

Thermo Scientific Accucore XL HPLC Columns

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Based on Core Enhanced Technology™ using 4 µm solid core particles, Accucore™ XL HPLC columns allow users of conventional HPLC methods to enjoy performance far beyond that of columns packed with 5 µm, 4 µm or even 3 µm fully porous particles. Very high separation efficiencies using standard HPLC instruments and conditions provide increased peak resolution and lower limits of detection. An ultra-stable packed bed results in exceptionally robust columns that demonstrate excellent retention and response reproducibility.



*Accucore XL HPLC columns
Ultimate core performance for conventional HPLC methods*

- *4 µm solid core particles for all users*
- *Same system, same method, better results*
- *Robust, fast and easy to use*



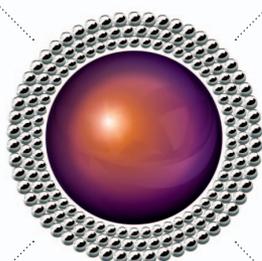
The Key Components of Core Enhanced Technology

Solid Core Particles

4 μm diameter particles with a solid core generate very high efficiencies with conventional HPLC methods

Automated Packing Process

Enhanced automated procedures ensure that all columns are packed with the highest quality



Tight Control of Particle Diameter

Enhanced selection process keeps particle size distribution to a minimum and produces high efficiency columns

Advanced Bonding Technology

Optimized phase bonding creates a series of high coverage, robust phases

Features and Benefits of Accucore XL HPLC Columns

- **Compatible with conventional HPLC methods**
- **High resolution**
- **Sharp, tall peak shape**
- **Reproducible chromatography**
- **Long column lifetime**
- **No need to change methods or invest in new equipment**
- **Separate difficult to resolve peaks**
- **Lower limits of detection – detect trace levels of analytes**
- **Confidence in your results**

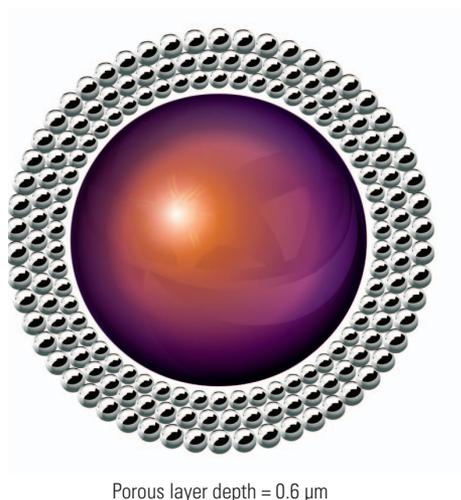
Ultimate Core Performance

for Conventional HPLC Methods

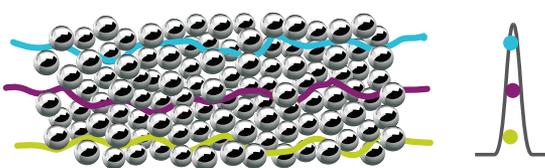
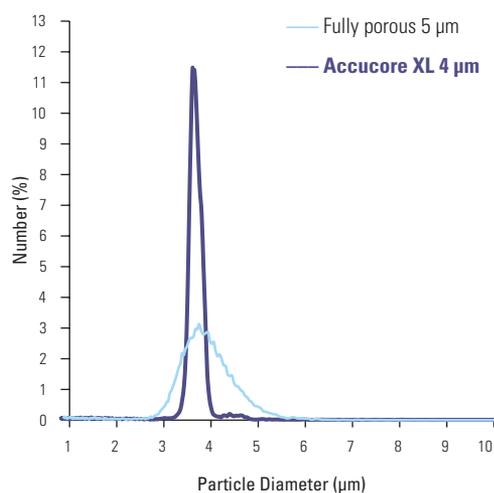
Solid Core Advantage

The solid core particle design, tight control of particle diameter and automated packing process used for Accucore XL HPLC columns result in minimized eddy diffusion.

Accucore XL 4 μm solid core particle



Particle Size Distribution – Accucore XL versus typical fully porous material



Material	Accucore XL 4 μm
Particle Size Distribution (D90/10)	1.15

*Minimized eddy diffusion results in higher efficiency
– sharper taller peaks*

Adjusting Conventional HPLC Methods

For users of conventional HPLC methods working in regulated environments there may be regulatory issues to consider when changing columns in order to realise the improvements offered by newer technologies. For example USP (United States Pharmacopeia) General Chapter <621> Chromatography-System Suitability describes the maximum adjustments that can be made to an analysis so that a method still fulfils the requirements of the system suitability test.

Column Parameter	Allowed Change
Column length	± 70%
Column internal diameter	± 25%
Particle size	Reduction of up to 50%; no increase

Method Parameter	Allowed Change
Flow rate	± 50%
Injection volume	System suitability testing (SST) criteria must be met
Column temperature	± 10%
Mobile phase pH	± 0.2
UV wavelength	No changes outside manufacturer specifications
Concentration of salts in buffer	± 10%
Composition of mobile phase	Minor component adjustment ± 30% or ± 10% absolute, whichever is smaller

Transferring a method from a column packed with a 5 µm fully porous material to an Accucore XL 4 µm HPLC column requires no changes to method parameters and involves only a 25% reduction in particle size – thus meeting the above requirements.



Accucore XL HPLC Columns

Two different phases are available in the Accucore XL HPLC column range, C18 and C8.

Accucore XL phases are characterized using three tests based on the Tanaka testing protocols. This detailed phase characterization allows the retentivity, selectivity and secondary interactions demonstrated by HPLC packing materials under specified conditions to be objectively compared.

