



Kinetex Core-Shell LC Columns

When Innovation Meets Quality

Pharmaceutical Edition



- Award Winning Particle Technology
- Reproducible, Consistent Results
- High Efficiency, Resolution, and Sensitivity



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Kinetex™
Core-Shell Technology

LC Accessories

Kinetex Core-Shell is a multi-award winning technology, first introduced in 2009 by Phenomenex R&D Experts, which has proven to deliver dramatic improvements in efficiency over conventional fully porous media providing advantages such as increased resolution, higher productivity, reduced solvent consumption, and decreased overall costs.

Whether you are running HPLC or UHPLC methods, the Kinetex core-shell family delivers dramatically improved performance over your current column.

Phenomenex designs and manufactures its own silica and organo-silica core-shell particles to ensure quality control throughout the entire manufacturing process. The combination of a consistent, solid high density core along with proprietary column packing technologies ensures optimum bed structure and high column performance.

- Performance gains on ANY LC system
- System-to-system and lab-to-lab method transferability
- Improve the productivity of dated, established legacy methods

Multi-Award-Winning Technology



Strong History of Continuous Innovation

Kinetex has over 15 years of proven innovation, consistently delivering reliability and Industry Leading Performance across phases with robust retention mechanisms, meeting analytical needs across multiple industries.



Find your core-shell solution at www.phenomenex.com/Kinetex



Strong History of Continuous Innovation



KINETEX
Core-Shell Technology

- 2 Particle Sizes
- 3 Phases

2009

Chromatographers in the following industries can benefit from the advantages of Core-Shell technology:

-  **Raw Materials Testing**
-  **Drug Discovery**
-  **ADME/DMPK Studies**
-  **Drug Substance Assay**
-  **Related Substances**
-  **Excipients**
-  **Dissolution Studies**
-  **Drug Product Assay**
-  **Formulation Development**
-  **API Synthesis**

- 5 Particle Sizes
- 11 Phases
- Available in Micro, Analytical, Semi Prep and Prep Columns



Kinetex
Core-Shell Technology

NOW

Fully Porous		Kinetex Core-Shell		Average Efficiency Gain with Kinetex*	Fully Porous		Kinetex Core-Shell		Average Efficiency Gain with Kinetex*
	vs			90 % Higher		vs			20 % Higher
	vs			85 % Higher		vs			50 % Higher

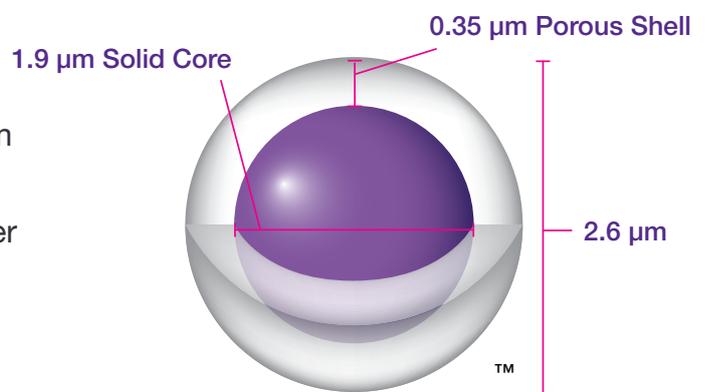
* May not be representative of all applications

Core-Shell Advantage

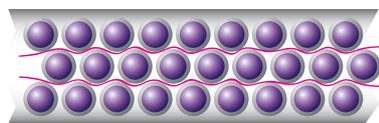
By using sol-gel processing techniques that incorporate nano-structuring technology, a durable and homogeneous porous shell is grown on a solid silica core to create a Kinetex Core-Shell particle. This particle morphology reduces broadening contributions resulting in extremely high efficiencies when compared to columns featuring fully porous particles.

Kinetex 2.6 μm Core-Shell Particle

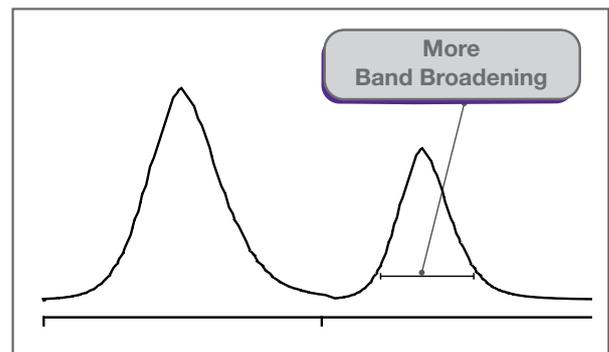
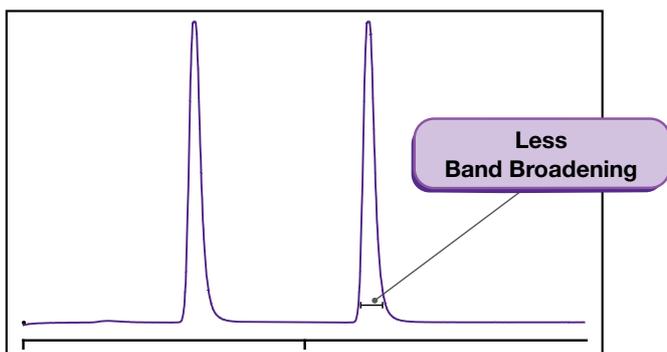
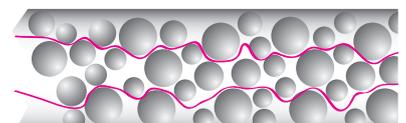
- Higher throughput without sacrificing resolution
- Easy method transfer across LC system platforms
- Reduce solvent consumption with faster analysis
- Achieve lower levels of detection and quantitation



Kinetex Core-Shell



Fully Porous

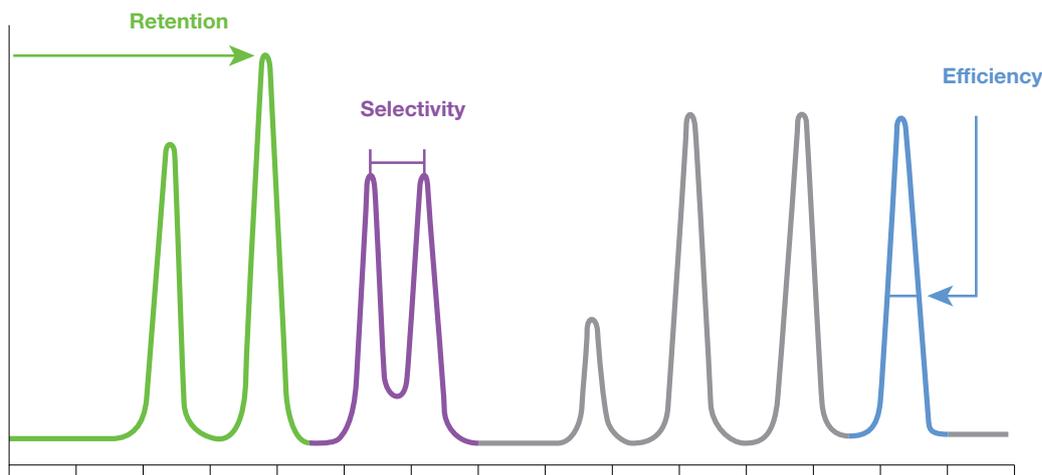
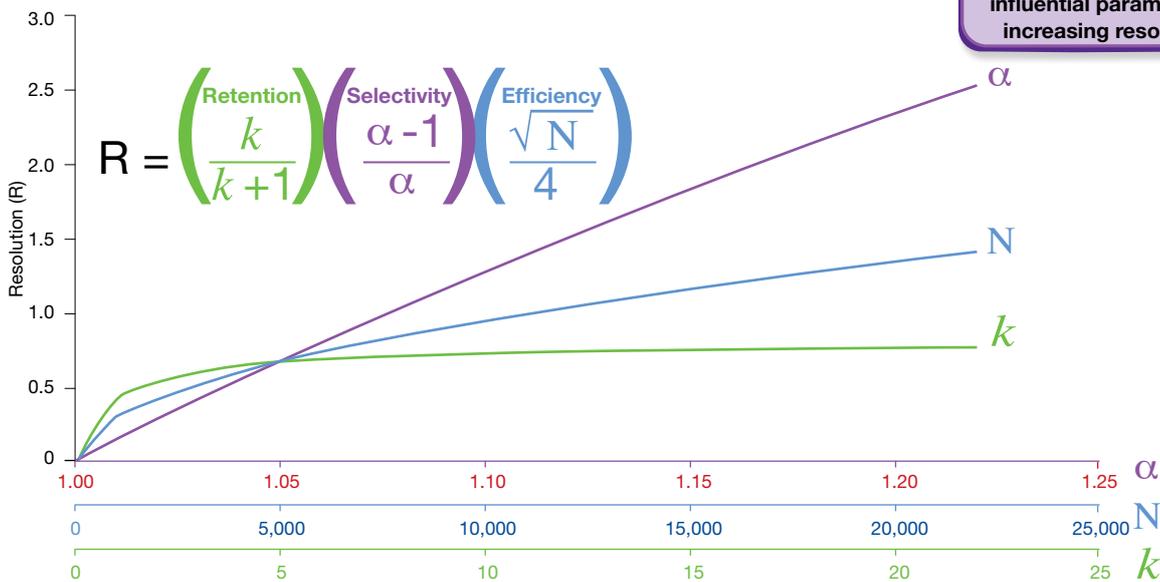


Impact of Selectivity on Resolution

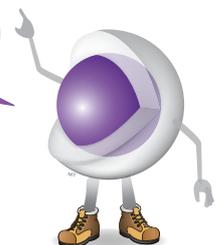
Selectivity (α) has the greatest impact on chromatographic resolution (R) when compared to other parameters. Often, the simplest and most effective way to improve your chromatographic results is to change your column's phase or solid support. Phenomenex offers a wide breadth of stationary phase chemistries across multiple solid supports for simplified method development and optimization.

