eXceed expectations

Acquity UPLC®

Waters

THE SCIENCE OF WHAT'S POSSIBLE.™

Acquity
UPLC®

Advancing Separation Science

In 2004, separation science was revolutionized with the introduction of Ultra-Performance Liquid Chromatography [UPLC® Technology]. Significant advances in instrumentation and column technology were made to achieve dramatic increases in resolution, sensitivity and speed in liquid chromatography. For the first time, a holistic approach involving simultaneous innovations in particle technology and instrument design was endeavored to meet and overcome the challenges of the analytical laboratory in order to make analytical scientists more successful, and businesses more profitable and productive.

BEH C_{18}

BEH C_8

BEH Shield RP18

BEH Phenyl

BEH HILIC

BEH Amide

BEH130 C_{18}

BEH300 C_{18}

BEH300 C_4

BEH Glycan

HSS T3

HSS C_{18}

HSS C_{18} SB

HSS PFP

HSS Cyano

CSH C_{18}

CSH Fluoro-Phenyl

CSH Phenyl-Hexyl

OST C_{18}

AccQ•Tag Ultra

BEH200 SEC

BEH125 SEC

Versatility of UPLC Technology

When investing in a new LC instrument, it is important to consider its capabilities to meet existing and future demand. With UPLC Technology, one can invest in the future by utilizing a single system with the capability to optimally run sub-2-µm UPLC Columns with the ruggedness and robustness to run legacy HPLC methods. The ACQUITY UPLC® System family is an LC technology platform that can be utilized independent of your separation needs, thus facilitating improved productivity and simplifying method transfer from site to site.

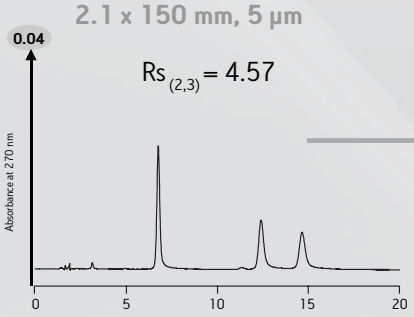
THE SOLUTION TO MEET YOUR METHOD REQUIREMENTS

UPLC Technology facilitates improvements of resolution, sensitivity and speed of analysis to be achieved without compromise. Whether the separation goal is to achieve ultra-fast analysis, increased throughput while maintaining resolution, improving resolution while decreasing analysis time or achieve ultra-high resolution, the flexibility of the ACQUITY UPLC System enables method requirements to be met.

