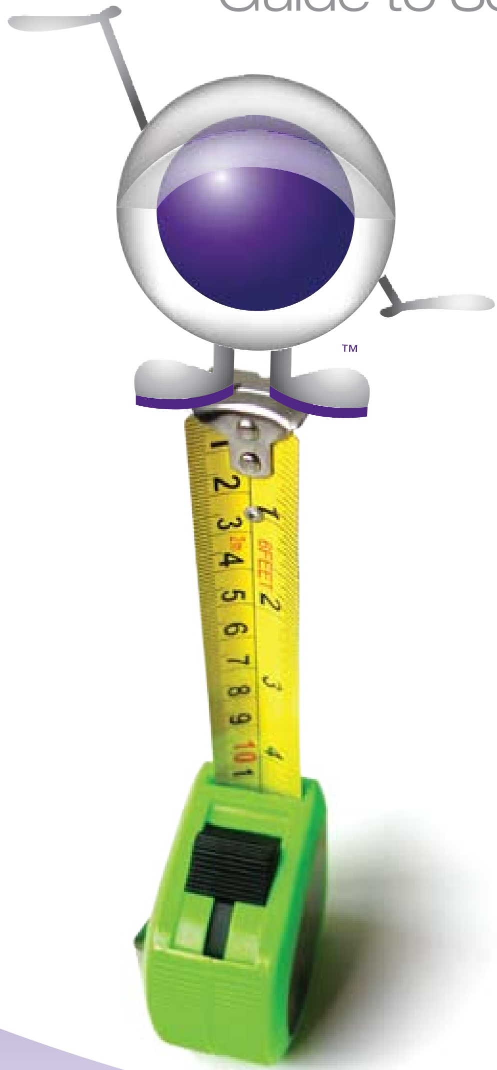
Achieving Ultra-High Performance

Guide to Scaling with Kinetex® Columns



phenomenex®
...breaking with tradition℠

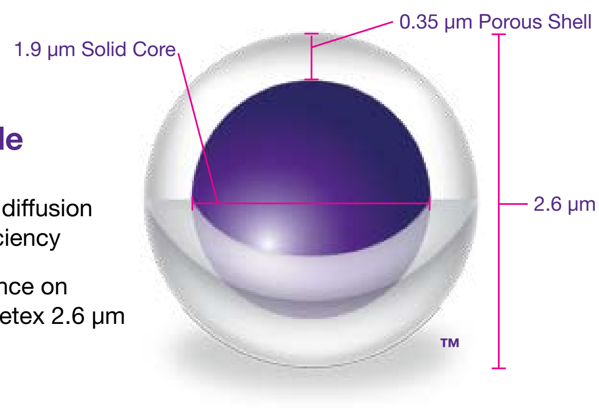
Innovation in

Particle Technology

The Kinetex® core-shell particle is not fully porous. Using sol-gel processing techniques that incorporate nano structuring technology, a durable, homogenous porous shell is grown on a solid silica core. This highly optimized process combined with uniform particle size distribution produces a column that generates extremely high plate counts on par with sub-2 µm particles. When using Kinetex 2.6 µm core-shell columns, less column backpressure is generated, allowing it to be used on any LC system.**

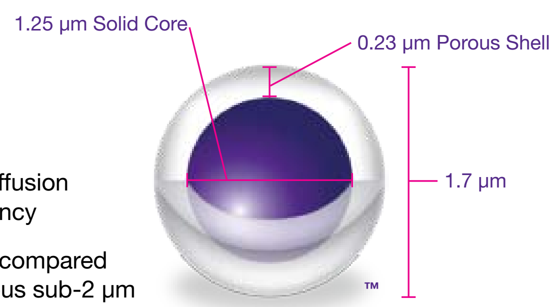
Kinetex 2.6 µm Core-Shell Particle

- Reduced controlled diffusion path maximizes efficiency
- Ultra-high performance on any system with Kinetex 2.6 µm columns



Kinetex 1.7 µm Core-Shell Particle

- Reduced controlled diffusion path maximizes efficiency
- Increased efficiencies compared to traditional fully porous sub-2 µm columns. Typical operating backpressures > 400 bar



Traditional Fully Porous Particle

- Long and variable diffusion path limits efficiencies
- Ultra-high performance limited to UHPLC systems with traditional fully porous sub-2 µm columns

** When using Kinetex 1.7 µm, increased performance can be achieved, however higher pressure-capable instrumentation is required.


Advanced in Every Way
TM

Increase Efficiency with Kinetex® Core-Shell Technology

Column efficiency (N), the measure of theoretical plates over a given length, is one of the most important indicators of column performance. Efficiency is heavily influenced by:

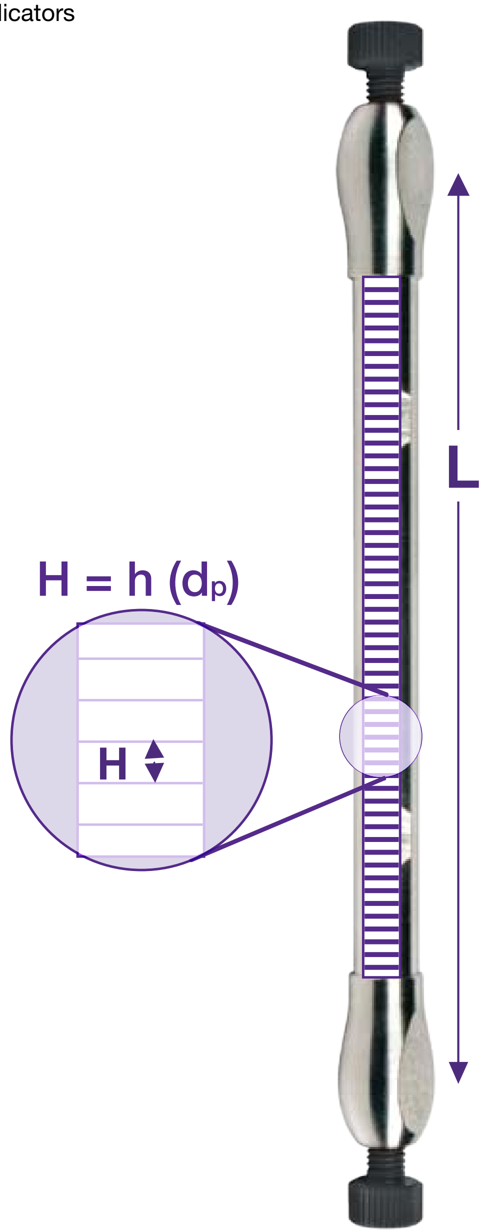
- Column length
- Particle size

This relationship can be illustrated with the following equation:

$$N = \frac{L}{H}$$

- N = Efficiency (plates)
- L = Column Length (mm)
- H = Plate Height
  $H = h\,(d_p)$
- h = Reduced Plate Height
  (Typically 2-2.5, assume 2.2 for calculations)
- d_p = Particle Diameter (mm)

Using this equation, a column's theoretical efficiency may be estimated.



Example:

- A 150 x 4.6 mm 5 µm column would have its efficiency calculated as follows:

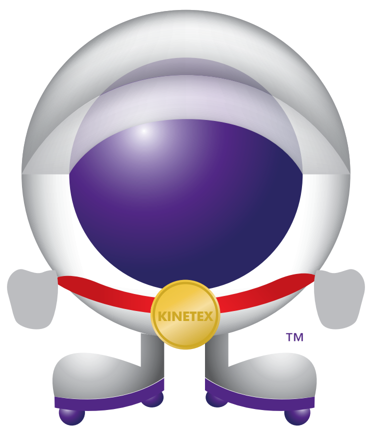
$$N = \frac{150}{(2.2).005} \rightarrow N = \frac{150}{.011} \rightarrow N = 13{,}636 \text{ plates}$$

- Then, to convert to plates/ meter

$$N_{p/m} = [13636 \text{ plates / length of column (mm)}] \times 1000 \text{ mm/m}$$

$$\rightarrow N_{p/m} = (13636 / 150 \text{ mm}) \times 1000 \text{ mm/m} = 90{,}906 \text{ p/m}$$

Smaller particle size columns will produce higher efficiencies.

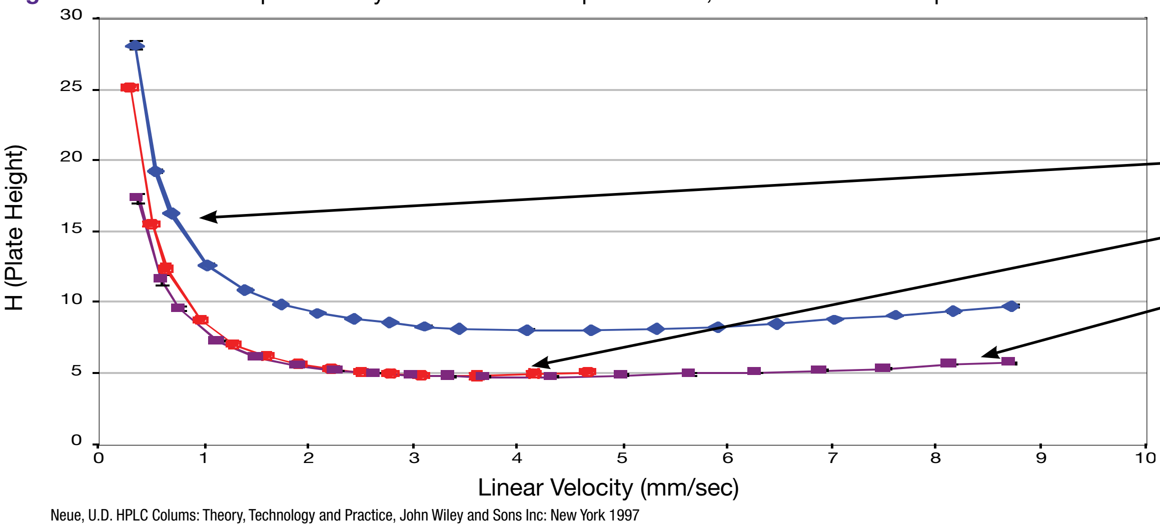


Increase Efficiency with Kinetex® Core-Shell Technology

In order to more accurately predict the efficiency of Kinetex columns using the efficiency equation, an effective particle size d_e of 1.7 µm must be used (Figure 1). As such:

An effective d_p of 1.7 µm is used for Kinetex 2.6 µm particles
An effective d_p of 1.5 µm is used for Kinetex 1.7 µm particles

Figure 1. van Deemter plot of Fully Porous 3 and 1.7 µm Column, and the Kinetex 2.6 µm Core-Shell Column



Kinetex 2.6 µm columns have the efficiency of a 1.7 µm particle. This has been experimentally proven in multiple van Deemter experiments (See Figure 1)

Fully Porous 3 µm C18
Fully Porous 1.7 µm C18
Kinetex Core-Shell 2.6 µm C18

What would be the calculated change in Efficiency from...

A 10 µm Fully Porous Media to a Kinetex 2.6 µm Media?

$$\Delta N = \frac{d_p}{d_e} \rightarrow \Delta N = \frac{10}{1.7} \rightarrow \Delta N = 5.88$$

*Approximately **6x** Increase in Efficiency*

A 5 µm Fully Porous Media to a Kinetex 2.6 µm Media?

$$\Delta N = \frac{d_p}{d_e} \rightarrow \Delta N = \frac{5}{1.7} \rightarrow \Delta N = 2.94$$

*Approximately **3x** Increase in Efficiency*

A 3 µm Fully Porous Media to a Kinetex 2.6 µm Media?

$$\Delta N = \frac{d_p}{d_e} \rightarrow \Delta N = \frac{3}{1.7} \rightarrow \Delta N = 1.76$$

*Approximately **2x** Increase in Efficiency*

A 2.5 µm Fully Porous Media to a Kinetex 2.6 µm Media?

$$\Delta N = \frac{d_p}{d_e} \rightarrow \Delta N = \frac{2.5}{1.7} \rightarrow \Delta N = 1.47$$

*Approximately **1.5x** Increase in Efficiency*

A 1.7 µm Fully Porous Media to a Kinetex 2.6 µm Media?

$$\Delta N = \frac{d_p}{d_e} \rightarrow \Delta N = \frac{1.7}{1.7} \rightarrow \Delta N = 1$$

Same Efficiency

Increase Resolution

What is resolution?