The Impact of Selectivity on Resolution

Selectivity is the most influential parameter for increasing resolution!

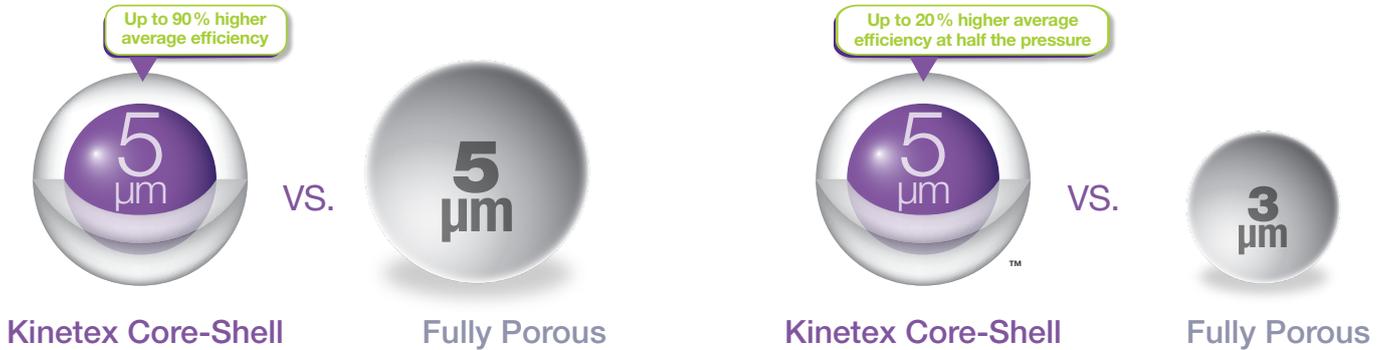


Find your Ideal Kinetex Selectivity on pages 14-15



Improved Performance

Kinetex 5 μm columns have efficiencies and peak capacities on par with traditionally fully porous 3 μm columns while still only requiring backpressures seen with traditional 5 μm columns in both isocratic and gradient methods.



Advantages of Low Backpressures with Kinetex 5 μm Columns

- Longer column lifetime
- Higher throughput
- Increased system compatibility and method transferability

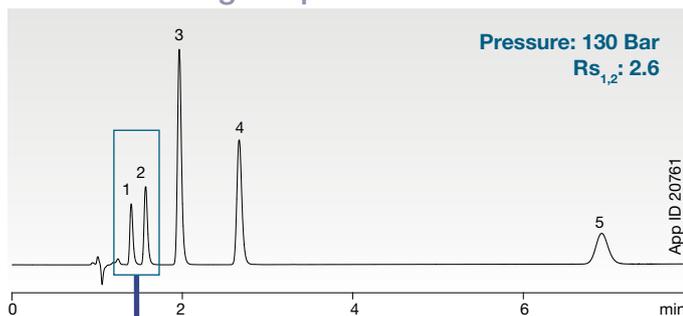
Instantly Improve 5 μm and 3 μm Methods

Immediately improve resolution, productivity, and sensitivity of your current 3 μm and 5 μm HPLC methods with **Kinetex 5 μm** core-shell technology. This core-shell particle was specifically developed for use on standard or older model HPLC systems that may have low pressure limitations.

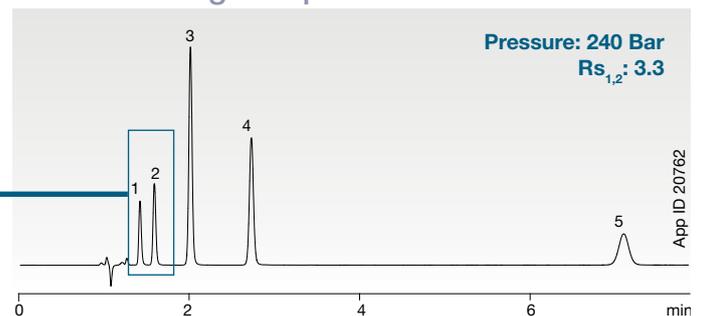
Resolution of Core-shell vs. Fully Porous

Higher Resolution with no Pressure Increase

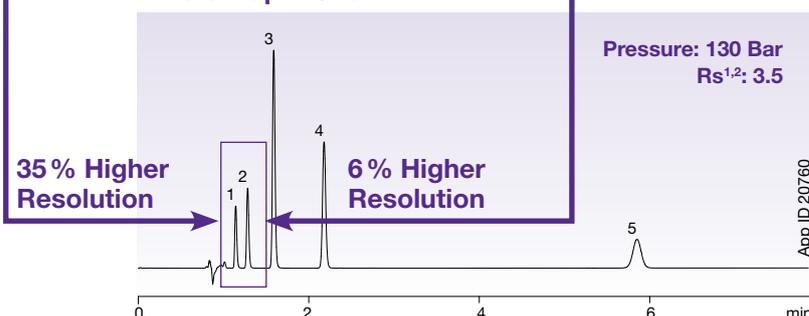
Waters® XBridge® 5 μm C18



Waters XBridge 3.5 μm C18



Kinetex 5 μm C18



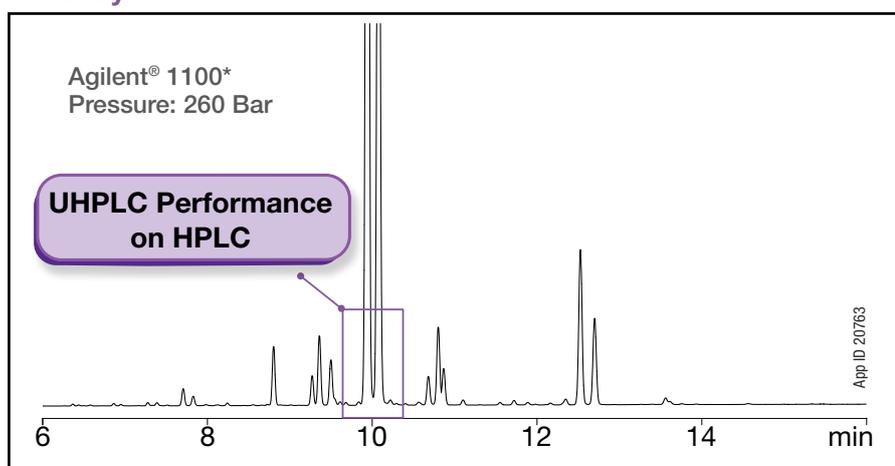
Waters and XBridge are registered trademarks of Waters Corporation. Phenomenex is not affiliated with Waters Corporation. Comparative separations may not be representative of all applications.

Ultra-High Performance on Both U/HPLC Systems

Dramatically improve the productivity and performance of your existing methods with the use of shorter Kinetex columns, while decreasing your solvent usage! On a low volume HPLC or UHPLC system **Kinetex 2.6 μm** columns will provide up to 3x the efficiency of 5 μm and potentially double the efficiency of 3 μm fully porous media.

Performance with Kinetex 2.6 μm

HPLC System

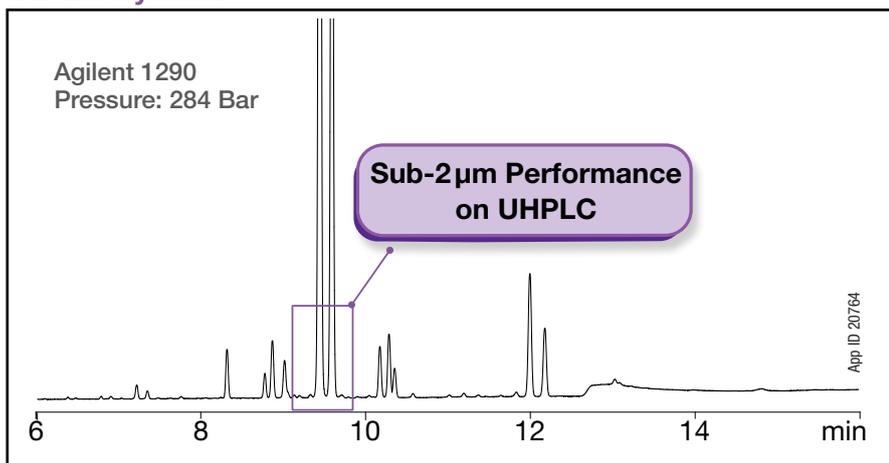


Conditions for all columns

Columns: Kinetex 2.6 μm C18
Part No.: [00D-4462-E0](#)
Dimensions: 100 x 4.6 mm
Mobile: A: Water with 0.1% TFA
Phase: B: Acetonitrile with 0.1% TFA
Gradient: Time (min) % B
0 10
20 70
Flow Rate: 1.2 mL/min
Temperature: Ambient
Detection: UV @ 210 nm
Sample: Mupirocin degradants

*Agilent 1100 was optimized with the Core-Shell Performance Enhancement Kit [AQ0-8892](#).
Comparative separations may not be representative of all applications.