Acquity UPLC®

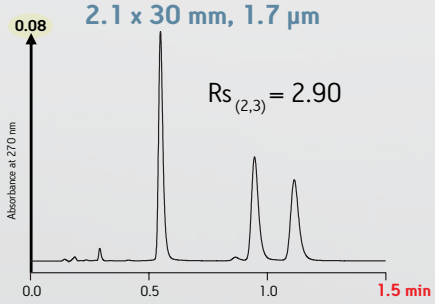
HPLC

2.1 x 150 mm, 5 µm



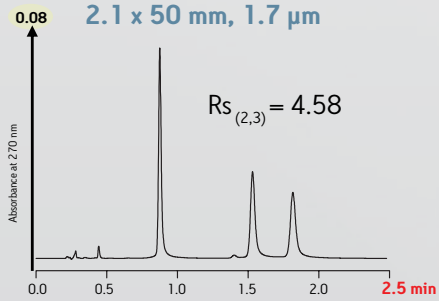
ULTRA SPEED

2.1 x 30 mm, 1.7 µm



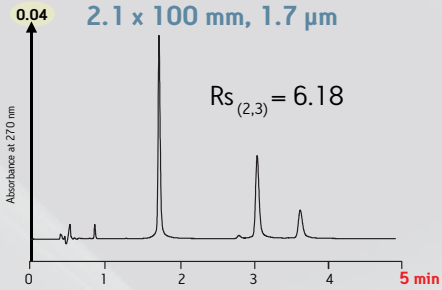
SPEED WITH RESOLUTION

2.1 x 50 mm, 1.7 µm



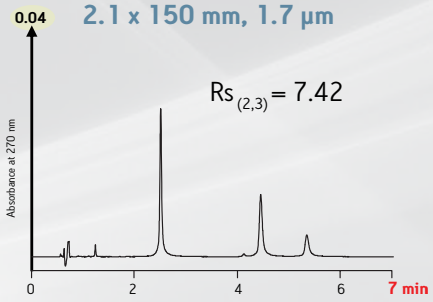
RESOLUTION WITH SPEED

2.1 x 100 mm, 1.7 µm

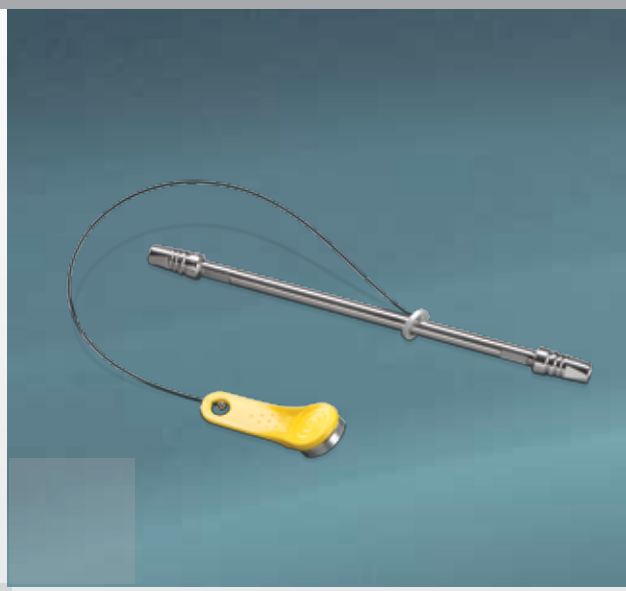


ULTRA RESOLUTION

2.1 x 150 mm, 1.7 µm



Industry-Leading Selectivity Choice

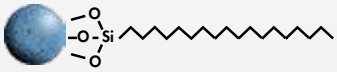


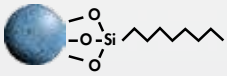
- **6 UPLC particles** including Ethylene Bridged Hybrid (BEH), High Strength Silica (HSS) and Charged Surface Hybrid (CSH™)
  - – BEH 125, 130, 200 and 300Å
  - – HSS 100Å
  - – CSH 130Å
- **22 stationary phases** including C_{18}, Phenyl-Hexyl, C_8, Embedded-Polar, C_4, HILIC, Amide, Diol, Cyano and PFP
- **7 application-specific chemistries** for SEC, amino acid analysis, proteins, peptides, oligonucleotides and glycan analysis
- Designed to work seamlessly with ultra-low dispersion ACQUITY UPLC Systems while withstanding pressures up to 18,000 psi (1241 bar)
- **200+ configurations** enable the selection of balanced resolution and throughput

Directly scalable to e***X***tended ***P***erformance [***XP***] 2.5 µm Columns as well as 3.5, 5 and 10 µm HPLC columns

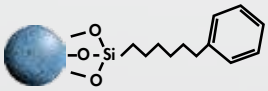
ACQUITY UPLC BEH 1.7 µm	→	XBridge HPLC Columns [2.5 ***XP***, 3.5, 5 and 10 µm]
ACQUITY UPLC HSS 1.8 µm	→	XSelect HSS HPLC Columns [2.5 ***XP***, 3.5 and 5 µm]
ACQUITY UPLC CSH 1.7 µm	→	XSelect CSH HPLC Columns [2.5 ***XP***, 3.5 and 5 µm]

BEH Technology™

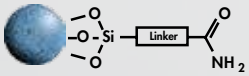
BEH C_{18} 

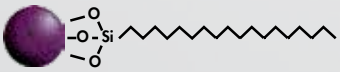
BEH C_8 

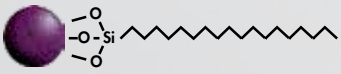
BEH Shield RP18 

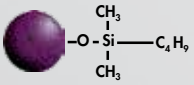
BEH Phenyl 

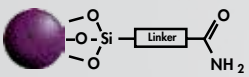
BEH HILIC 

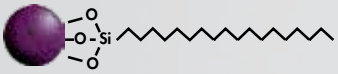
BEH Amide 

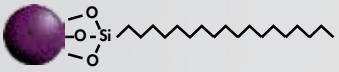
BEH130 C_{18}
Peptide Separation Technology 

