	9319A32	9319A3E	9319A35
50 mm	9319A52	9319A5E	9319A55
100 mm	9319A12	9319A1E	9319A15
150 mm	9319A62	9319A6E	9319A65
5 µm Columns			
30 mm	—	931953E	—
50 mm	9319552	931955E	9319555
100 mm	9319512	931951E	9319515
150 mm	9319562	931956E	9319565
250 mm	—	—	9319575

EXP® Reusable Fittings for HPLC & UHPLC

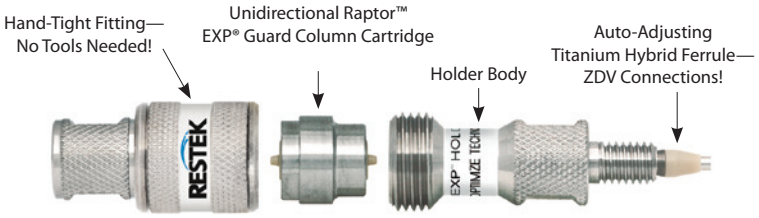
for 10-32 fittings and 1/16" tubing

Effortlessly achieve 8,700+ psi HPLC seals by hand! (Wrench-tighten to 20,000+ psi.) Hybrid titanium/PEEK seal can be installed repeatedly without compromising your seal.

Description	qty.	cat.#
EXP Hand-Tight Fitting (Nut w/Ferrule)	ea.	25937
EXP Hand-Tight Fitting (Nut w/Ferrule)	10-pk.	25938
EXP Hand-Tight Nut (w/o Ferrule)	ea.	25939

Hybrid Ferrule U.S. Patent No. 8201854, Optimize Technologies. Optimize Technologies EXP Holders are Patent Pending. Other U.S. and Foreign Patents Pending. The Opti- prefix is a registered trademark of Optimize Technologies, Inc.

Raptor™ EXP® Guard Cartridges



Protect your investment and extend the life of our already-rugged LC columns and change guard column cartridges by hand without breaking fluid connections—no tools needed!

EXP® Direct Connect Holder

Description	qty.	cat.#
EXP Direct Connect Holder for EXP Guard Cartridges (includes hex-head fitting & 2 ferrules)	ea.	25808

Maximum holder pressure: 20,000 psi (1,400 bar)

Raptor™ EXP® Guard Column Cartridges

Description	Particle Size	qty.	5 x 2.1 mm cat.#	5 x 3.0 mm cat.#	5 x 4.6 mm cat.#
Raptor FluoroPhenyl EXP Guard Column Cartridges	2.7 µm	3-pk.	9319A0252	9319A0253	9319A0250
Raptor FluoroPhenyl EXP Guard Column Cartridges	5 µm	3-pk.	931950252	931950253	931950250

Maximum cartridge pressure: 600 bar/8,700 psi (2.7 µm) or 400 bar/5,800 psi (5 µm)

Raptor™ SPP LC columns combine the speed of SPP with the resolution of USLC® technology. Learn more at **www.restek.com/raptor**

Experience *Selectivity Accelerated.* Order the Raptor™ FluoroPhenyl today at **www.restek.com/raptor**

RESTEK®
Pure Chromatography

Questions about this or any other Restek® product?
Contact us or your local Restek® representative (www.restek.com/contact-us).

www.restek.com

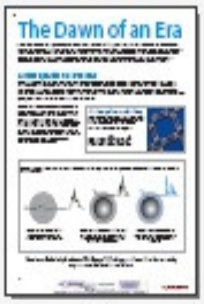
QUALITY ISO 9001 · 17025 · Guide 34

Lit. Cat.# GNSS2369-UNV

Raptor LC Columns

Page Pic INDEX


1

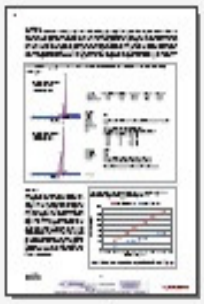


2


3


4

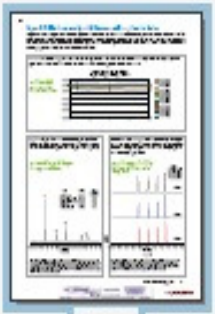

5

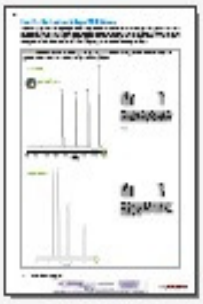

6

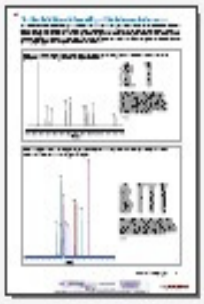

7

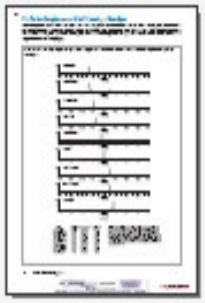

8

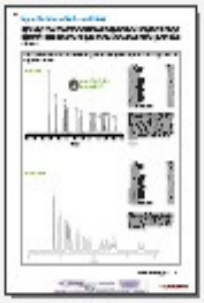

9


10


11


12

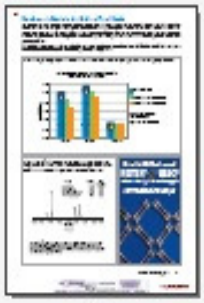

13

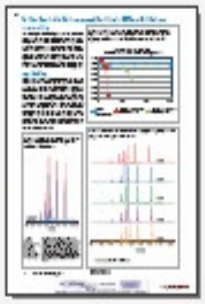

14

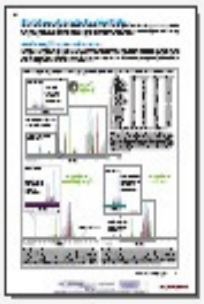

15

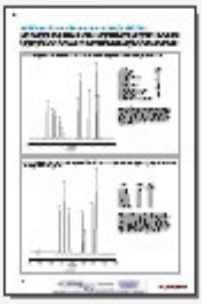

16


17


18


19


20


21

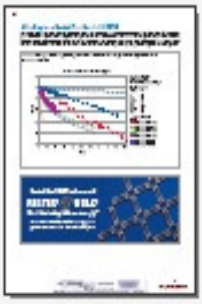

22

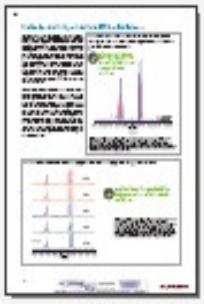

23


24

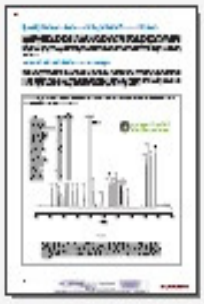

25


26


27

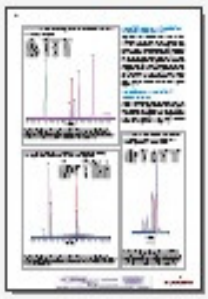

28


29


30

Raptor LC Columns

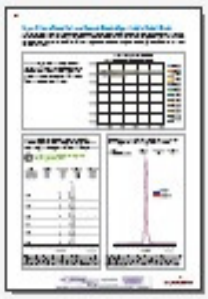
Page Pic INDEX


31


32


33

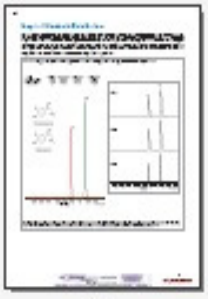

34


35


36


37


38


39


40


41


42


43


44


45


46


47


48


49


50


51


52


53


54


55