UHPLC System



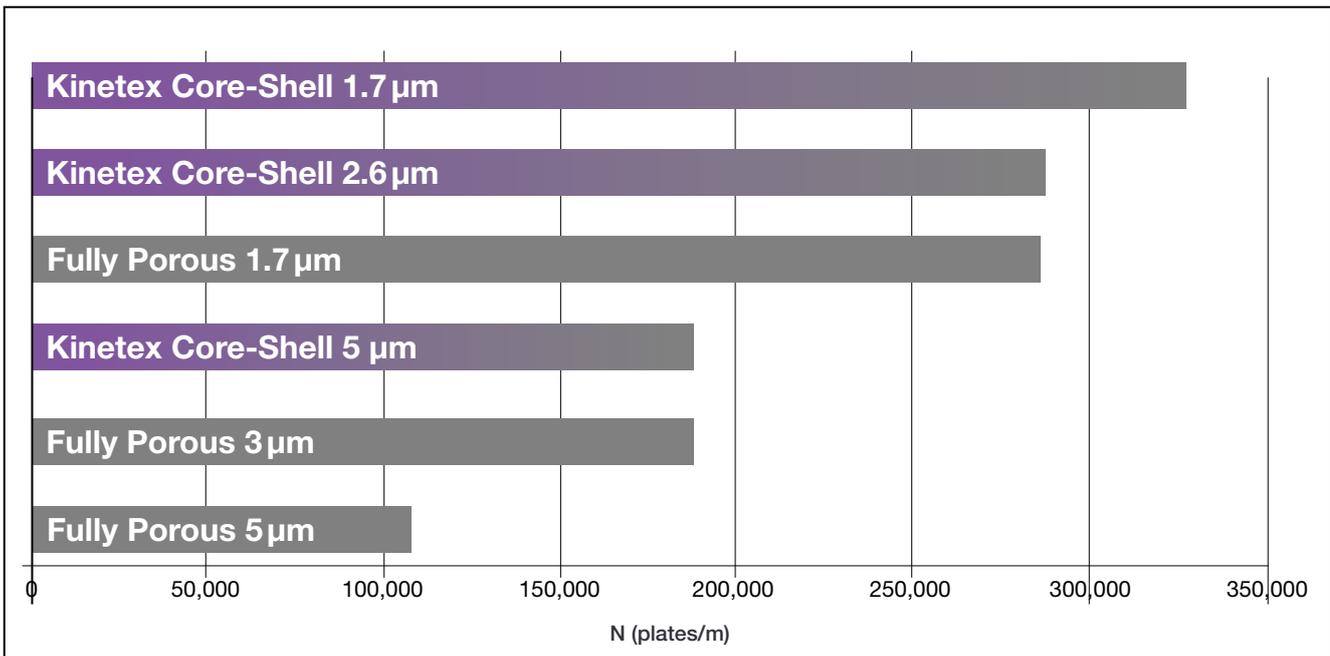
Learn more about Kinetex LC solutions at
www.phenomenex.com/Kinetex



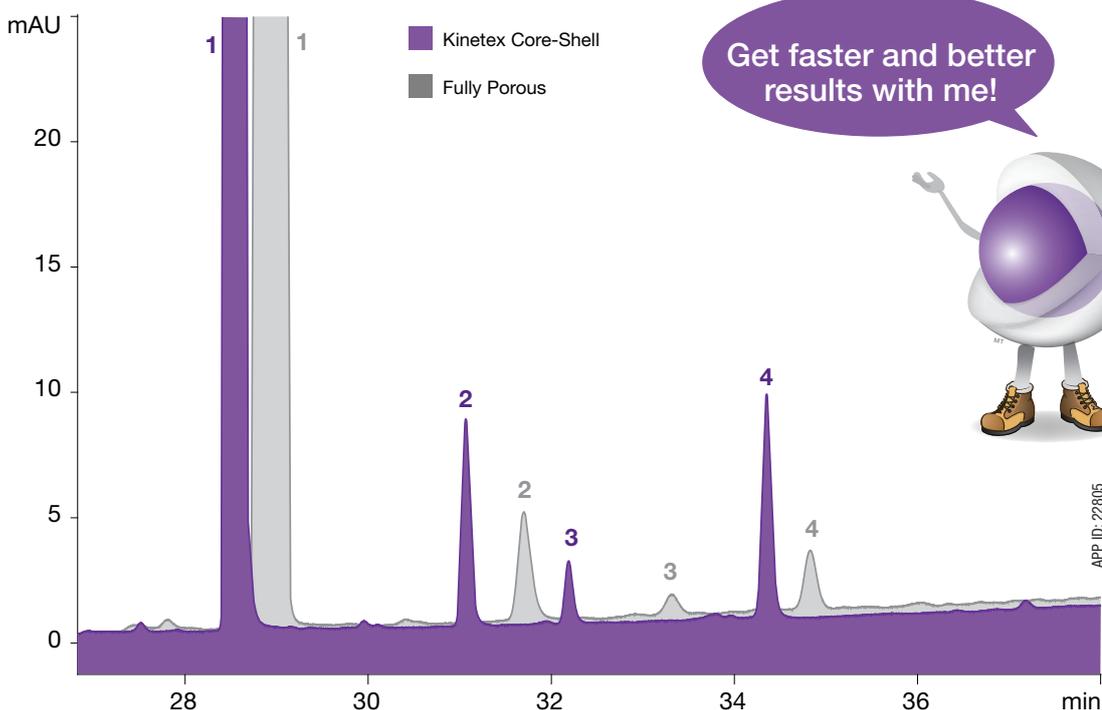
Ultra-High Efficiency with Core-Shell Particles

The band broadening (wide peaks) and lengthy retention times of traditional fully porous products can limit your results. Kinetex Core-Shell ultra-high efficient performance achieves shorter run times, higher levels of sensitivity, and overall better HPLC or UHPLC results.

Core-Shell vs. Fully Porous Efficiency Levels (plates/m)



Core-Shell Performance Gains



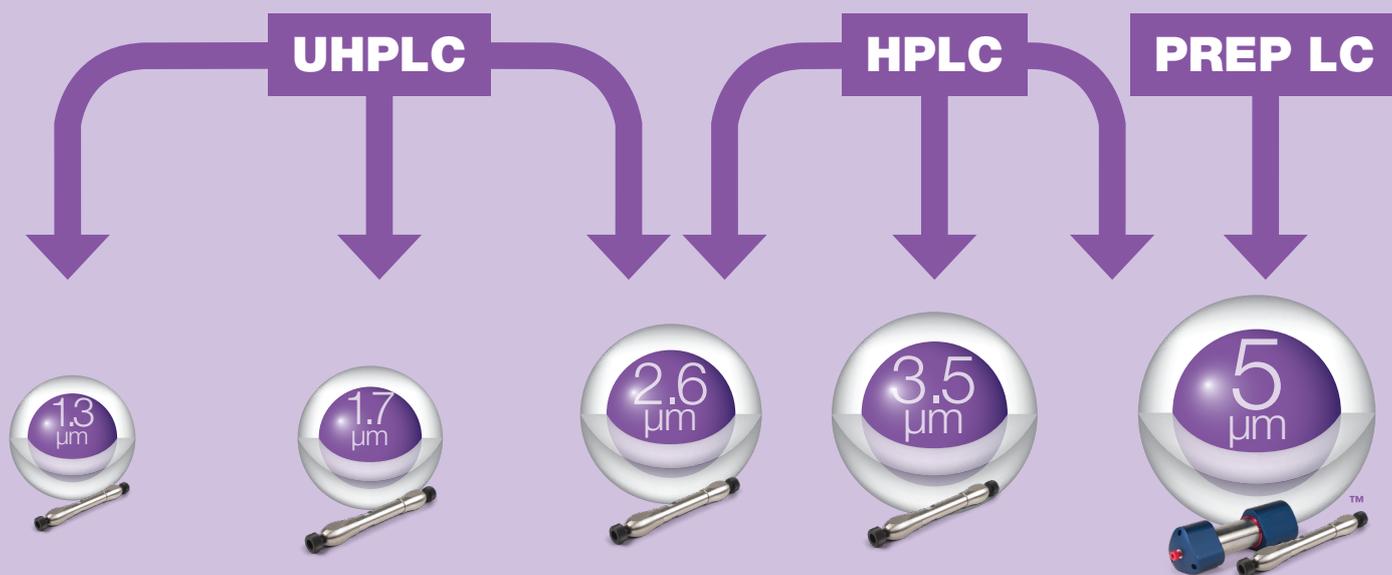
Scalable Particle Platform

Easily develop and transfer your method between systems



With Kinetex 5 μm , 3.5 μm , 2.6 μm , 1.7 μm , and 1.3 μm Core-Shell Technology, you are no longer restricted from developing high-performance LC methods. These five scalable Kinetex particle sizes allow to develop and transfer your method effortlessly from system to system.