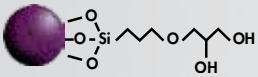
BEH300 C_{18}
Peptide Separation Technology 

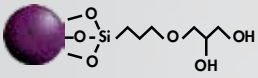
BEH300 C_4
Protein Separation Technology 

BEH Glycan
Glycan Separation Technology 

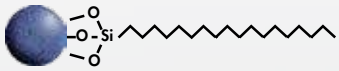
OST C_{18}
Oligonucleotide
Separation Technology 

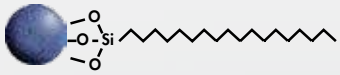
AccQ•Tag Ultra
Amino Acid Analysis 

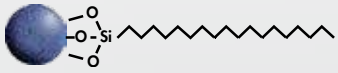
BEH200 SEC 

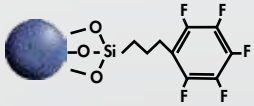
BEH125 SEC 

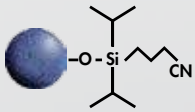
HSS
HIGH STRENGTH SILICA

HSS T3 

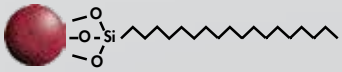
HSS C_{18} 

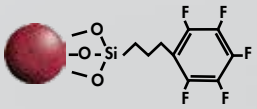
HSS C_{18} SB 

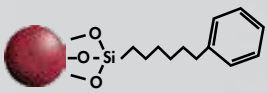
HSS PFP 

HSS Cyano 

CSH™ Technology

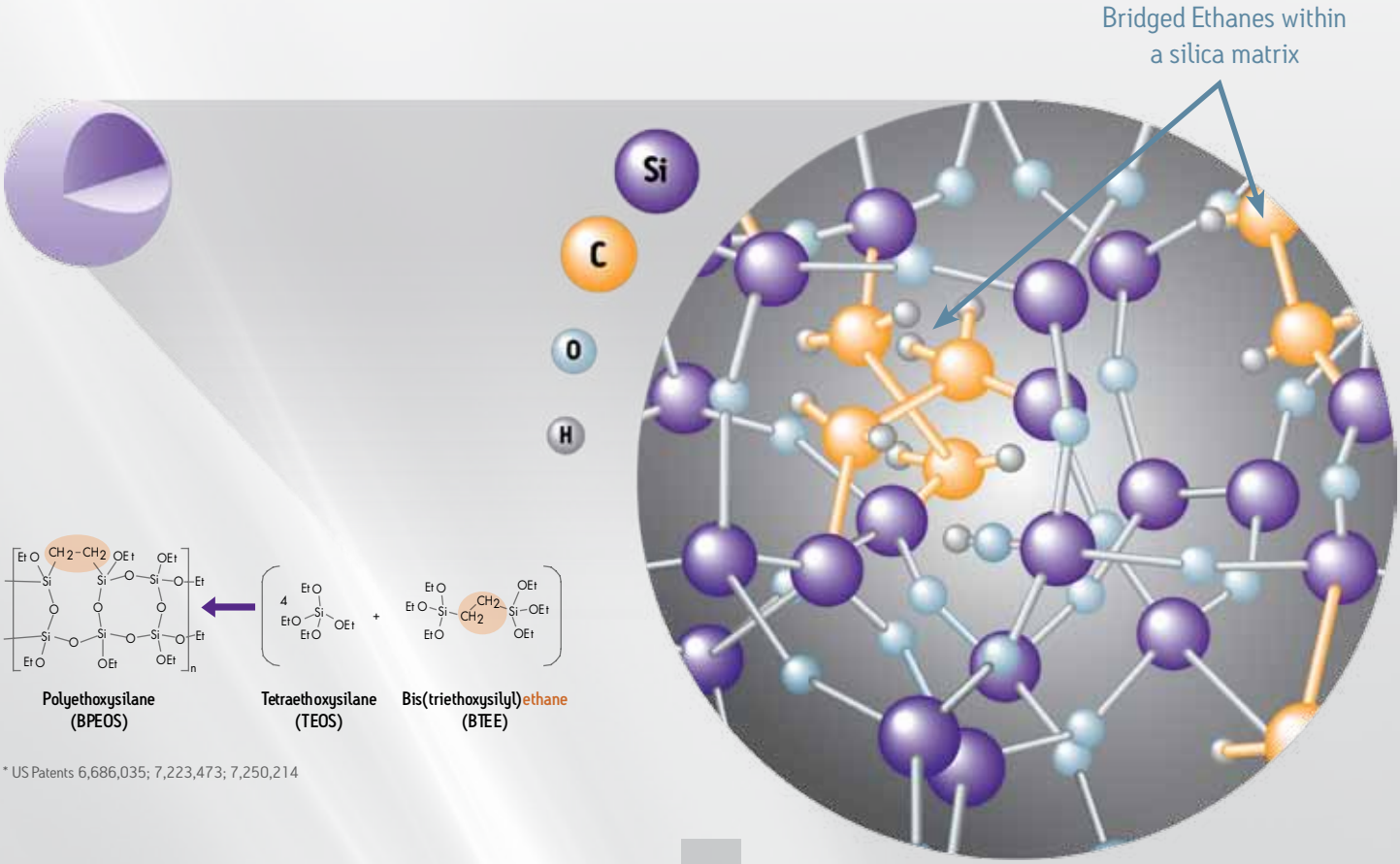
CSH C_{18} 

CSH Fluoro-Phenyl 

CSH Phenyl-Hexyl 

Ethylene Bridged Hybrid [BEH] Particle Technology

For more than a decade, hybrid particle technology [HPT]* has delivered unsurpassed versatility and performance, enabling chromatographers to push the limits of LC separations. In 1999, Waters innovation in particle technology resulted in the creation of the XTerra® Family of reversed-phase columns. This first generation organic/inorganic methyl hybrid provides significant improvement to the most problematic characteristics plaguing silica-based column: poor peak shape for basic compounds and column longevity