T1: Hydrophobic Interactions

			Parameter	Term
	HR	Hydrophobic Retention	Retention of compounds based on their hydrophobicity	k'
	HS	Hydrophobic Selectivity	Separation of compounds that have similar structure, but differ slightly in hydrophobicity	α
	SS	Steric Selectivity	Separation of compounds that have similar structure, but differ in shape	α
	HBC	Hydrogen Bonding Capacity	Separation related to degree of end capping	α

T2: Secondary Interactions Under Neutral pH

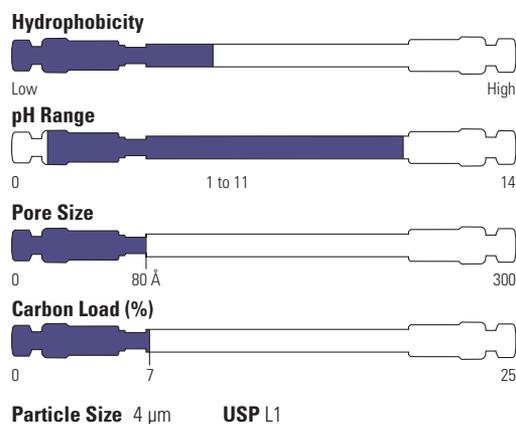
			Parameter	Term
	BA	Base Activity	Peak shape for basic analytes resulting from total silanol activity (all dissociated at pH 7.6)	t_r
	C	Chelation	Peak shapes for chelating analytes resulting from silica metal content	t_r
	IEX(7.6)	Ion Exchange Capacity (pH 7.6)	Separation between basic and neutral compounds resulting from total silanol activity (all dissociated at pH 7.6)	α

T3: Secondary Interactions Under Acidic pH

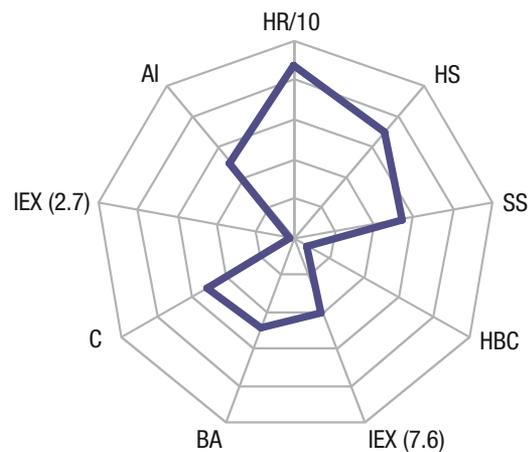
			Parameter	Term
	AI	Acid Interaction	Interactions resulting in poor peak shape for acidic analytes	t_r
	IEX(2.7)	Ion Exchange Capacity (pH 2.7)	Separation between basic and neutral compounds resulting from acidic silanol activity	α

The results of the phase characterizations are shown in the radar plots on the next page.

Accucore XL C18

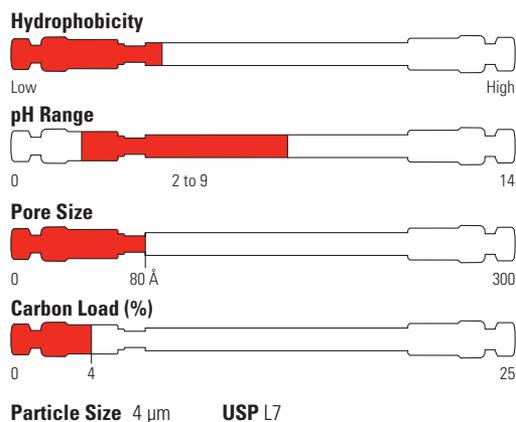


- Optimum retention of non-polar compounds
- Hydrophobic interaction mechanism
- Separates a broad range of analytes

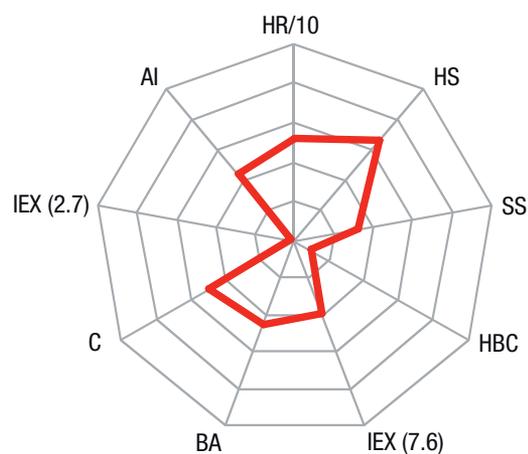


The carbon loading of Accucore XL C18 provides high retention of non-polar analytes via a predominantly hydrophobic interaction mechanism. The highly retentive nature of the phase means that it can be used to separate a broad range of analytes.

Accucore XL C8



- Similar selectivity to C18 with lower retention
- Recommended for analytes with moderate hydrophobicity



Accucore XL C8 offers lower hydrophobic retention than columns packed with longer alkyl chain length material, such as C18. It is then therefore recommended for analytes with moderate hydrophobicity, or when a less hydrophobic phase provides optimum retention.

Column Formats

Accucore XL HPLC columns are offered in analytical and micro formats. Optimum conditions and ratings are shown in the table below.

Column ID	Optimum Flow Rate	Optimum Injection Volume	Backpressure Rating	Temperature Rating
2.1 mm	0.3 mL/min	2 μ L	600 bar	70 $^{\circ}$ C
3.0 mm	0.6 mL/min	5 μ L	600 bar	70 $^{\circ}$ C
4.6 mm	1.3 mL/min	10 μ L	600 bar	70 $^{\circ}$ C

Analytical and Micro Columns

Accucore HPLC columns are packed into our high pressure hardware. These stainless steel columns are engineered to the highest quality and have a pressure rating of 600 bar.



Guard Cartridges

Guard cartridges are designed to protect your column from particulates introduced from the matrix or instrument and from any strongly retained components in the injected sample.