Complete Scalable Solution from UHPLC to HPLC to PREP LC



Incredible UHPLC efficiency and performance gains

20% higher efficiency than fully porous 1.7 μm columns

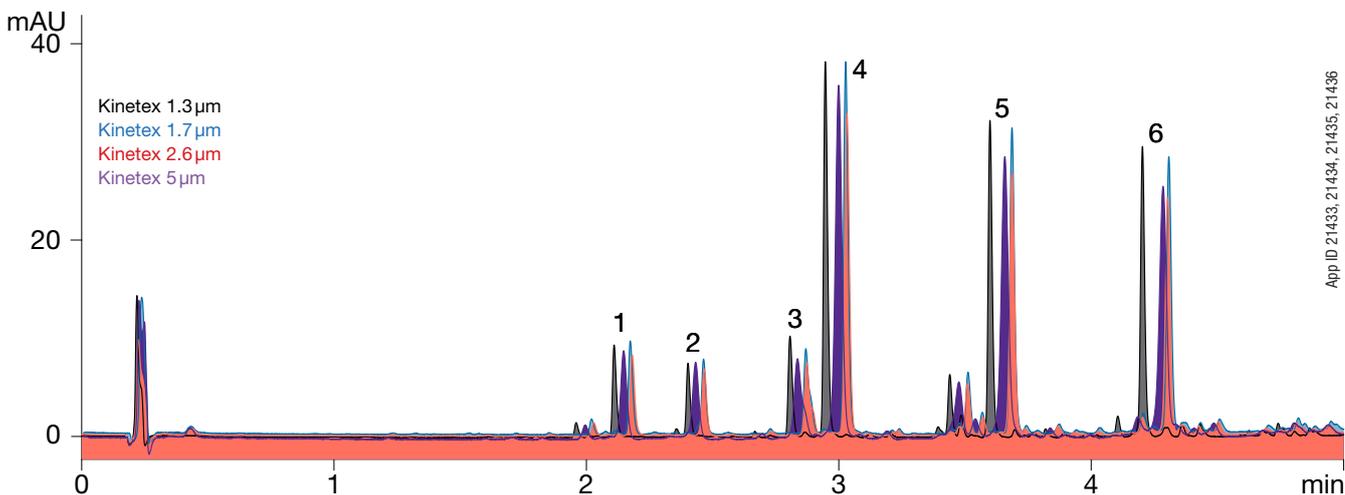
Achieve sub-2 μm performance on HPLC and UHPLC systems

Instantly improve your pharmacopoeia (Ph. Eur. & USP) monographs that require 3.5 μm particle size

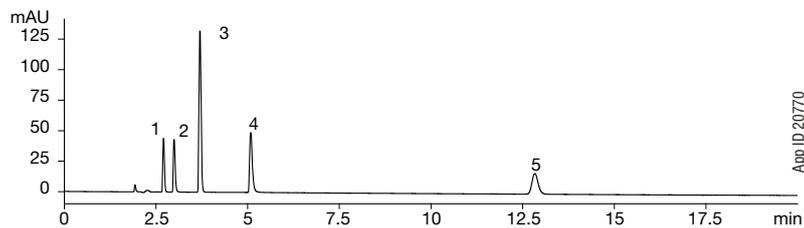
3 μm or better efficiencies at 5 μm pressures for HPLC and PREP LC methods

Scalability: UHPLC/HPLC/PREP LC

Gingerols



Kinetex 5µm C18 on Shimadzu® LC-20A



App ID 20770



Columns: Kinetex 5µm C18
Dimension: 250 x 4.6 mm
Part No.: [00G-4601-E0](#)

Conditions are the same except as noted:

Mobile Phase: Water/Acetonitrile/
Phosphoric Acid
(600:400:2)

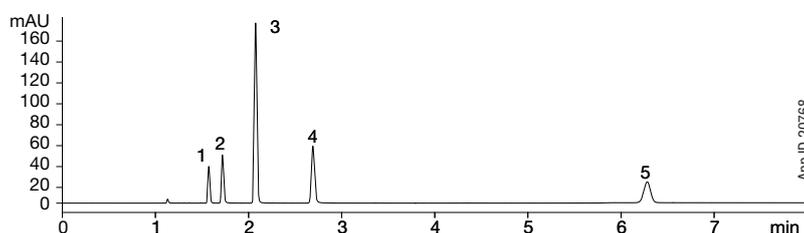
Flow Rate: 1 mL/min

Temperature: Ambient

Detection: UV @ 237 nm

Sample: 1. Impurity A
2. Impurity B
3. Impurity C
4. Acetylsalicylic acid
5. Impurity D

Kinetex 2.6µm C18 on Agilent® 1100

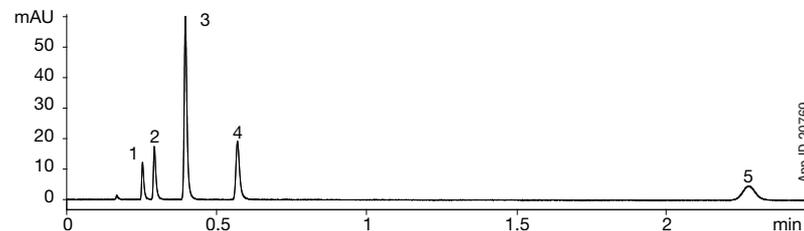


App ID 20768



Columns: Kinetex 2.6µm C18
Dimension: 150 x 4.6 mm
Part No.: [00F-4462-E0](#)

Kinetex 1.7µm C18 on Agilent 1290



App ID 20769



Columns: Kinetex 1.7µm C18
Dimension: 50 x 3.0 mm
Part No.: [00B-4475-Y0](#)
Mobile Phase: 680:320:2

Particle Size Recommended Based on System

	5µm	3.5µm	2.6µm	1.7µm	1.3µm
UHPLC					
HPLC					
PREP LC					

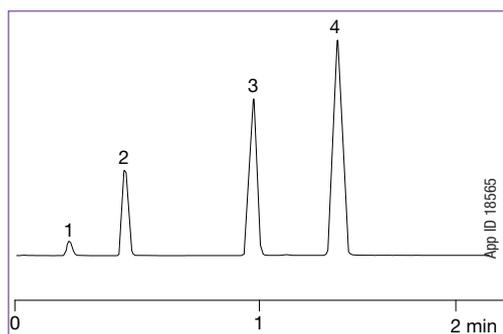
To find Kinetex applications go to
<https://www.phenomenex.com/applications>



Adaptability and Method Transfers

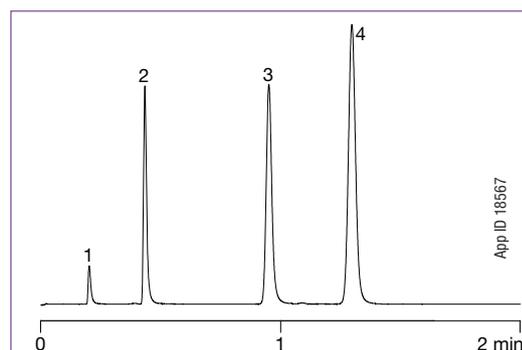
UHPLC methods developed with fully porous sub-2 μm columns often generate higher backpressure that only certain systems can run. With the **Kinetex 2.6 μm** particle performance you are no longer restricted by system limitations for your HPLC or UHPLC method development.

Kinetex 2.6 μm , 4.6 mm ID on Agilent® 1100



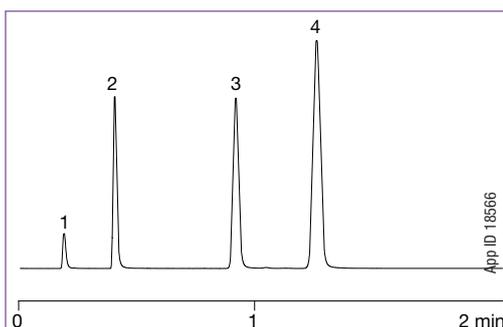
Column: Kinetex 2.6 μm C18
Dimensions: 50 x 4.6 mm
Part No.: [00B-4462-E0](#)
Mobile Phase: Acetonitrile / Water (50:50)
Flow Rate: 2.35 mL/min*
Temperature: Ambient
Detection: UV @ 254 nm
Sample: 1. Uracil
2. Acetophenone
3. Toluene
4. Naphthalene

Kinetex 2.6 μm , 3.0 mm ID on Shimadzu® Prominence UFLC®



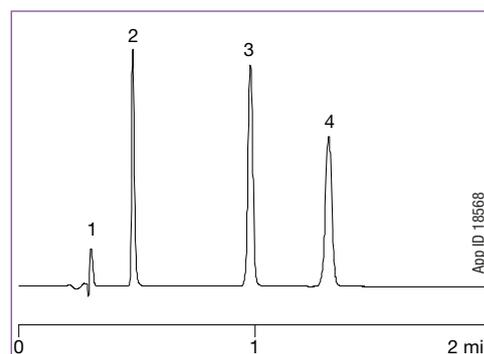
Column: Kinetex 2.6 μm C18
Dimensions: 50 x 3.0 mm
Part No.: [00B-4462-Y0](#)
Mobile Phase: Acetonitrile / Water (50:50)
Flow Rate: 1.0 mL/min*
Temperature: Ambient
Detection: UV @ 254 nm
Sample: 1. Uracil
2. Acetophenone
3. Toluene
4. Naphthalene

Kinetex 2.6 μm , 2.1 mm ID on Agilent 1200



Column: Kinetex 2.6 μm C18
Dimensions: 50 x 2.1 mm
Part No.: [00B-4462-AN](#)
Mobile Phase: Acetonitrile / Water (50:50)
Flow Rate: 0.49 mL/min*
Temperature: Ambient
Detection: UV @ 254 nm
Sample: 1. Uracil
2. Acetophenone
3. Toluene
4. Naphthalene

Kinetex 2.6 μm , 2.1 mm ID on Waters® ACQUITY® UPLC®



Column: Kinetex 2.6 μm C18
Dimensions: 50 x 2.1 mm
Part No.: [00B-4462-AN](#)
Mobile Phase: Acetonitrile / Water (50:50)
Flow Rate: 0.49 mL/min*
Temperature: Ambient
Detection: UV @ 254 nm
Sample: 1. Uracil
2. Acetophenone
3. Toluene
4. Naphthalene

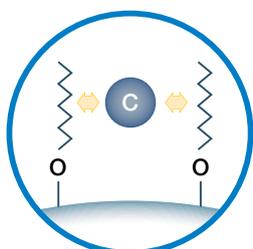
*Please note that the flow rates were scaled to maintain the same linear velocity.