due to chemical instability. The XTerra particle was the first commercially available option to improve these issues without the drawbacks of unpredictable selectivity produced by alternative materials such as organic polymers, zirconia and graphitic carbon. With the commercialization of 2.5 µm XTerra particles, the concept of fast HPLC with small particles was born, improving the productivity of chromatographic laboratories globally.



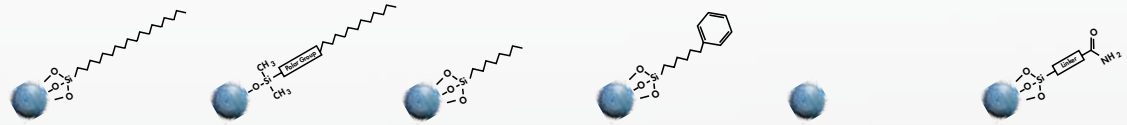
Polyethoxysilane (BPEOS) | Tetraethoxysilane (TEOS) | Bis(triethoxysilyl)ethane (BTEE)

* US Patents 6,686,035; 7,223,473; 7,250,214

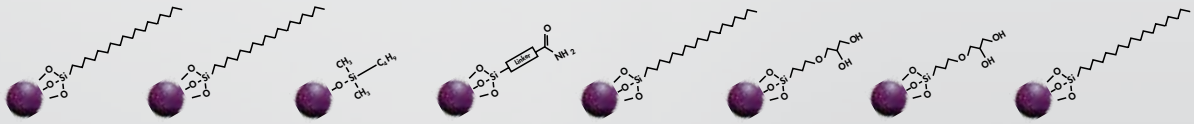
Based on the overall success of XTerra, research continued to further improve upon HPT and bring chromatographic performance to a new level. In 2004, Waters revolutionized liquid chromatography with the introduction of the ACQUITY UPLC System. At the heart of the system was Waters second generation hybrid, the Ethylene Bridged Hybrid [BEH] particle. In 2005, BEH Technology™ was expanded to analytical and preparative particle sizes (2.5, 3.5, 5 and 10 µm) with the introduction of XBridge™ Columns, enabling seamless migration between HPLC and UPLC Technology platforms. Robust methods can now be developed across an unparalleled range of temperature, mobile-phase pH and pressures to improve organizational efficiency and bring products to market faster.