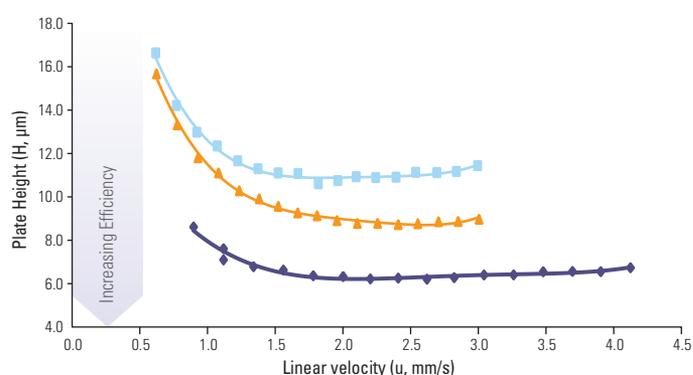
4 μm Solid Core Particles for all Users

The 4 μm solid core particles used in Accucore XL HPLC columns have been specifically designed to get the optimum chromatographic performance from conventional HPLC instruments.

- Very high efficiencies
- Little decrease in efficiency as flow rate is increased
- Moderate backpressures

Efficiency

Accucore XL HPLC columns generate higher efficiencies than columns packed with 5 μm and 3 μm fully porous material – as shown in the van Deemter curve below.



- Fully porous C18, 5 μm
- Fully porous C18, 3 μm
- **Accucore XL C18, 4 μm**

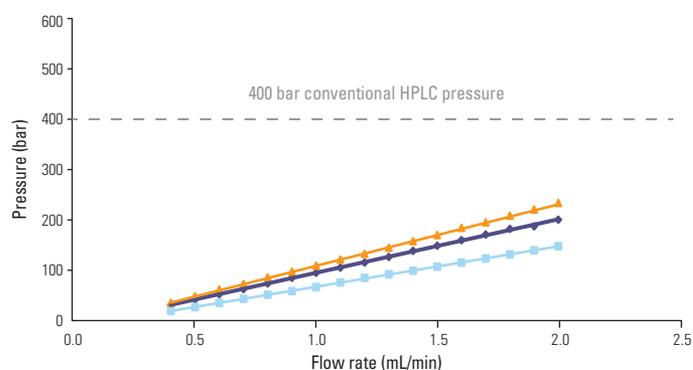
Identical instrument and method conditions for all columns

Column Dimensions:	150 x 4.6 mm
Mobile Phase:	50% water : 50% acetonitrile
Temperature:	30 °C
Injection Volume:	1 μL
Detection:	UV at 254 nm (0.1 s rise time, 20 Hz)
Sample:	o-xylene

- *75% higher efficiency than 5 μm fully porous*
- *50% higher efficiency than 3 μm fully porous*

Backpressure

Accucore XL HPLC columns generate reasonable backpressures, moderately higher than fully porous 5 μm and lower than fully porous 3 μm , that are compatible with conventional HPLC instruments.



- Fully porous C18, 5 μm
- Fully porous C18, 3 μm
- **Accucore XL C18, 4 μm**

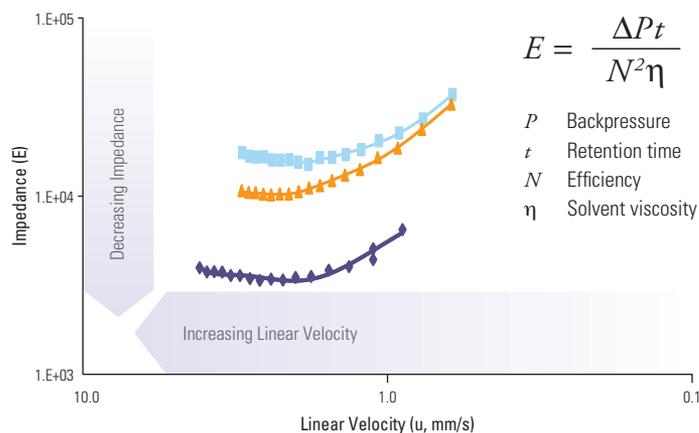
Identical instrument and method conditions for all columns

Column Dimensions:	150 x 4.6 mm
Mobile Phase:	50% water : 50% acetonitrile
Temperature:	30 °C

- *Backpressures between those generated by 3 μm and 5 μm fully porous*
- *Within conventional HPLC instrumentation pressure limit - even at high flow rates*

Impedance

Impedance (E) combines retention time, efficiency and backpressure in a single term. Lower impedance values indicate fast and higher efficiency separations performed at lower backpressures.



- Fully porous C18, 5 μm
- Fully porous C18, 3 μm
- **Accucore XL C18, 4 μm**

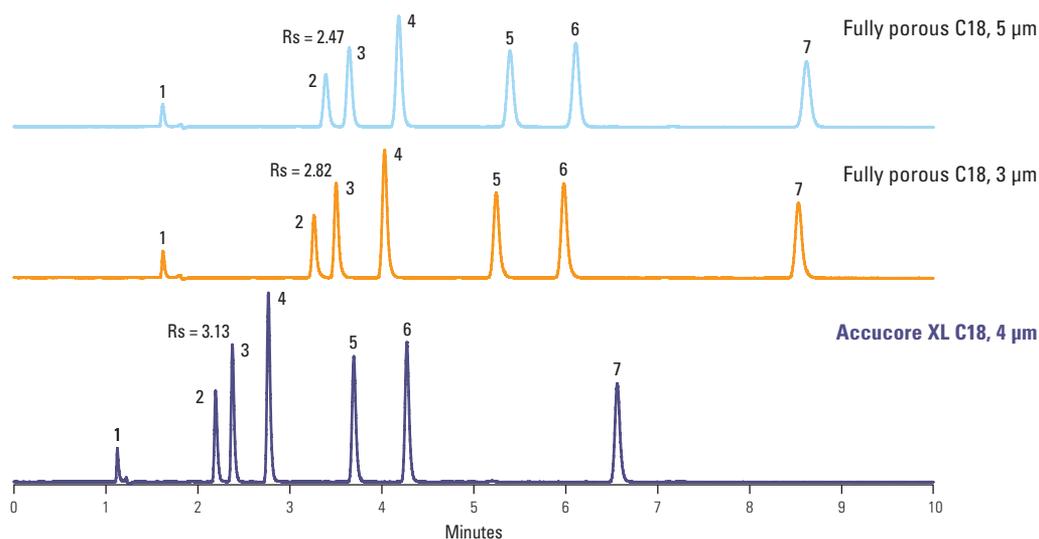
Identical instrument and method conditions for all columns

Column Dimensions:	150 x 4.6 mm
Mobile Phase:	50% water : 50% acetonitrile
Temperature:	30 °C
Injection Volume:	1 μL
Detection:	UV at 254 nm (0.1 s rise time, 20 Hz)
Sample:	o-xylene

- **78% lower impedance than 5 μm fully porous**
- **67% lower impedance than 3 μm fully porous**

Resolution

The high chromatographic efficiencies offered by Accucore XL HPLC columns represent tall, narrow peaks. This provides significant advantages in terms of better peak separations (resolution) and lower limits of detection.