Resolution (R_s) describes the separation power of the complete chromatographic system relative to the components of the mixture. Through obtaining optimal resolution, scientists are able to:

1. Identify more compounds
2. Decrease run times
3. Increase solvent savings

$$R_s = \frac{\sqrt{N}}{4}\left(\frac{\alpha - 1}{\alpha}\right)\left(\frac{k}{k+1}\right)$$

Resolution is proportional to the square root of N (the column efficiency)

Compounds are baseline resolved when resolution is ≥ 1.5
Compounds are not baseline resolved when resolution is < 1.5.

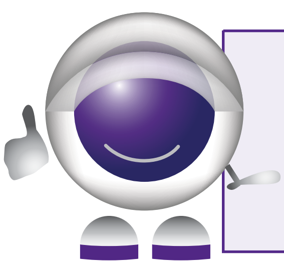
It is clear that large increases in efficiency can significantly increase resolution.

Example:

If column efficiency triples, by going from a 5 µm column to a Kinetex® 2.6 µm column of equivalent dimensions (see pg. 5), what would be the expected impact to resolution?

With a 3x increase in efficiency ($\Delta N=3$)

Resolution will increase by $\sqrt{3}$ → 73 % increase in Resolution



If I am using a 5 µm 150 mm length column and have a critical pair with a resolution of only 1.3, could I expect to get baseline resolution with a Kinetex column of equivalent dimension?

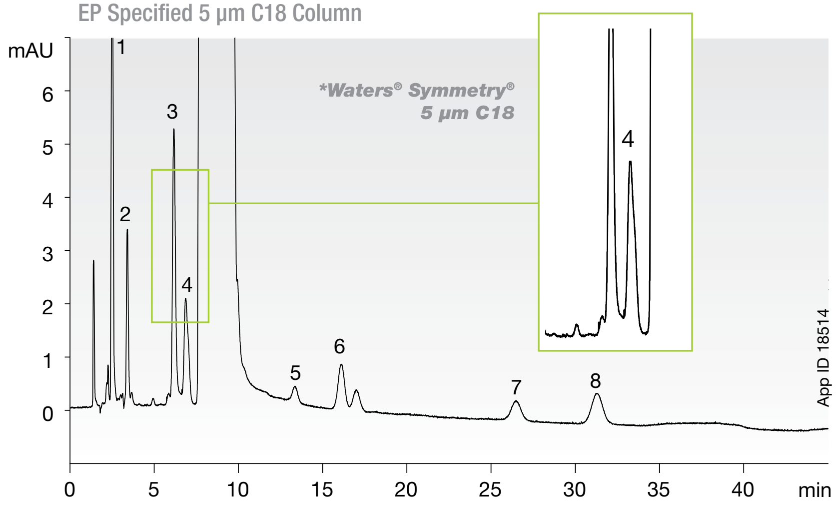
Yes!

$$N = \frac{5}{1.7} \rightarrow R_{scaling\ factor} = \sqrt{3} \rightarrow R_{scaling\ factor} = 1.73 \rightarrow R_s = 1.3 \times 1.73 \rightarrow R_s final = 2.25$$

Increase Resolution

EP Method for Atenolol and Related Impurities

EP Specified 5 µm C18 Column



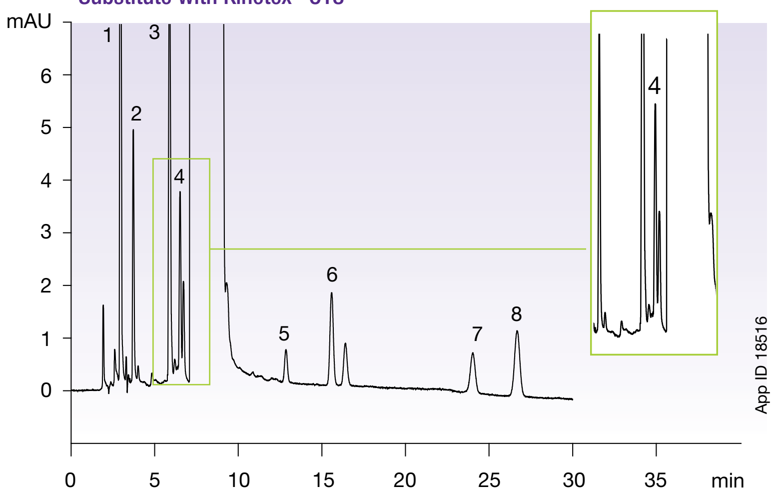
Column: *Waters® Symmetry® 5 µm C18
Dimensions: 150 x 3.9 mm

Conditions same for both columns except as noted:
Flow Rate: 0.6 mL/min
Mobile Phase: 12.5 mM Phosphoric acid in Water, pH 3.0 + 2.0 g Sodium Octanesulfonate + 0.8 g Tetrabutyl Ammonium Hydrogen Sulfate / Methanol / THF (80:18:2)
Temperature: 22 °C
Detection: UV @ 226 nm
Sample: Atenolol Related Substance

1. Impurity B
2. Impurity A
3. Impurity J
4. Impurity I
5. Impurities D and E
6. Impurity F
7. Impurity G
8. Impurity H

Improved Resolution and Higher Sensitivity

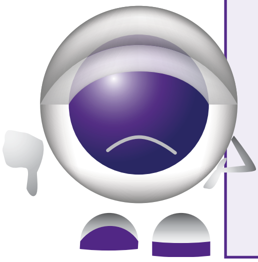
Substitute with Kinetex® C18



Column: Kinetex 2.6 µm C18
Dimensions: 150 x 4.6 mm
Part No.: 00F-4462-E0

READ ME!