BEH Technology™

BEH Technology Selectivity Choices



ACQUITY UPLC	BEH C_{18} 1.7 µm	BEH Shield RP18 1.7 µm	BEH C_8 1.7 µm	BEH Phenyl 1.7 µm	BEH HILIC 1.7 µm	BEH Amide 1.7 µm
Ligand Type	Trifunctional C_{18}	Monofunctional Embedded Polar	Trifunctional C_8	Trifunctional Phenyl-Hexyl	Unbonded BEH Particle	Trifunctional Carbamoyl
Ligand Density*	3.1 µmol/m²	3.3 µmol/m²	3.2 µmol/m²	3.0 µmol/m²	n/a	7.5 µmol/m²
Carbon Load*	18%	17%	13%	15%	unbonded	12%
Endcap Style	proprietary	TMS	proprietary	proprietary	n/a	none
USP Classification	L1	L1	L7	L11	L3	-
pH Range	1-12	2 -11	1-12	1-12	1-9	2-11
Low pH Temp. Limit	80 °C	50 °C	60 °C	80 °C	45 °C	90 °C
High pH Temp. Limit	60 °C	45 °C	60 °C	60 °C	45 °C	90 °C
Pore Diameter*	130 Å	130 Å	130 Å	130 Å	130 Å	130 Å
Surface Area*	185 m²/g	185 m²/g	185 m²/g	185 m²/g	185 m²/g	185 m²/g
HPLC Column Equivalent	XBridge BEH C_{18}	XBridge BEH Shield RP18	XBridge BEH C_8	XBridge BEH Phenyl	XBridge BEH HILIC	XBridge BEH Amide
HPLC Particle Sizes	2.5, 3.5, 5, 10 µm	2.5, 3.5, 5, 10 µm	2.5, 3.5, 5, 10 µm	2.5, 3.5, 5 µm	2.5, 3.5, 5 µm	2.5, 3.5 µm

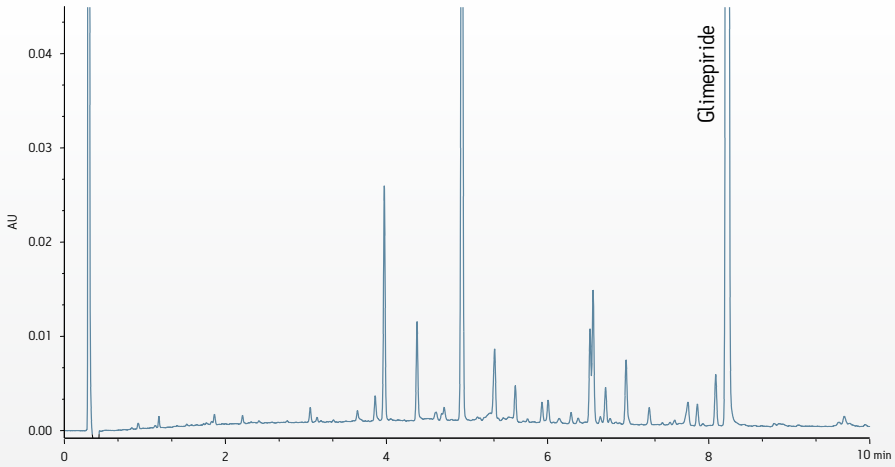


ACQUITY UPLC	BEH130 C_{18} 1.7 µm	BEH300 C_{18} 1.7 µm	BEH300 C_4 1.7 µm	BEH Glycan 1.7 µm	OST C_{18} 1.7 µm	BEH200 SEC 1.7 µm	BEH125 SEC 1.7 µm	AccQ•Tag Ultra 1.7 µm
	Peptide Separation Technology	Peptide Separation Technology	Protein Separation Technology	Glycan Separation Technology	Oligonucleotide Separation Technology	Protein Separation Technology	Protein Separation Technology	Amino Acid Analysis
Ligand Type	Trifunctional C_{18}	Trifunctional C_{18}	Monofunctional C_4	Trifunctional Carbamoyl	Trifunctional C_{18}	Trifunctional Diol	Trifunctional Diol	Trifunctional C_{18}
Ligand Density*	3.1 µmol/m²	3.1 µmol/m²	2.4 µmol/m²	7.5 µmol/m²	3.1 µmol/m²	7.5 µmol/m²	4.8 µmol/m²	3.1 µmol/m²
Carbon Load*	18%	12%	8%	12%	18%	12%	15%	18%
Endcap Style	proprietary	proprietary	none	none	proprietary	none	none	proprietary
USP Classification	L1	L1	L26	-	L1	L33	L33	L1
pH Range	1-12	1-12	1-10	2-11	1-12	1-8	1-8	1-12
Low pH Temp. Limit	80 °C	80 °C	80 °C	90 °C	80 °C	60 °C	60 °C	80 °C
High pH Temp. Limit	60 °C	60 °C	50 °C	90 °C	60 °C	60 °C	60 °C	60 °C
Pore Diameter*	130 Å	300 Å	300 Å	130 Å	130 Å	200 Å	125 Å	130 Å
Surface Area*	185 m²/g	90 m²/g	90 m²/g	185 m²/g	185 m²/g	220 m²/g	398 m²/g	185 m²/g
HPLC Column Equivalent	XBridge BEH130 C_{18} Peptide Separation Technology	XBridge BEH300 C_{18} Peptide Separation Technology	XBridge BEH300 C_4 Protein Separation Technology	—	XBridge OST C_{18} Oligonucleotide Separation Technology	—	—	—
HPLC Particle Sizes	3.5, 5, 10 µm	3.5, 5, 10 µm	3.5 µm	—	2.5 µm	—	—	—