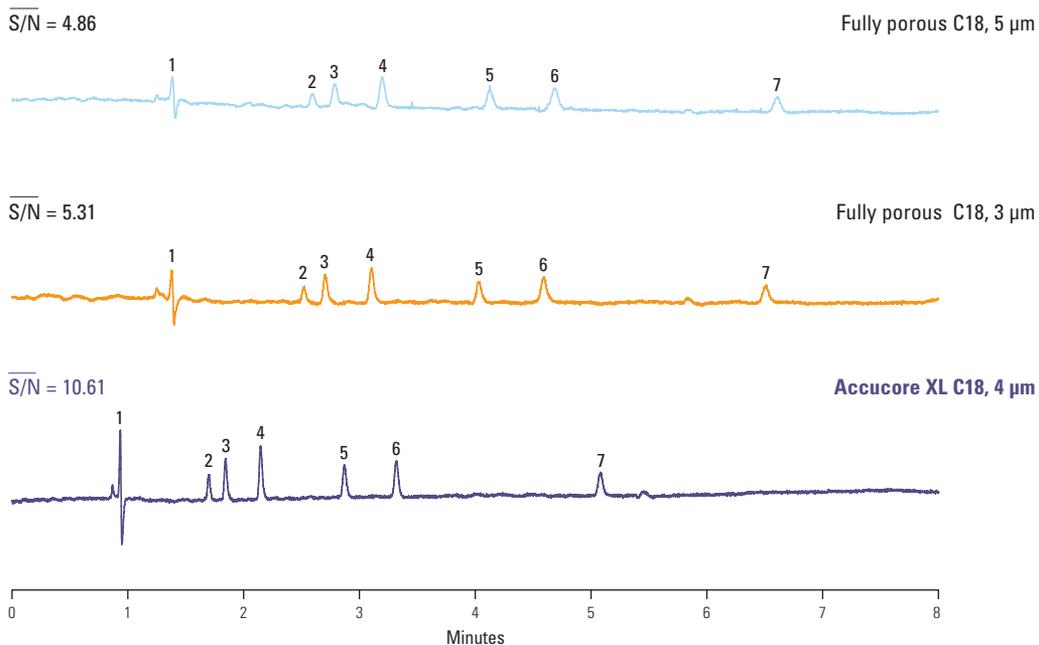


- **27% higher resolution than 5 μm fully porous**
- **11% higher resolution than 3 μm fully porous**

Identical instrument and method conditions for all columns

Column Dimensions:	150 x 4.6 mm
Mobile Phase A:	water
Mobile Phase B:	acetonitrile
Gradient:	35 to 60% B in 10 min
Flow Rate:	1.0 mL/min
Temperature:	30 °C
Injection Volume:	5 μL
Detection:	UV at 247 nm (0.1 s rise time, 20 Hz)
Sample:	1. uracil (t0) 2. tebuthiuron 3. metoxuron 4. monuron 5. chlorotoluron 6. diuron 7. linuron

Sensitivity



Column	Amount on Column	Average S/N	Limit of Detection (based on S/N = 3)
Fully porous C18, 5 μm	1 ng	4.86	0.62 ng
Fully porous C18, 3 μm	1 ng	5.31	0.56 ng
Accucore XL C18, 4 μm	1 ng	10.61	0.28 ng

Identical instrument and method conditions for all columns

Column Dimensions:	150 x 4.6 mm
Mobile Phase A:	water
Mobile Phase B:	acetonitrile
Gradient:	35 to 60% B in 7.5 min
Flow Rate:	1.3 mL/min
Temperature:	30 °C
Injection Volume:	1 μL
Detection:	UV at 247 nm (0.1 s rise time, 20 Hz)
Sample:	1. uracil (t ₀) 2. tebuthiuron 3. metoxuron 4. monuron 5. chlorotoluron 6. diuron 7. linuron (each at 1 ng/ μL)

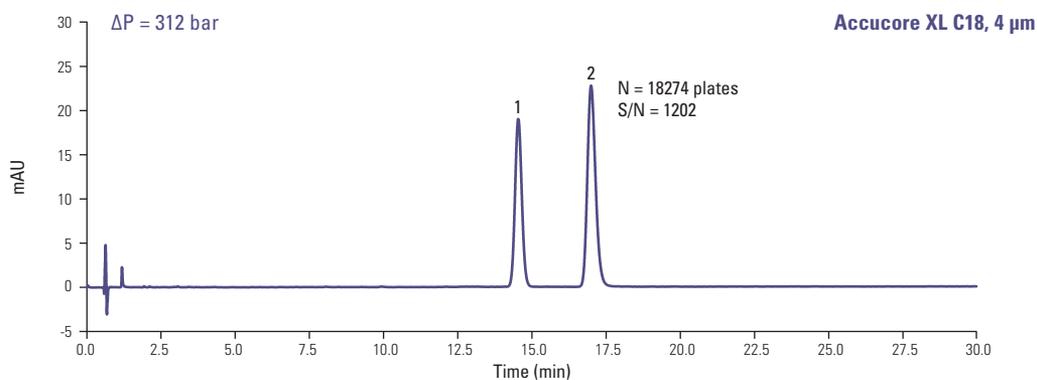
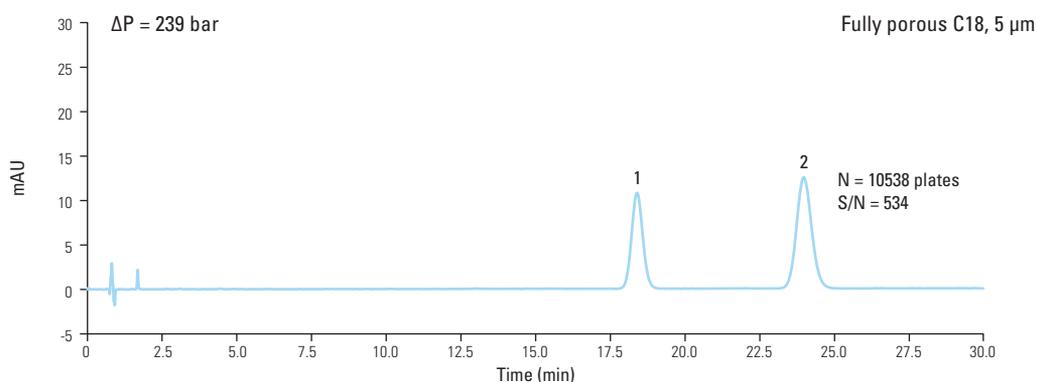
- 120% more sensitive than 5 μm fully porous
- 100% more sensitive than 3 μm fully porous