Recommended Selectivities

Quick guide to easily select your phase

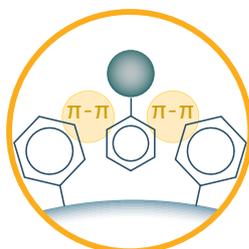
<p>Acids</p> <p>C18 F5 Phenyl-Hexyl</p>	<p>Bases</p> <p>EVO C18 XB-C18 Biphenyl Polar C18 PS-C18</p>	<p>Neutrals</p> <p>C18 C8 Biphenyl</p>	<p>Aromatics</p> <p>Biphenyl Phenyl-Hexyl F5</p>
<p>Acids, Bases, and Neutrals</p> <p>Polar C18 Biphenyl EVO C18 F5</p>	<p>Highly Polar Compounds</p> <p>Polar C18 F5 Biphenyl HILIC</p>	<p>High pH</p> <p>EVO C18</p>	<p>Isomers</p> <p>F5</p>

Separation Mechanisms



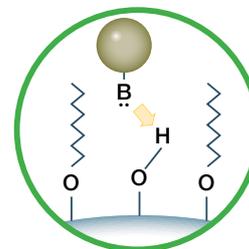
Hydrophobicity

The ability of a phase to hydrophobically interact with carbon groups



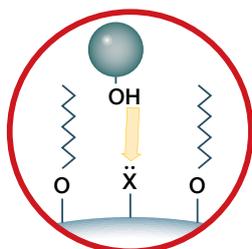
Steric Interaction

The ability of a phase to separate compounds based on structural differences



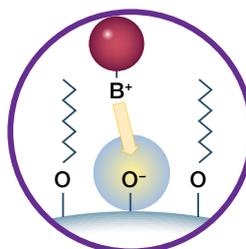
Hydrogen Bond Donating Capacity

The ability of a phase to hydrogen-bond with proton accepting groups



Hydrogen Bond Accepting Capacity

The ability of a phase to hydrogen-bond with proton donating groups



Cation Selectivity at pH 2.8

The ability of a phase to interact with cation groups at acidic pH

Cation Selectivity at pH 7.0

The ability of a phase to interact with cation groups at neutral pH

Select the Right Phase for Your Analysis

Combining the high efficiency of Kinetex Core-Shell Technology with an excellent range of surface chemistries gives you the best opportunity for increased resolution.

Kinetex Phase Selection



Unbonded silica phase for HILIC conditions to provide selectivity for polar compounds



100% aqueous stable which allows for excellent reversed phase retention and enhanced polar and aromatic selectivity



All-purpose hydrophobic retention and methylene selectivity



Minimized hydrophobic retention for highly hydrophobic compounds



High pH stability from 1-12 to deliver robust methods and improved peak shape for bases



Highly reproducible pentafluorophenylpropyl phase, exceptional for halogenated, conjugated, isomeric, or highly polar compounds



Greater retention and separation of aromatic compounds



Superior peak shape and enhanced separation of basic compounds under neutral and acidic conditions



A multi-modal C18 column with a unique positive surface modification that displays improved peak shape for basic compounds



Combined C18 and polar modified surface that provide polar and non-polar retention alongside 100% aqueous stability

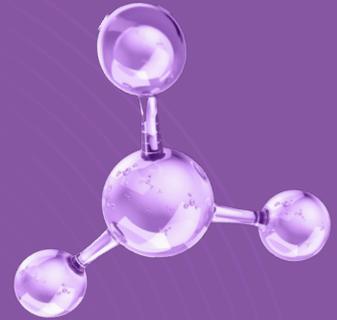
Simple Selection of the Suitable Column

	Particle Sizes (µm)	Pore Size (Å)	Effective Surface Area (m ² /g)	Effective Carbon Load (%)	pH Range	Pressure Stability (bar/PSI)
Kinetex Phases						
Kinetex Polar C18	2.6	100	200	9	1.5 – 8.5*	1,034/15,000
Kinetex PS C18	2.6	100	200	9	1.5 – 8.5*	1,034/15,000
Kinetex C18	1.3, 1.7, 2.6, 5	100	200	12	1.5 – 8.5*	1,034/15,000
Kinetex EVO C18	1.7, 2.6, 5	100	200	11	1.5 – 12	1,034/15,000
Kinetex XB-C18	1.7, 2.6, 3.5, 5	100	200	10	1.5 – 8.5*	1,034/15,000
Kinetex C8	1.7, 2.6, 5	100	200	8	1.5 – 8.5*	1,034/15,000
Kinetex Biphenyl	1.7, 2.6, 5	100	200	11	1.5 – 8.5*	1,034/15,000
Kinetex Phenyl-Hexyl	1.7, 2.6, 5	100	200	11	1.5 – 8.5*	1,034/15,000
Kinetex F5	1.7, 2.6, 5	100	200	9	1.5 – 8.5*	1,034/15,000

† Shipping conditions may vary slightly in terms of organic to aqueous ratio, depending on column dimensions.

* pH stability under gradient conditions. pH stability is 1.5-10 under isocratic conditions.

**Pressure limits are stable for all Kinetex columns 4.6 mm ID and under. For 10 mm ID Kinetex columns pressure > 413 bar/6000 psi may compromise column longevity. For 21.1, 30, and 50 mm ID Kinetex columns pressure > 241 bar/3500 psi may compromise column longevity.