Can this be done by going to a fully porous 1.7 µm particle?



Yes. Except the 3x increase in resolution comes with a **9x** increase in backpressure.

$$\Delta P = \frac{\phi \eta L \mu}{d_p^2}$$

µ = Linear Velocity
L = Column Length
d_p = Particle Diameter
ϕ = Flow Resistance Parameter
η = Mobile Phase Viscosity

* Waters and Symmetry are registered trademarks of Waters Corporation. Phenomenex is in no way affiliated with Waters Corporation. Comparative separations may not be representative of all applications.

Increase Resolution

Kinetex® columns are the highest efficiency columns sold today. Selecting an equivalent length Kinetex column and optimizing flow for the particle will provide the highest R_s.

Isocratic Separations

A. Scale the flow rate to achieve the same mobile phase linear velocity with the new column ID.

$$Flow\ Rate_{Kinetex} = Flow\ Rate_{Original}\ x \left(\frac{diameter_{Kinetex}}{diameter_{Original}} \right)^2$$

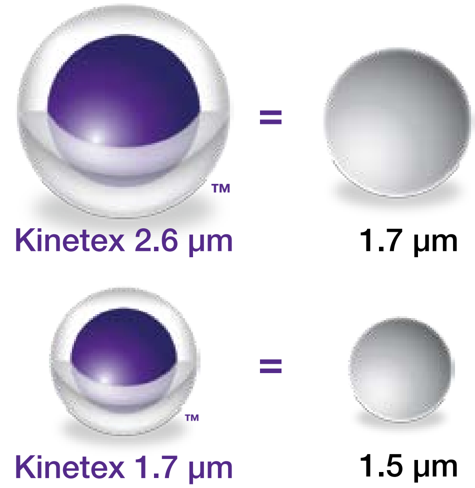
Example: 1 mL/min flow rate 4.6 mm ID to 3.0 mm ID

$$1\ \text{mL/ min x} \left(\frac{3.0\ \text{mm}}{4.6\ \text{mm}} \right)^2 = 0.43\ \text{mL/min}$$

Note: considerations should be made for system backpressure & flow rate limitations.

Effective particle size of Kinetex (d_e)

Kinetex 2.6 µm = 1.7 µm
Kinetex 1.7 µm = 1.5 µm



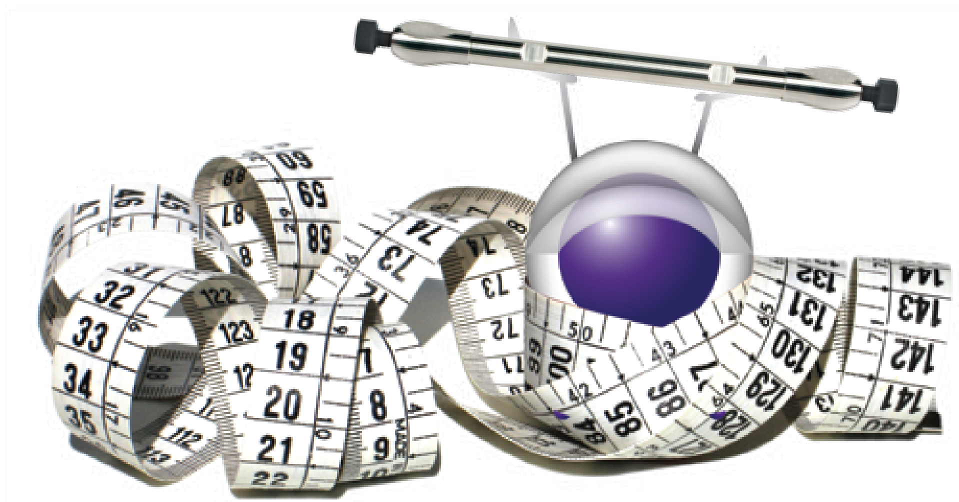
B. Scale the injection volume to account for change in column ID.

$$Inj.vol._{Kinetex} = Inj.vol._{Original}\ x \left(\frac{diameter_{Kinetex}}{diameter_{Original}} \right)^2$$

optional

The mobile phase linear velocity may be adjusted in line with the reduced effective particle size.

$$Flow\ Rate_{Kinetex}\ x \left(\frac{d_{p\ Original}}{d_{e\ Kinetex}} \right)$$



Increase Resolution

Gradient Separations

A. Scale the flow rate to achieve the same mobile phase linear velocity with the new column ID.

$$\text{Flow Rate}_{Kinetex} = \text{Flow Rate}_{Original} \times \left(\frac{\text{diameter}_{Kinetex}}{\text{diameter}_{Original}}\right)^2$$

B. Scale the injection volume to account for change in column ID.

$$\text{Inj.vol.}_{Kinetex} = \text{Inj.vol.}_{Original} \times \left(\frac{\text{diameter}_{Kinetex}}{\text{diameter}_{Original}}\right)^2$$

C. To match your original gradient program, adjust the time segment at each step to maintain the same column volume (cv) per unit time. The calculated time segment will take into account changes in column ID, flow rate, and column length.

$$\text{Time Segment}_{Kinetex} = \text{Time Segment}_{Original} \times \left(\frac{ID_{Kinetex}}{ID_{Original}}\right)^2 \times \left(\frac{\text{Flow Rate}_{Original}}{\text{Flow Rate}_{Kinetex}}\right) \times \left(\frac{\text{Column Length}_{Kinetex}}{\text{Column Length}_{Original}}\right)$$

optional

The mobile phase linear velocity may be adjusted in line with the reduced effective particle size.

$$\text{Flow Rate}_{Kinetex} \times \left(\frac{d_{p\ Original}}{d_{e\ Kinetex}}\right)$$

Increase Productivity

Productivity may be defined as: unit resolution per unit time

Resolution must be maintained as run time is reduced or no improvement in productivity is realized. To choose the correct length Kinetex® column for increasing productivity, we recommend using a simple ratio comparison:

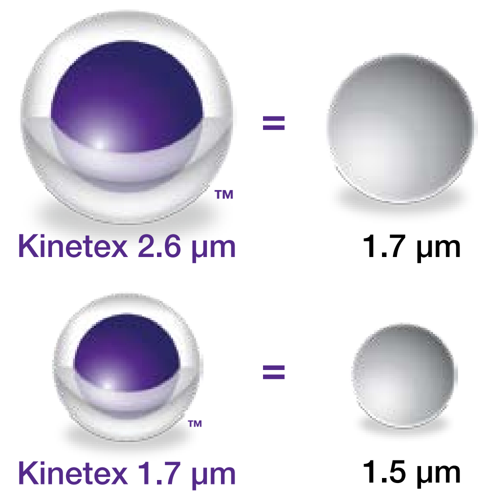
$$\frac{\text{Column Length}_{\text{Original}}}{d_{\text{p Original}}} : \frac{\text{Column Length}_{\text{Kinetex}}}{d_{\text{e Kinetex}}}$$

A comparison of these ratios will be indicative of the difference in resolution power between the two columns. A shorter Kinetex column, providing the resolving power of the original column, will maintain resolution while decreasing run time.

Effective particle size of Kinetex (d_e)

Kinetex 2.6 µm = 1.7 µm

Kinetex 1.7 µm = 1.5 µm



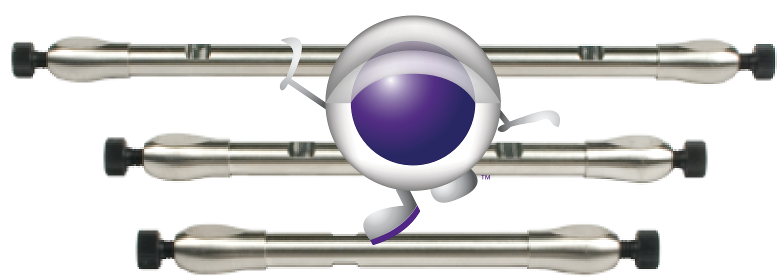
Comparison Examples

Effective Length/ Particle Size		Unit Conversion		Column Efficiency Comparison
250 mm/5 µm	→	250 mm/.005 mm	→	50,000
100 mm/1.7 µm	→	100 mm/.0017 mm	→	58,825

This indicates that a similar resolution can be found between these two columns.

Effective Length/ Particle Size		Unit Conversion		Column Efficiency Comparison
150 mm/3 µm	→	150 mm/.003 mm	→	50,000
100 mm/1.7 µm	→	100 mm/.0017 mm	→	58,825

This indicates that a similar resolution can be found between these two columns.



Increase Productivity

Isocratic Separations

A. Choose the correct Kinetex® column:

$$\frac{\text{Column Length}_{\text{Original}}}{d_{p\ \text{Original}}} : \frac{\text{Column Length}_{\text{Kinetex}}}{d_{e\ \text{Kinetex}}}$$

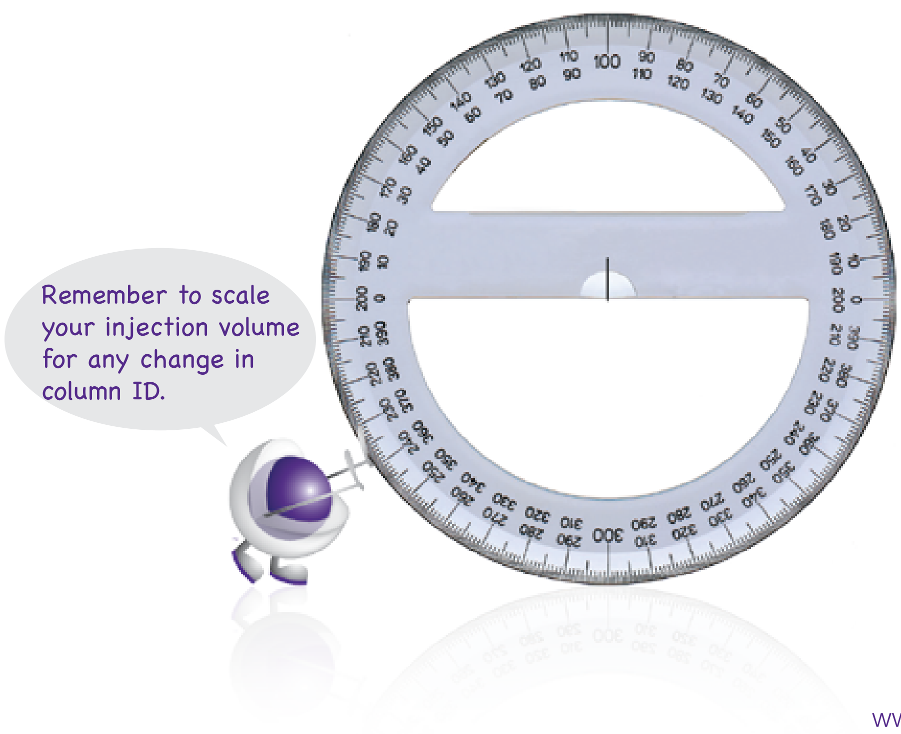
B. Scale the flow rate to achieve the same mobile phase linear velocity with a new column ID.

$$\textit{Flow Rate}_{\textit{Kinetex}} = \textit{Flow Rate}_{\textit{Original}}\ x \left(\frac{\textit{diameter}_{\textit{Kinetex}}}{\textit{diameter}_{\textit{Original}}}\right)^2$$

optional

The mobile phase linear velocity may be adjusted in line with the reduced effective particle size.

$$\textit{Flow Rate}_{\textit{Kinetex}}\ x \left(\frac{d_{p\ \textit{Original}}}{d_{e\ \textit{Kinetex}}}\right)$$



Gradient Separations

$$\frac{\text{Column Length}_{\text{Original}}}{d_{p\ \text{Original}}} : \frac{\text{Column Length}_{\text{Kinetex}}}{d_{e\ \text{Kinetex}}}$$