Same System, Same Method, Better Results

The following applications show the improvements in performance that Accucore XL HPLC columns offer without any changes in instrument configuration or method conditions.

Ibuprofen and Valerophenone (USP)

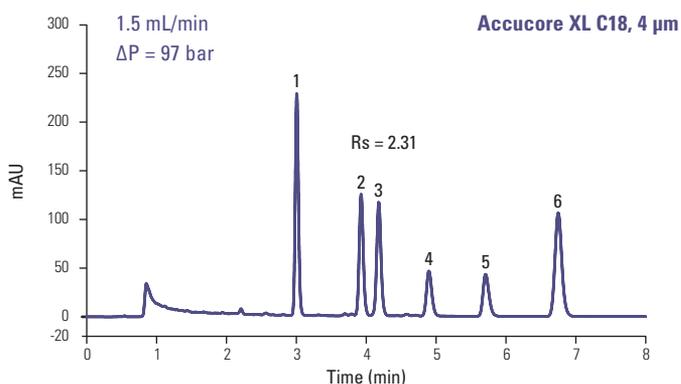
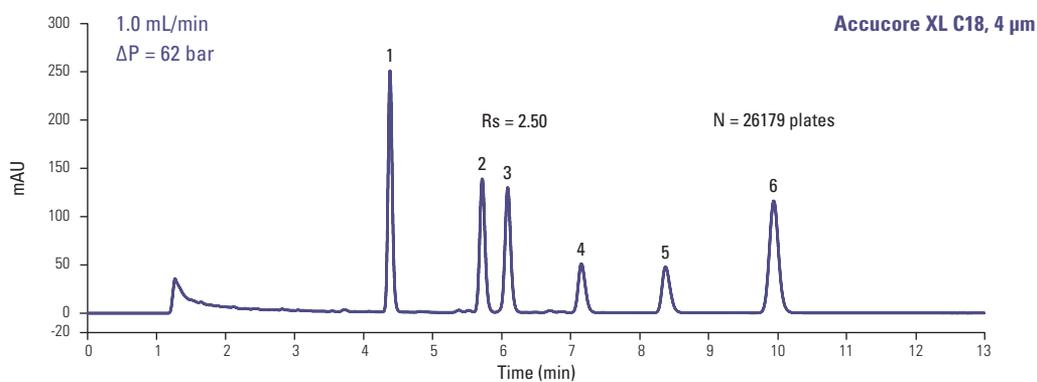
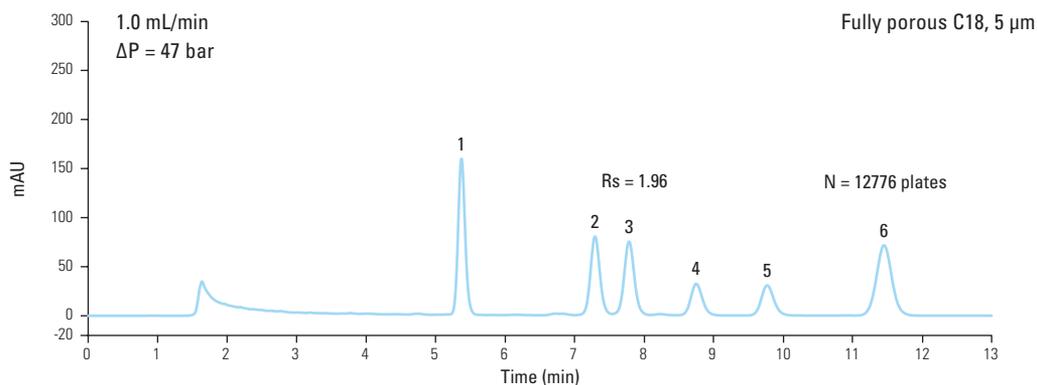


Analytes	Columns:	Accucore XL C18 4 μm , 150 x 4.6 mm Fully porous C18 5 μm , 150 x 4.6 mm
1. Valerophenone	Mobile phase:	66.3:33.7 (v/v) water with phosphoric acid, pH 2.5:methanol
2. Ibuprofen	Flow rate:	2 mL/min
	Column temperature:	30 °C
	Detection:	UV at 214 nm
	Injection volume:	5 μL