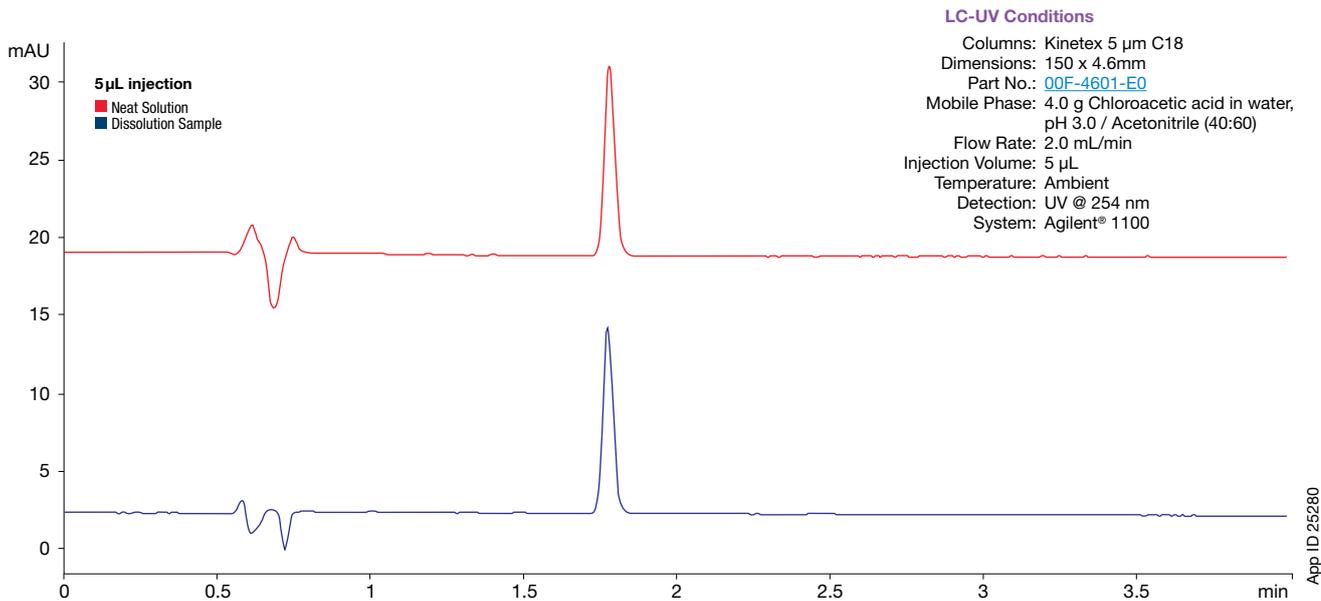


Pharmaceutical Applications

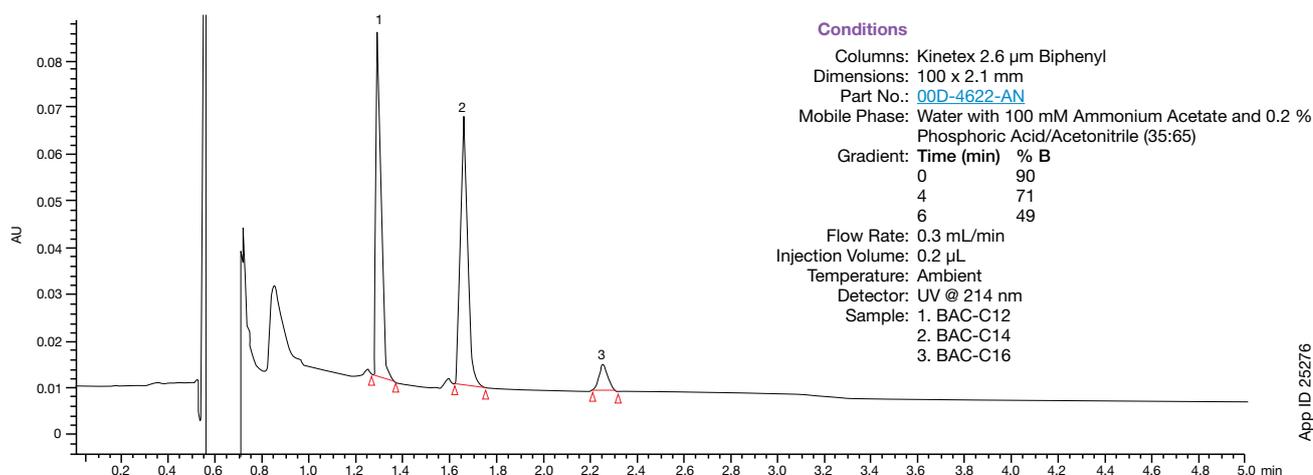


Pharmaceutical Applications

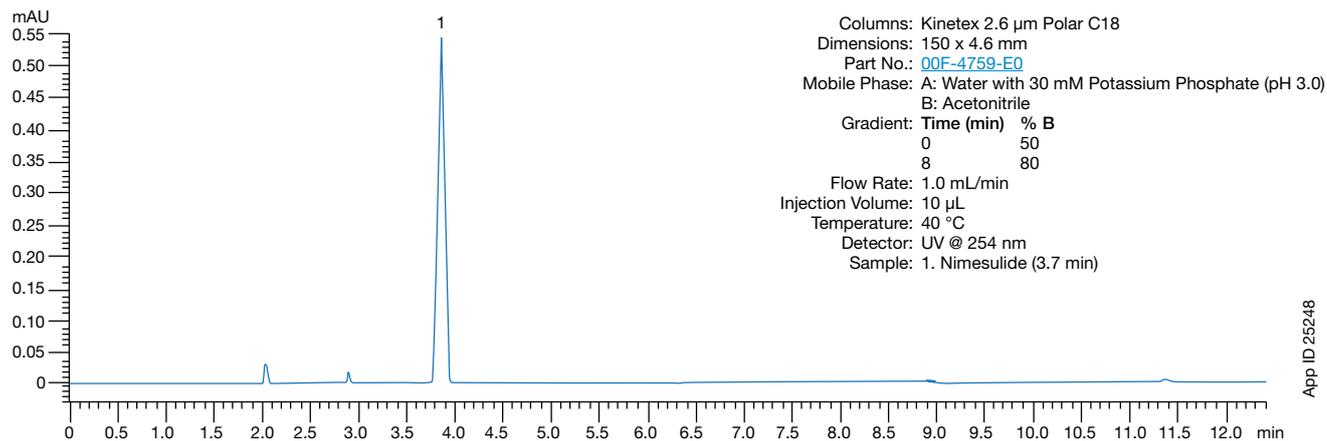
Ibuprofen Tablet USP Dissolution: A Rapid HPLC Alternative to the Traditional UV Method



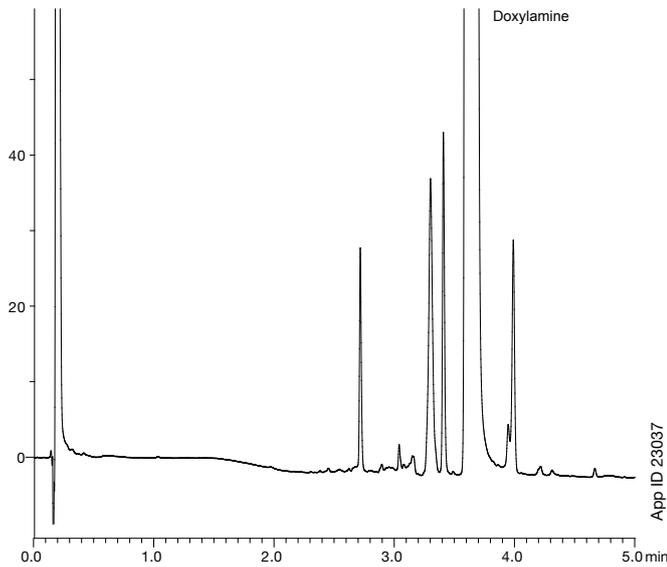
Separation of Benzalkonium Chloride Homologs (C12, C14, and C16)



NSAID Active Ingredient Nimesulide from a Topical Gel Formulation Using a Kinetex 2.6 μ m Polar C18 Column



Doxylamine Impurity Profile Using a Kinetex EVO C18 Core-Shell LC Column



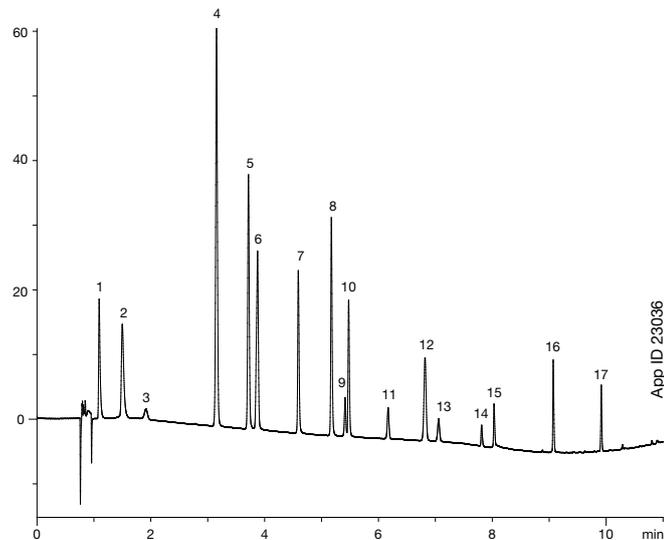
LC-UV Conditions

Columns: Kinetex 2.6 μ m EVO C18
 Dimensions: 50 x 2.1 mm
 Part No.: [00B-4725-AN](#)
 Mobile Phase: A: 20 mM Ammonium bicarbonate (pH 10)
 B: Acetonitrile
 Gradient:

Time (min)	% B
0	5
5	09

 Flow Rate: 0.7 mL/min
 Temperature: Ambient
 Detector: UV @ 254 nm
 Sample: Impurity profile of Doxylamine
 Concentration: 25 mg/mL API in DMSO

Cold Medicine API Screen Using a Kinetex EVO C18 Core-Shell LC Column



LC-UV Conditions

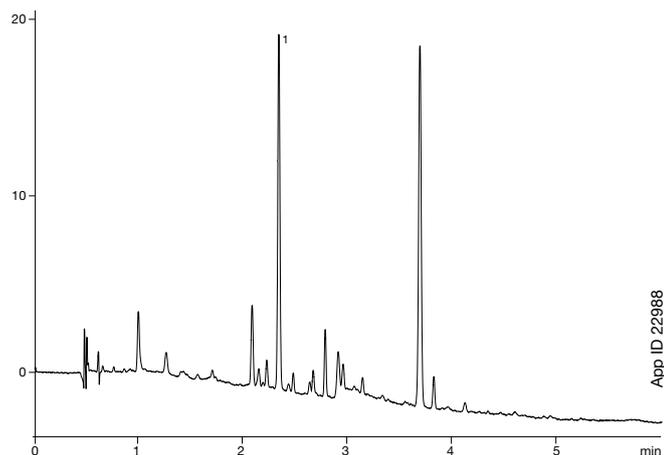
Columns: Kinetex 2.6 μ m EVO C18
 Dimensions: 100 x 4.6 mm
 Part No.: [00D-4725-E0](#)
 Mobile Phase: A: 0.1 % TFA
 B: 0.1 % TFA in Acetonitrile
 Gradient:

Time (min)	% B
0	2
6	30
11	100

 Flow Rate: 1.25 mL/min
 Temperature: Ambient
 Detector: UV @ 254 nm
 Sample:

1. Maleic acid	10. Brompheniramine
2. Fumaric acid	11. Acetylsalicylic acid
3. Phenylephrine	12. 4-Nitrophenol
4. Acetaminophen	13. Impurity
5. Pheniramine	14. Dextromethorphan
6. Doxylamine	15. Diphenhydramine
7. Pyrilamine	16. Clemastine
8. Chlorpheniramine	17. Ibuprofen
9. Guaifenesin	

Forced Degradation of Cefaclor Analysis Using Kinetex EVO C18 Core-Shell LC Column



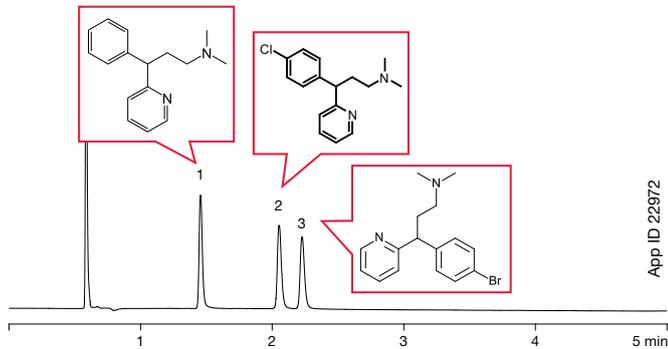
LC-UV Conditions

Columns: Kinetex 2.6 μ m EVO C18
 Dimensions: 100 x 4.6 mm
 Part No.: [00D-4725-E0](#)
 Mobile Phase: A: 0.1 % H3PO4 in Water
 B: 0.1 % H3PO4 in Acetonitrile
 Gradient:

Time (min)	% B
0	5
6	40

 Flow Rate: 1.75 mL/min
 Temperature: Ambient
 Detector: UV @ 254 nm
 Sample: 1. Cefaclor

Pheniramine and Halogenated Derivatives Separated with a Kinetex 2.6 μ m EVO C18 Core-Shell Column