B. Scale the flow rate to achieve the same mobile phase linear velocity with a new column ID.

$$\textit{Flow Rate}_{\textit{Kinetex}} = \textit{Flow Rate}_{\textit{Original}}\ x \left(\frac{\textit{diameter}_{\textit{Kinetex}}}{\textit{diameter}_{\textit{Original}}}\right)^2$$

C. To match your original gradient program, adjust the time segment at each step to account for any changes in flow rate, ID, and column length:

$$\textit{Time Segment}_{\textit{Kinetex}} = \textit{Time Segment}_{\textit{Original}}\ x \left(\frac{\textit{Column Length}_{\textit{Kinetex}}}{\textit{Column Length}_{\textit{Original}}}\right) x \left(\frac{\textit{Flow Rate}_{\textit{Original}}}{\textit{Flow Rate}_{\textit{Kinetex}}}\right) x \left(\frac{\textit{ID}_{\textit{Kinetex}}}{\textit{ID}_{\textit{Original}}}\right)^2$$

optional

$$\textit{Flow Rate}_{\textit{Kinetex}}\ x \left(\frac{d_{p\ \textit{Original}}}{d_{e\ \textit{Kinetex}}}\right)$$

Increase Throughput

Optimum throughput is achieved by decreasing total analysis time as much as possible while maintaining acceptable chromatographic performance ($R_s \geq 1.5$).

Conventional way to increase throughput

Fully Porous 5 µm 250 x 4.6 mm
R_s 2.0

Fully Porous 3 µm 150 x 4.6 mm
R_s 2.0

R_s = no change
Throughput =1.7x Increase

Kinetex® way to increase throughput

Fully Porous 5 µm 250 x 4.6 mm
R_s 2.0

R_s = 1.3x
Throughput = 1.7x Increase

Kinetex 2.6 µm 150 x 4.6 mm
R_s 2.65

Optional: Increase flow rate 3x for particle size adjustment.
5x Increase in Throughput

Fully Porous 5 µm 250 x 4.6 mm
R_s 2.0

R_s = 1.1x
Throughput = 2.5x Increase

Kinetex 2.6 µm 100 x 4.6 mm
R_s 2.17

Optional: Increase flow rate 3x for particle size adjustment.
7.5x Increase in Throughput

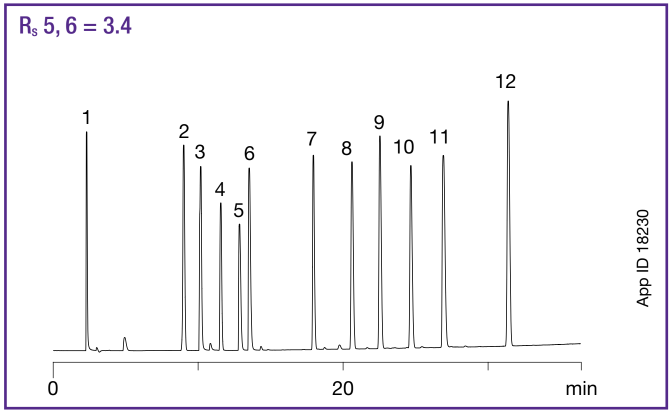
Fully Porous 5 µm 250 x 4.6 mm
R_s 2.0

R_s = 0.77x
Throughput = 5x Increase

Kinetex 2.6 µm 50 x 4.6 mm
R_s 1.53

Optional: Increase flow rate 3x for particle size adjustment.
15x Increase in Throughput

Increase Throughput



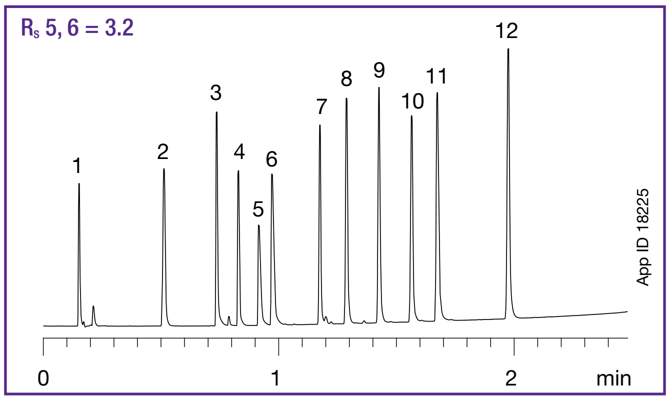
Columns: Fully Porous 5 µm C18(2)
Dimensions: 250 x 4.6 mm
Mobile Phase: A: 0.1 % Formic acid / Water
B: 0.1 % Formic acid / Acetonitrile
Gradient:

Step No.	Time	% A	% B
1.	0	95	5
2.	2.79	95	5
3.	36.15	5	95
4.	36.38	95	5
5.	50.93	95	5

Flow Rate: 1 mL/min
Temperature: 45 °C
Detection: UV @ 254 nm (25 °C)
Backpressure: 106 bar

Sample:
1. Pyridine
2. Acetaminophen
3. Quinine
4. Acebutolol
5. Chlorpheniramine
6. Triprolidine
7. Prednisolone
8. 4-Chlorobenzoic acid
9. 4-Chlorocinnamic acid
10. Diazepam
11. Diflunisal
12. Hexanophenone

16x Increase in Throughput



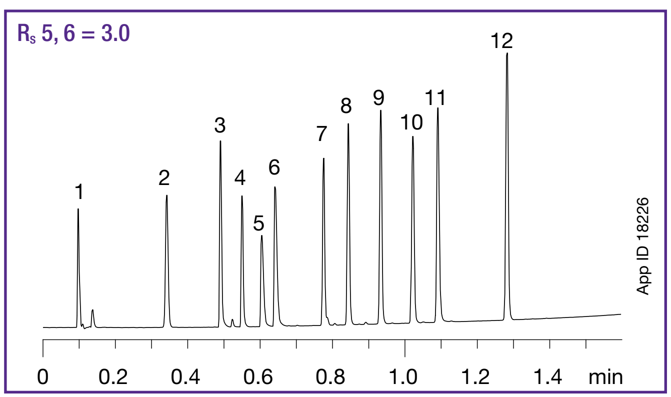
Columns: Kinetex® 2.6 µm C18
Dimensions: 50 x 4.6 mm
Part No.: 00B-4462-E0
Mobile Phase: A: 0.1 % Formic acid / Water
B: 0.1 % Formic acid / Acetonitrile
Gradient:

Step No.	Time	% A	% B
1.	0	95	5
2.	0.20	95	5
3.	2.47	5	95
4.	2.48	95	5
5.	3.47	95	5

Flow Rate: 2.94 mL/min
Temperature: 45 °C
Detection: UV @ 254 nm (25 °C)
Backpressure: 300 bar

Sample:
1. Pyridine
2. Acetaminophen
3. Quinine
4. Acebutolol
5. Chlorpheniramine
6. Triprolidine
7. Prednisolone
8. 4-Chlorobenzoic acid
9. 4-Chlorocinnamic acid
10. Diazepam
11. Diflunisal
12. Hexanophenone

25x Increase in Throughput!



Columns: Kinetex 2.6 µm C18
Dimensions: 50 x 4.6 mm
Part No.: 00B-4462-E0
Mobile Phase: A: 0.1 % Formic acid / Water
B: 0.1 % Formic acid / Acetonitrile
Gradient:

Step No.	Time	% A	% B
1.	0	95	5
2.	0.14	95	5
3.	1.59	5	95
4.	1.60	95	5
5.	2.23	95	5

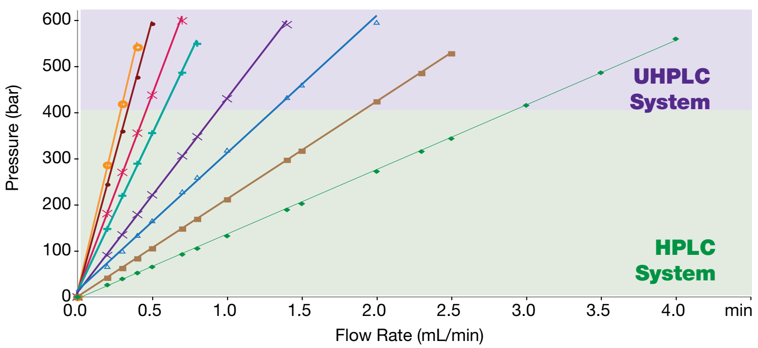
Flow Rate: 4.6 mL/min
Temperature: 45 °C
Detection: UV @ 254 nm (25 °C)
Backpressure: 485 bar

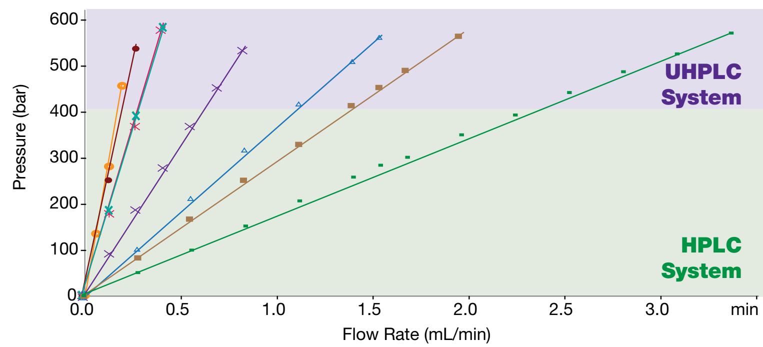
Sample:
1. Pyridine
2. Acetaminophen
3. Quinine
4. Acebutolol
5. Chlorpheniramine
6. Triprolidine
7. Prednisolone
8. 4-Chlorobenzoic acid
9. 4-Chlorocinnamic acid
10. Diazepam
11. Diflunisal
12. Hexanophenone

Choosing the
Best Kinetex® Column

Expected Backpressure at Different Flow Rates*

There is an optimal Kinetex column for your system and operating conditions. Use these graphs to determine the starting Kinetex particle size and dimension for your method.





- Kinetex 100 x 2.1 mm, 1.7 µm
- Kinetex 50 x 2.1 mm, 1.7 µm
- Kinetex 150 x 2.1 mm, 2.6 µm
- Kinetex100 x 2.1 mm, 2.6 µm
- Kinetex 50 x 2.1 mm, 2.6 µm
- Kinetex 150 x 4.6 mm, 2.6 µm
- Kinetex100 x 4.6 mm, 2.6 µm
- Kinetex 50 x 4.6 mm, 2.6 µm

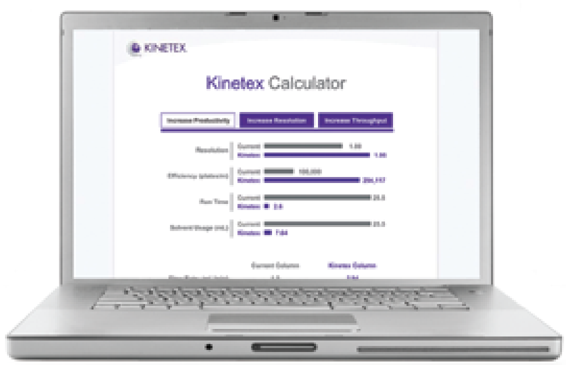
Material Characteristics

Packing Material	Total Particle Size (µm)	Porous Shell (µm)	Solid Core (µm)	Pore Size (Å)	Effective Surface Area (m²/g)	Effective Carbon Load %	pH Stability	Pressure Stability
Kinetex C18	2.6	0.35	1.9	100	200	12	1.5-10	
Kinetex XB-C18	2.6	0.35	1.9	100	200	10	1.5-10	
Kinetex C8	2.6	0.35	1.9	100	200	8	1.5-10	600 bar
Kinetex PFP	2.6	0.35	1.9	100	200	9	1.5-8.0	
Kinetex HILIC	2.6	0.35	1.9	100	200	0	2.0-7.5	
Kinetex C18	1.7	0.23	1.25	100	200	12	1.5-10	
Kinetex XB-C18	1.7	0.23	1.25	100	200	10	1.5-10	
Kinetex C8	1.7	0.23	1.25	100	200	8	1.5-10	1000 bar
Kinetex PFP	1.7	0.23	1.25	100	200	9	1.5-8.0	
Kinetex HILIC	1.7	0.23	1.25	100	200	0	2.0-7.5	

*Due to variation in system, sample and method parameters, graphs provided may not be representative of all applications.
Data generated on Agilent 1200 SL.