- 73% higher efficiency
- 125% higher sensitivity

Fat Soluble Vitamins

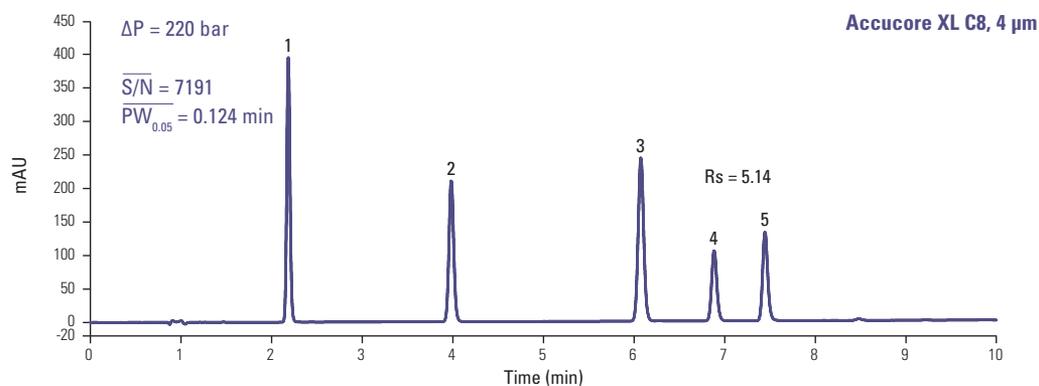
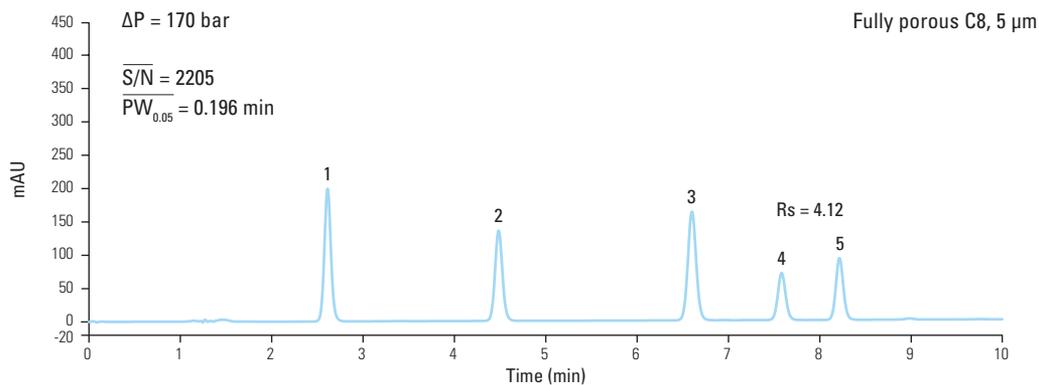


Analytes	Columns:	Accucore XL C18 4 µm, 150 x 4.6 mm Fully porous C18 5 µm, 150 x 4.6 mm
1. Vitamin K2	Mobile phase:	80:20 (v/v) acetonitrile:methanol
2. Vitamin D2	Flow rates:	1 mL/min 1.5 mL/min
3. Vitamin D3	Column temperature:	30 °C
4. Vitamin E	Detection:	UV at 280 nm
5. Vitamin E acetate	Injection volume:	5 µL
6. Vitamin K1		

- 105% higher efficiency
- 28% better resolution of critical pair
- Reduced run time with good resolution at increased flow rate



Endocrine Disruptors



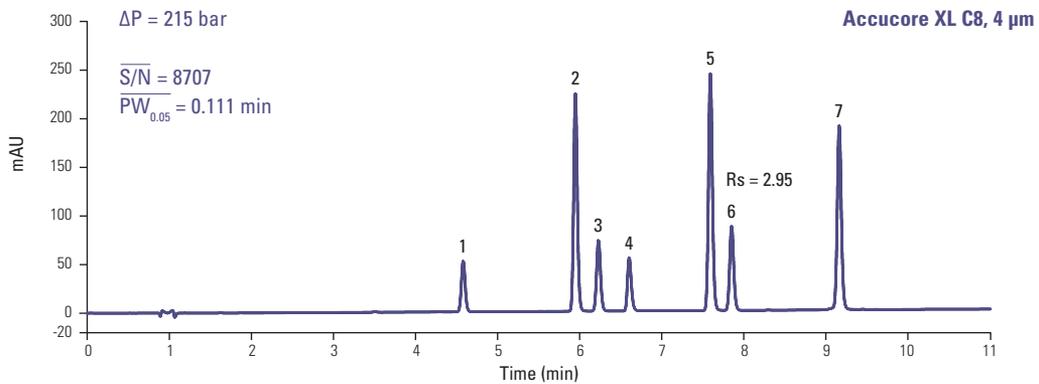
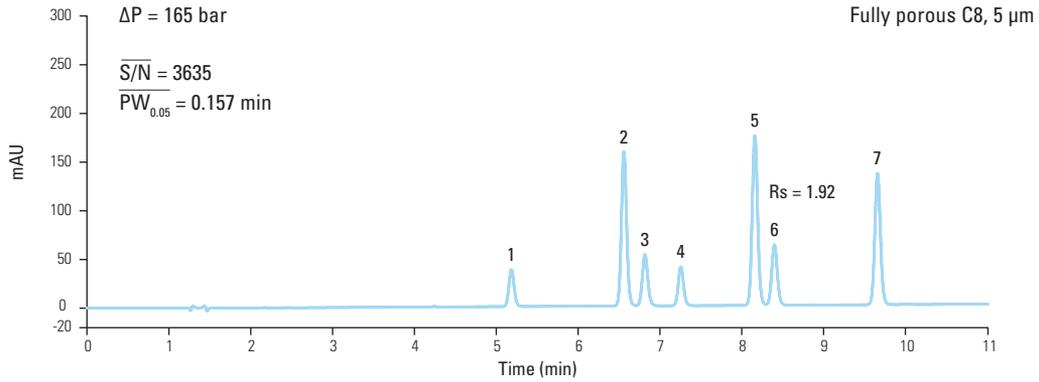
Analytes
1. Desethyl Atrazine
2. Simazine
3. Atrazine
4. Diuron
5. Bisphenol A

Columns:	Accucore XL C8 4 µm, 150 x 4.6 mm
	Fully porous C8 5 µm, 150 x 4.6 mm
Mobile phase A:	water
Mobile phase B:	acetonitrile
Gradient:	Time (min) % B
	0.0 25
	20.0 70
	20.1 75
	25.0 25
Flow rate:	1.5 mL/min
Column temperature:	25 °C
Detection:	UV at 220 nm
Injection volume:	5 µL



- 31% better resolution of critical pair
- 37% narrower peaks
- 226% higher sensitivity