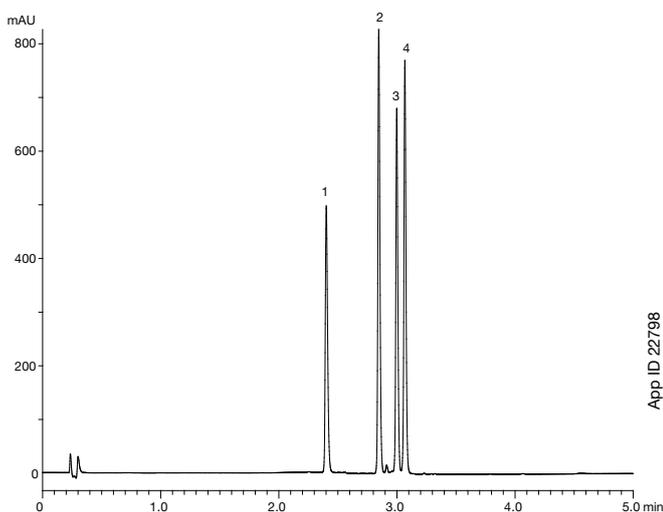
LC-UV Conditions

Columns: Kinetex 2.6 μ m EVO C18
 Dimensions: 100 x 4.6 mm
 Part No.: [00D-4725-E0](#)
 Mobile Phase: A: 10 mM Ammonium bicarbonate (pH 10.2)
 B: Acetonitrile
 Gradient:

Time (min)	% B
0	50
4	60

 Flow Rate: 1.25 mL/min
 Temperature: Ambient
 Detector: UV @ 210 nm
 Sample: 1. Pheniramine
 2. Chlorpheniramine
 3. Brompheniramine

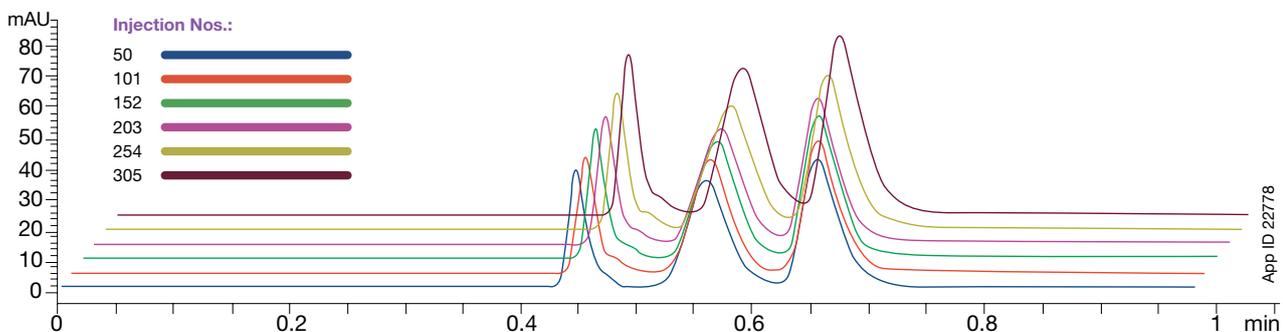
Analysis of Common Statin Drugs Using a Kinetex F5 Core-Shell LC Column



LC-UV Conditions

Columns: Kinetex 2.6 μ m F5
 Dimensions: 50 x 2.1 mm
 Part No.: [00B-4723-AN](#)
 Mobile Phase: A: 0.1 % TFA in Water
 B: Acetonitrile
 Gradient: 20 to 90 % B in 1 min. Hold for 4 min
 Flow Rate: 0.5 mL/min
 Temperature: Ambient
 Detector: UV @ 248 nm
 Sample: 1. Lovastatin
 2. Atorvastatin
 3. Pravastatin
 4. Simvastatin

100% Aqueous Stability of Kinetex EVO C18 Core-Shell LC Columns

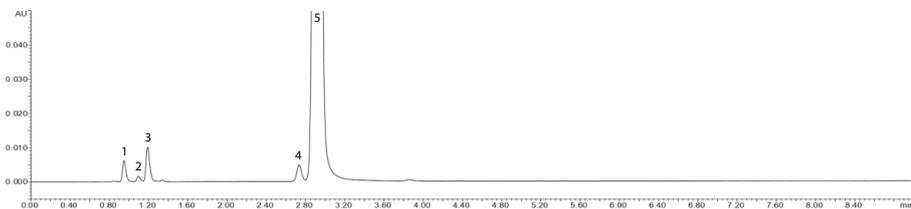


LC-UV Conditions

Columns: Kinetex 5 μ m EVO C18
 Dimensions: 50 x 4.6 mm
 Part No.: [00B-4633-E0](#)
 Mobile Phase: 0 mM Sodium phosphate pH 2.5
 Flow Rate: 1 mL/min
 Temperature: 30 $^{\circ}$ C
 Detector: UV @ 270 nm
 Sample: 1. Norepinephrine
 2. Epinephrine
 3. Dopamine

Pharmaceutical Applications

Ph. Eur. Monograph 2217: Lamivudine Related Substances with Ph. Eur. Method Modernization



App ID 27631

LC-UV Conditions

Columns: Kinetex 2.6 μ m C18
 Dimensions: 150 x 3.0 mm
 Part No.: [00F-4462-Y0](#) – Method 4
 Mobile Phase: Mobile Phase Table 1
 Flow Rate: 0.82 mL/min – Method 4
 Injection Volume: 3 μ L – Method 4
 Temperature: 35 $^{\circ}$ C
 Detector: UV @ 277 nm
 Sample: Waters[®] ACQUITY Arc[®] HPLC – Method 4

Click Each!



Tech Note

European Pharmacopoeia Paracetamol Monograph Draft Method: Achieving Improved Sensitivity, Resolution, and Separation for Paracetamol and All 14 Related Impurities using Kinetex 5 μ m C18 Core-Shell Columns



Tech Note

LC-MS/MS Quantitative Analysis of NDMA in Ranitidine Active Pharmaceutical Ingredient (API) and Drug Product using the SCIEX[®] 4500 QTRAP[™]



Tech Note

Ph. Eur. Monograph 2217: Lamivudine Related Substances with Ph. Eur. Method Modernization



Tech Note

Assay of Doxepin Hydrochloride According to USP Monograph Using Three Different HPLC Columns



Tech Note

USP Butamben Assay and Organic Impurities by LC-UV using the Kinetex 5 μ m XB-C18 Core-Shell HPLC Column



Tech Note

Meeting and Surpassing System Suitability for USP Sildenafil Citrate Assay and Organic Impurities



Tech Note

Meeting and Surpassing System Suitability for USP Fluconazole and Related Impurities



Tech Note

USP Assay and Organic Impurities (LC-UV) for Chloroquine Phosphate



Tech Note

USP Assay (LC-UV) for Lopinavir and Ritonavir Tablets

Kinetex Applications



Click Each!



Tech Note

Meeting System Suitability for USP Amlodipine and Olmesartan Medoxomil Tablets Assay and Organic Impurities



Tech Note

Identification and Sensitive Quantitation of N-nitroso N-desmethyl Orphenadrine Impurity in Orphenadrine Citrate API



Tech Note

Meeting System Suitability for USP Abacavir and Lamivudine Tablets Assay



Tech Note

Analysis of Related Substances of Chlorhexidine Digluconate: Kinetex 5 μ m C18 Batch Reproducibility and Effect of Gradient Delay Volume on Separation of Impurities



Tech Note

Development of a Multi-Step Purification Process for the Purification of a Crude Synthetic Peptide (Exenatide) Mixture



Tech Note

Separation of Fexofenadine Hydrochloride and its Organic Impurities per USP Monograph



Tech Note

Ph. Eur. Monograph 2280: Fexofenadine Hydrochloride Related Substances and Assay



Tech Note

Ph. Eur. Monograph 1028: Metoprolol Tartrate and Related Substances with Ph. Eur. Method Modernization



Tech Note

Driving More Sensitive and Selective Quantitation of Highly Potent Inhaled Corticosteroids in Human Plasma Using Accurate Mass Spectrometry

Kinetex Applications *cont'd*

 Click Each!



Tech Note

Low-pg/mL Quantitation of Long-acting Insulin Analog in Rat Plasma



Tech Note

AQbD Approach to Stability Indicating Method Development for Valsartan Sacubitril Drug Product



Tech Note

Separation of Ezetimibe and its Organic Impurities per USP Monograph



Tech Note

Ph. Eur. Monograph 3036: Teriflunomide Assay and Related Substances on Kinetex™ 2.6 μm C18 Column



Tech Note

Low-level Quantification of 10 Mutagenic Nitrosamine Impurities in Pioglitazone Hydrochloride Using Accurate Mass Spectrometry



Tech Note

Lamivudine Related Substances Method per IP Monograph



Tech Note

Ph. Eur. Monograph 3036: Teriflunomide Assay and Related Substances on Kinetex 2.6 μm C18 Column