KINETEX CALCULATOR!

Instantly optimize your method at ***www.phenomenex.com/optimize*** OR contact Your Phenomenex representative for optimization assistance.



Ordering Information

Kinetex® 2.6 µm Analytical Columns (mm)

	30 x 4.6	50 x 4.6	75 x 4.6	100 x 4.6	150 x 4.6
XB-C18	—	00B-4496-E0	00C-4496-E0	00D-4496-E0	00F-4496-E0
C18	00A-4462-E0	00B-4462-E0	00C-4462-E0	00D-4462-E0	00F-4462-E0
C8	—	00B-4497-E0	00C-4497-E0	00D-4497-E0	00F-4497-E0
PFP	00A-4477-E0	00B-4477-E0	00C-4477-E0	00D-4477-E0	00F-4477-E0
HILIC	—	00B-4461-E0	00C-4461-E0	00D-4461-E0	00F-4461-E0

Kinetex 2.6 µm MidBore™ Columns (mm)

	30 x 3.0	50 x 3.0	75 x 3.0	100 x 3.0	150 x 3.0
XB-C18	—	00B-4496-Y0	—	00D-4496-Y0	—
C18	00A-4462-Y0	00B-4462-Y0	00C-4462-Y0	00D-4462-Y0	00F-4462-Y0
C8	—	00B-4497-Y0	—	00D-4497-Y0	—
PFP	00A-4477-Y0	00B-4477-Y0	00C-4477-Y0	00D-4477-Y0	00F-4477-Y0
HILIC	—	—	—	—	00F-4461-Y0

Kinetex 2.6 µm Minibore Columns (mm)

	30 x 2.1	50 x 2.1	100 x 2.1	150 x 2.1
XB-C18	—	00B-4496-AN	00D-4496-AN	—
C18	00A-4462-AN	00B-4462-AN	00D-4462-AN	00F-4462-AN
C8	—	00B-4497-AN	00D-4497-AN	—
PFP	00A-4477-AN	00B-4477-AN	00D-4477-AN	00F-4477-AN
HILIC	—	00B-4461-AN	00D-4461-AN	00F-4461-AN

Kinetex 1.7 µm Minibore Columns (mm)

	50 x 2.1	100 x 2.1	150 x 2.1
XB-C18	00B-4498-AN	00D-4498-AN	—
C18	00B-4475-AN	00D-4475-AN	00F-4475-AN
C8	00B-4499-AN	00D-4499-AN	—
PFP	00B-4476-AN	00D-4476-AN	00F-4476-AN
HILIC	00B-4474-AN	—	—

‡SecurityGuard Ultra cartridges require holder, Part No.: AJ0-9000.
Check for availability in your country.

3 batch method validation kits available upon request

Phenex™ RC (Regenerated Cellulose) Syringe Filters

- Rapid filtration of HPLC and GC samples prior to analysis
- Particulate, PVC, and extractable-free filters
- Universal filter compatible with both aqueous and mixed organic solutions

Choose filter diameter based on sample volume

	4 mm Diameter for ≤ 2 mL sample volumes			15 mm Diameter for 2 - 10 mL sample volumes			25 - 28 mm Diameter for 10 - 100 mL sample volumes		
Membrane Type/Size	**Part No.**	**Unit**	**Price**	**Part No.**	**Unit**	**Price**	**Part No.**	**Unit**	**Price**
0.20 µm (non-sterile)									
Phenex-RC (Regenerated Cellulose)	AF0-3203-12 AF0-3203-52	100/ pk 500/ pk		AF0-2203-12 AF0-2203-52	100/ pk 500/ pk		AF0-8203-12[1] AF0-8203-52[1]	100/ pk 500/ pk	
0.20 µm (sterile)									
Phenex-RC (Regenerated Cellulose)	—	—		—	—		AF0-8459	50/ pk	

Footnotes:
1. 26 mm diameter.
2. Additional dimensions and membrane types are available. Please contact your local Phenomenex technical consultant or distributor for availability or assistance.
3. Larger quantity purchases at significant savings are available.

Note:
AF0-8459 is 25 mm diameter.

KrudKatcher™ Ultra In-line Filter

- Disposable in-line filter fits virtually all UHPLC / HPLC columns 1.0 to 4.6 mm
- Extremely low dead-volume minimizes sample peak dispersion
- Pressure rated to 1375 bar (20,000 psi) (see p. 15 for more information)

Part No.	Description	Unit	Price
AF0-8497	KrudKatcher Ultra In-Line Filter, 0.5 µm Porosity x 0.004 in. ID	3/pk	

KrudKatcher Ultra requires 5/16 in. wrench. Installation wrench not provided.

UHPLC / HPLC Sure-Lok™ High Pressure PEEK® Male Nut Fittings

UHPLC / HPLC Sure-Lok High Pressure PEEK male nut fittings are recommended for installation of Kinetex columns. The convenient one-piece design (AQ0-8503) is pressure rated to 12,000 psi (827 bar). A handy fitting tightening tool (AQ0-8530) is available to facilitate achievement of a leak-free connection.

Part No.	Description	Unit	Price
AQ0-8503	Sure-Lok High Pressure PEEK 1-Pc Nut, 10-32, for 1/16 in. Tubing, 12,000 psi (827 bar)	10/pk	
AQ0-8530	Sure-Lok Fitting Tightening Tool, Aluminum	ea	

Sure-Lok Fitting Tightening Tool is required for AQ0-8503


AQ0-8503


AQ0-8530

guarantee

If you are not completely satisfied with Kinetex® core-shell columns, send in your comparative data to a similar product within 45 days and KEEP THE COLUMN FOR FREE.

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