Triazines



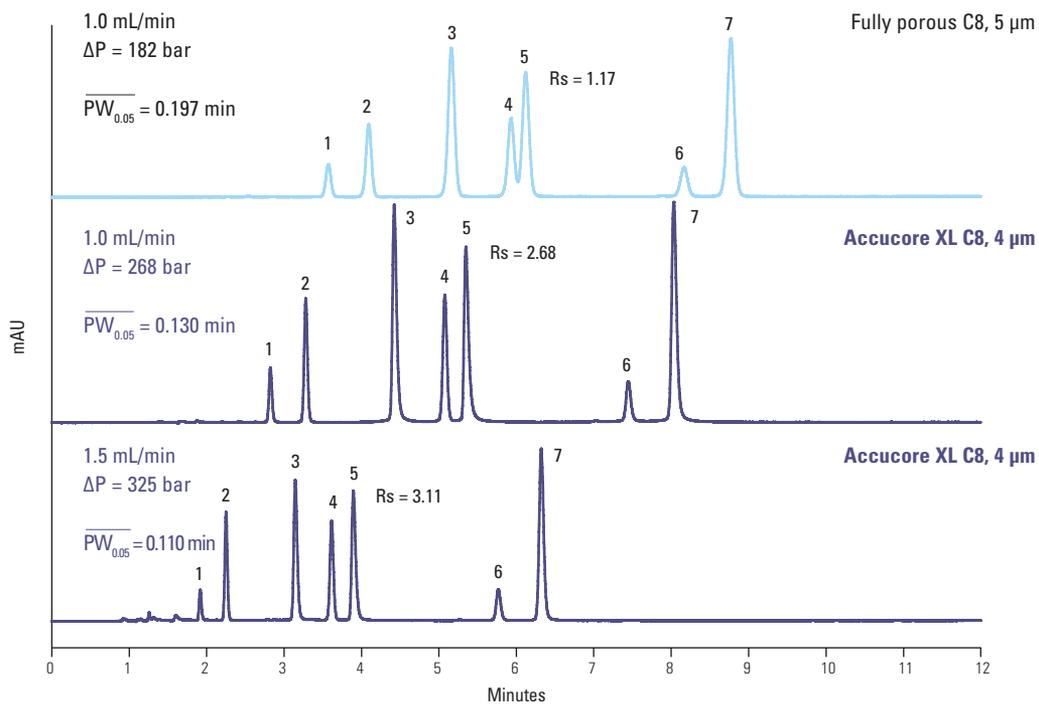
Analytes
1. Simazine
2. Simetryn
3. Atrazine
4. Prometon
5. Ametryn
6. Propazine
7. Prometryn

Columns:	Accucore XL C8 4 μm , 150 x 4.6 mm Fully porous C8 5 μm , 150 x 4.6 mm	
Mobile phase A:	water	
Mobile phase B:	acetonitrile	
Gradient:	Time (min)	% B
	0.0	20
	10.0	60
	10.1	20
	15.0	20
Flow rate:	1.5 mL/min	
Column temperature:	25 °C	
Detection:	UV at 220 nm	
Injection volume:	5 μL	

- 54% better resolution of critical pair
- 29% narrower peaks
- 140% higher sensitivity



Catechins



Analytes
1. Epigallocatechin
2. Catechin
3. Epigallocatechin gallate
4. Epicatechin
5. Gallocatechin gallate
6. Epicatechin gallate
7. Catechin gallate

Columns:	Accucore XL C8 4 µm, 150 x 4.6 mm
	Fully porous C8 5 µm, 150 x 4.6 mm
Mobile phase A:	water + 0.1% formic acid
Mobile phase B:	methanol + 0.1% formic acid
Gradient:	Time (min) % B
	0.0 20
	15.0 50
	15.1 20
	20.0 20
Flow rate:	1 mL/min
	1.5 mL/min
Column temperature:	25 °C
Detection:	UV at 280 nm
Injection volume:	5 µL



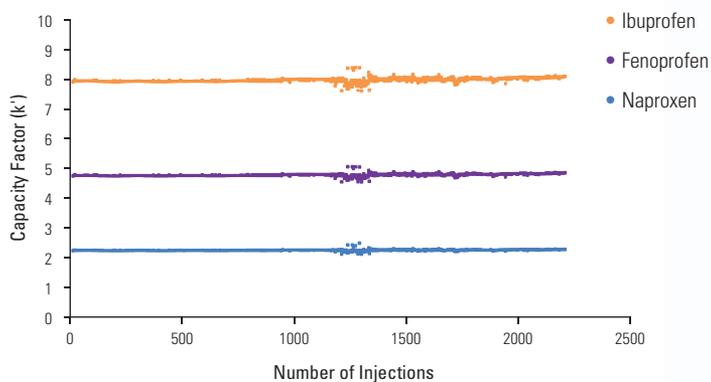
- 129% better resolution of critical pair
- 34% narrower peaks
- Reduced run time with good resolution at increased flow rate

Robust, Fast and Easy to Use

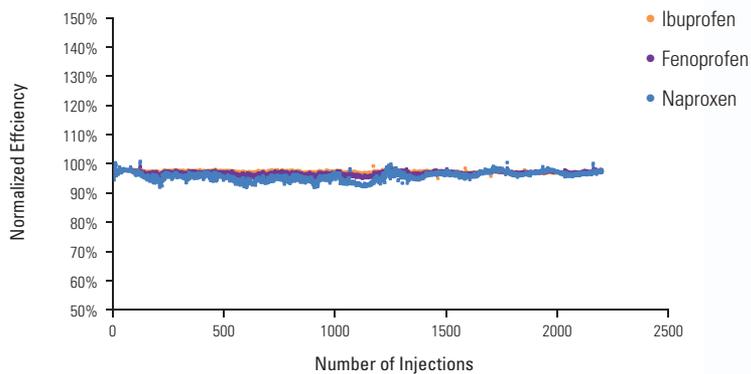
Robustness

Accucore XL HPLC columns are extremely robust offering excellent performance over extended use.