Optimize Your Analysis and Column Lifetime



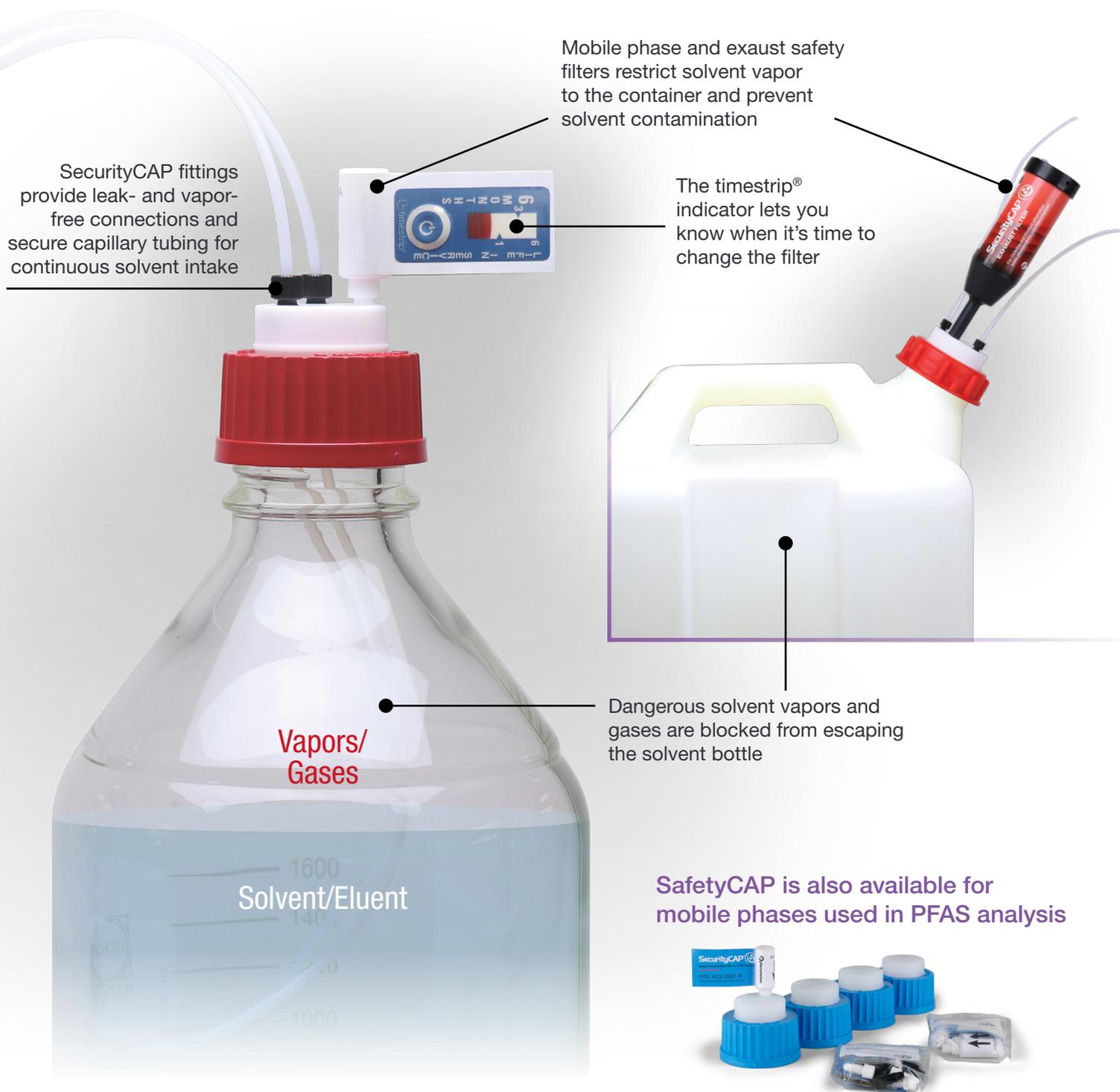
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2. SecurityLINK™: Get better HPLC/UHPLC results with fingertight, zero dead-volume connections
3. SecurityGuard™ and SecurityGuard ULTRA: Increase LC column lifetime

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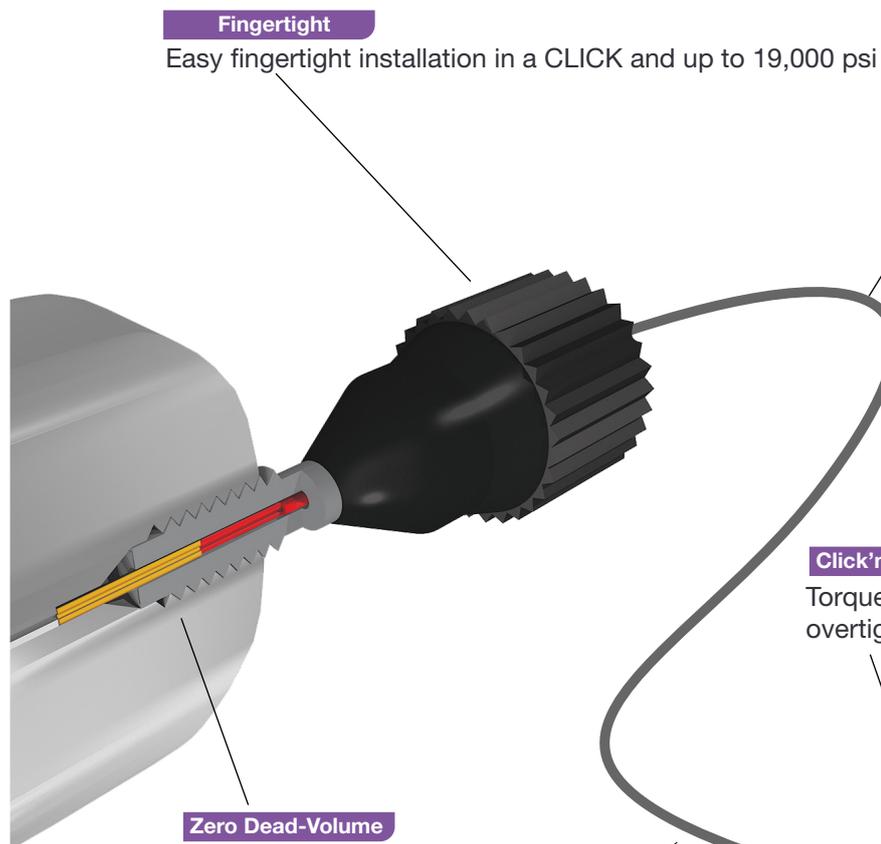
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Core-Shell Technology

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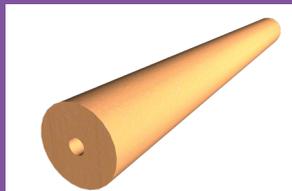
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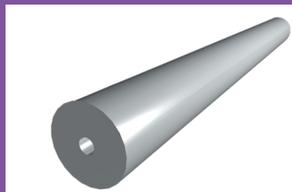
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Multiple materials and dimensions are available

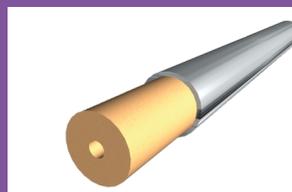
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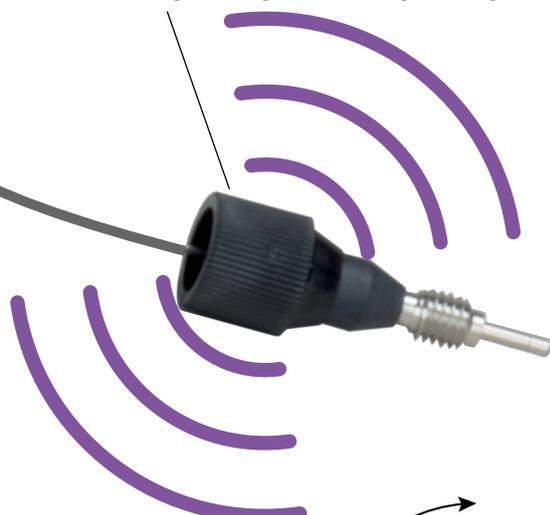
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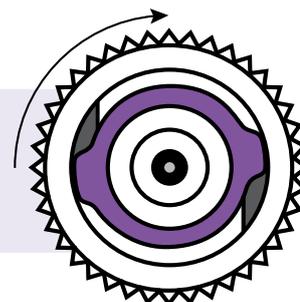
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Torque limiting technology prevents overtightening or undertightening



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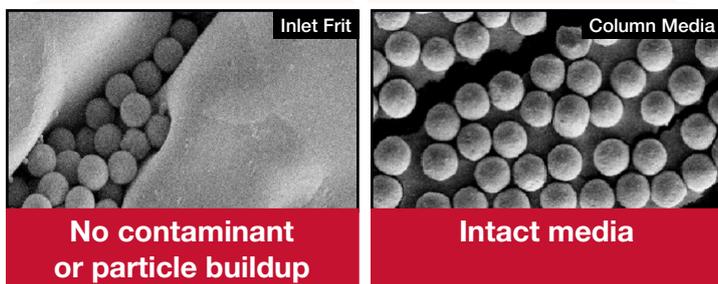
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SecurityGuard is a cost convenient universal column protection system that effectively protects your U/HPLC columns from the damaging effects of chemical contaminants without altering your chromatographic results.

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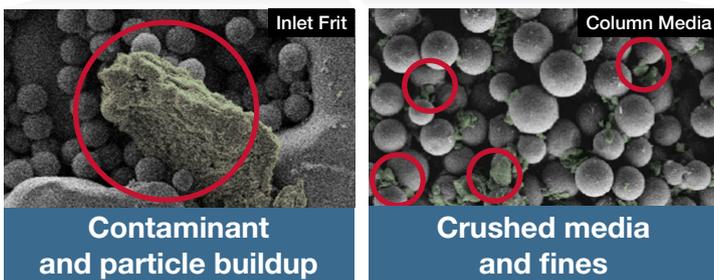
SecurityGuard ULTRA Cartridge System

The SecurityGuard ULTRA cartridge system protects ultra-high performance columns, like Kinetex, from damaging contaminants and microparticulates.

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