*Expected or approximate values.

Providing unprecedented levels of efficiency, peak asymmetry and chemical stability, 1.7 µm ACQUITY UPLC BEH C_{18} Columns are a universal C_{18} column choice, suitable for a diverse range of analytes. With industry-leading mobile-phase pH [1 – 12] and temperature [80 °C] compatibility, this trifunctionally-bonded alkyl column is a universal method development tool that can impact the retention, selectivity and sensitivity of ionizable compounds (with mobile-phase pH) while delivering exceptional low- and high-pH stability for all analyte types.

High Resolution Analysis of Glimepiride Forced Degradation on BEH C_{18}

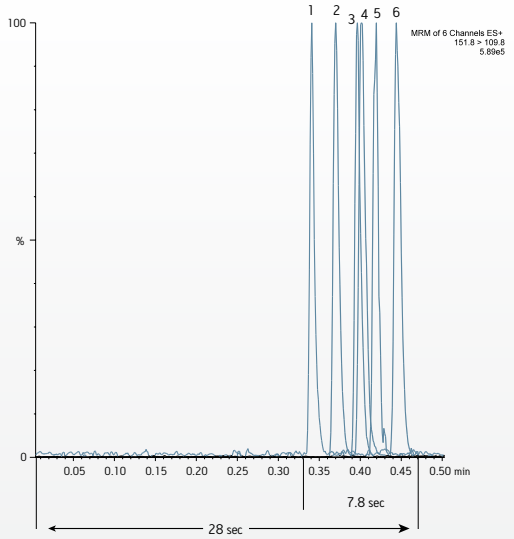


Column:	ACQUITY UPLC BEH C_{18} 2.1 x 100 mm, 1.7 µm
Part Number:	186002352
Mobile Phase A:	20 mM ammonium formate, pH 3
Mobile Phase B:	acetonitrile
Flow Rate:	0.8 mL/min
Gradient:	Time (min) / Profile %A %B: 0.0 88 12; 10.0 42 58; 10.1 88 12; 11.0 88 12
Column Temp.:	65 °C
Instrument:	ACQUITY UPLC with ACQUITY UPLC PDA
Sample:	Forced degradation of Glimepiride

For full conditions, reference application note 720002638EN

Forced degradation studies are performed to identify likely degradation products and establish degradation pathways as well as the intrinsic stability of a drug substance. In the later stage of drug development, forced degradation studies are used to distinguish between degradation products related to the drug substance in formulation from excipients. The increased resolution capability of UPLC Technology enables an improved characterization of complex samples.