Stability–Retention



Stability–Efficiency



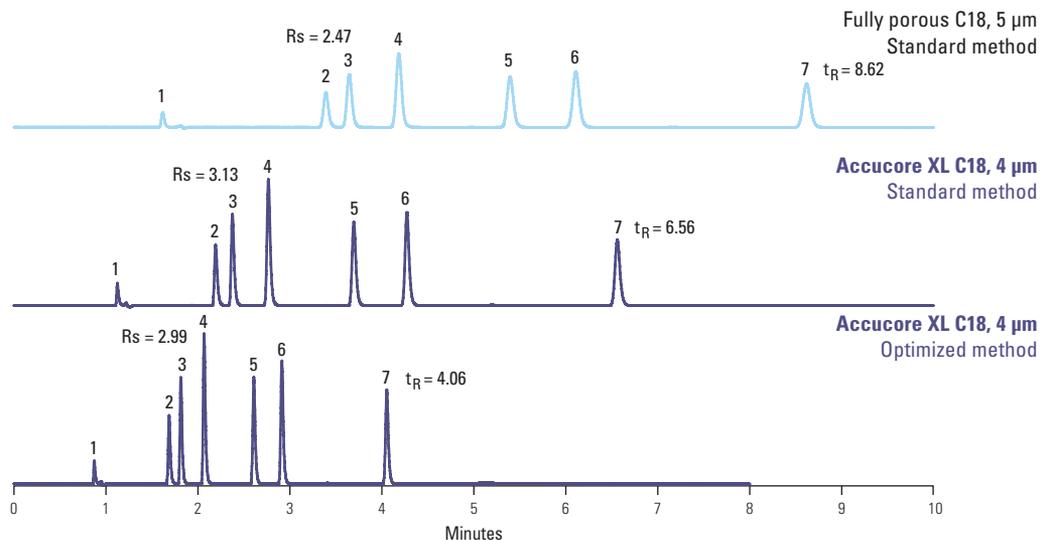
Column:	Accucore XL C8 4 μ m, 50 x 2.1 mm
Mobile Phase:	40:60 acetonitrile:20 mM ammonium formate pH3
Flow Rate:	0.3 mL/min
Temperature:	30 $^{\circ}$ C
Injection Volume:	2 μ L
Detection:	UV at 233 nm
Sample:	Non-Steroidal Anti Inflammatory Drugs (NSAIDs) ibuprofen, fenoprofen, naproxen



Stable retention and efficiency over thousands of injections

Productivity

In addition to using established conventional methods, the high efficiencies offered by Accucore XL HPLC columns, across a wide range of flow rates, allow methods to be optimized to reduce run times and increase productivity.



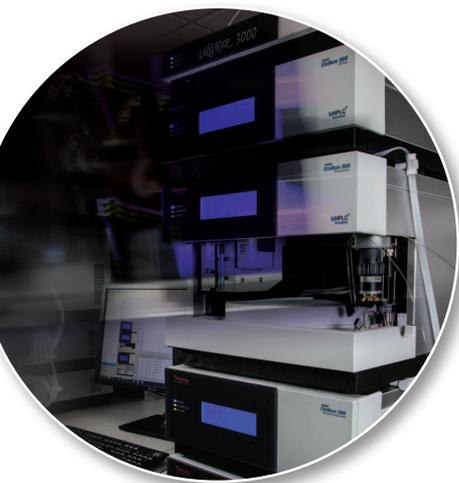
Column	Method	t_R of last peak	Reduction in time
Fully porous C18, 5 μm	Standard	8.62 min	0%
Accucore XL C18, 4 μm	Standard	6.56 min	24%
Accucore XL C18, 4 μm	Optimized	4.06 min	53%

Column Dimensions: 150 x 4.6 mm ID

Mobile Phase A: water

Mobile Phase B: acetonitrile

	Standard Method	Optimized Method
Gradient:	35 to 60% B in 10 min	35 to 60% B in 4 min
Flow Rate:	1.0 mL/min	1.3 mL/min
Temperature:	30 °C	
Injection Volume:	5 μL	
Detection:	UV at 247 nm (0.1 s rise time, 20 Hz)	
Sample:	1. uracil (t0) 2. tebuthiuron 3. metoxuron 4. monuron 5. chlorotoluron 6. diuron 7. linuron	



Run time reduced by over a third with an improvement in performance

Ordering Information

Accucore XL HPLC Columns

Description	Particle Size	Length (mm)	2.1 mm ID	3.0 mm ID	4.6 mm ID
Accucore XL C18	4 µm	50	74104-052130	74104-053030	74104-054630
		100	74104-102130	74104-103030	74104-104630
		150	74104-152130	74104-153030	74104-154630
		250	74104-252130	74104-253030	74104-254630
Accucore XL C8	4 µm	50	74204-052130	74204-053030	74204-054630
		100	74204-102130	74204-103030	74204-104630
		150	74204-152130	74204-153030	74204-154630
		250	74204-252130	74204-253030	74204-254630

Accucore XL Guard Cartridges (4/pk)

Description	Particle Size	Length (mm)	2.1 mm ID	3.0 mm ID	4.6 mm ID
Accucore XL C18	4 µm	10	74104-012101	74104-013001	74104-014001
Accucore XL C8	4 µm	10	74204-012101	74204-013001	74204-014001

UNIGUARD Direct-Connection Guard Cartridge Holders

Description	2.1 mm ID	3.0 mm ID	4.6 mm ID
UNIGUARD Drop-In Guard Cartridge Holder	852-00	852-00	850-00
Standard Replacement Tip	850-RT	850-RT	850-RT



Resources

for Chromatographers

Thermo Scientific Chromatography Columns and Consumables Catalog

This extensive catalog offers 600 pages of proven chromatography tools and product selection guides. Available online, with a robust search tool and optimized for your iPad®.

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Chromatography Resource Center

Our web-based resource center provides technical support, applications, technical tips and literature to help move your separations forward.

Visit www.thermoscientific.com/crc



For more information visit: www.thermoscientific.com/accucoreXL

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