Rapid Assay for Cytochrome p450 Isoenzymes on BEH C_{18}



LC Conditions:

Column:	ACQUITY UPLC BEH C_{18} 2.1 x 50 mm, 1.7 µm
Part Number:	186002350
Mobile Phase A:	0.1% formic acid in water
Mobile Phase B:	0.1% formic acid in methanol
Flow Rate:	0.8 mL/min
Gradient:	Time (min) / Profile %A %B: 0.0 95 5; 0.25 5 95; 0.26 95 5
Inj. Volume:	1 µL
Column Temp.:	40 °C
Instrument:	ACQUITY UPLC with ACQUITY UPLC TQ Detector

MS Conditions:

Ionization Mode:	ESI positive
Capillary Voltage:	3.0 kV
Desolv. Temp.:	450 °C
Desolv. Gas:	900 L/hr
Source Temp.:	150 °C
Acquisition:	MRM transitions
Dwell Time:	25 msec

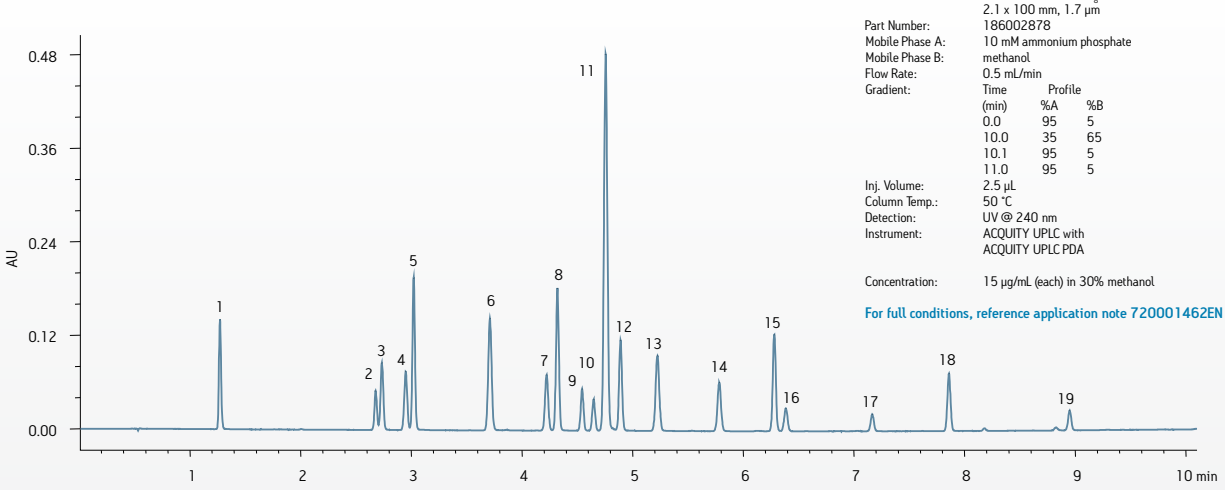
For full conditions, reference application note 720002339EN

p450	Substrate	Major Metabolite	Peak Number (metabolite)
1A2	Phenacetin	4-acetaminophenol	1
2A6	Coumarin	7-hydroxycoumarin	4
2C8/9/10	Tolbutamide	4-hydroxytolbutamide	5
2C19	S-mephenytoin	4-hydroxymephenytoin	3
2D6	Bufuralol	1-hydroxybufuralol	2
3A4	Midazolam	1-hydroxymidazolam	6

Responsible for more than 90% of drug metabolism on the market today, cytochrome p450 isoenzymes (and the level of interaction with the probe substrate) are used to determine the level of drug inhibition, induction or drug-drug interaction that has occurred. The ultra-low dispersion and system dwell volume of UPLC Technology enables the rapid analyses of these enzymes in less than 30 seconds.

Akin to the BEH C_{18} columns, 1.7 µm ACQUITY UPLC BEH C_8 Columns also provide exceptional efficiency, peak asymmetry and chemical stability, and are suitable for a diverse range of analytes. Due to its shorter alkyl-chain length, the BEH C_8 column exhibits lower hydrophobicity than a C_{18} column, resulting in lower retention and faster elution of analyte peaks. Additionally, alternate selectivity can result.

Analysis of Banned Carcinogenic Aromatic Amines on BEH C_8



Column: ACQUITY UPLC BEH C_8 2.1 x 100 mm, 1.7 µm
Part Number: 186002878
Mobile Phase A: 10 mM ammonium phosphate
Mobile Phase B: methanol
Flow Rate: 0.5 mL/min
Gradient:

Time (min)	Profile %A	%B
0.0	95	5
10.0	35	65
10.1	95	5
11.0	95	5

Inj. Volume: 2.5 µL
Column Temp.: 50 °C
Detection: UV @ 240 nm
Instrument: ACQUITY UPLC with ACQUITY UPLC PDA

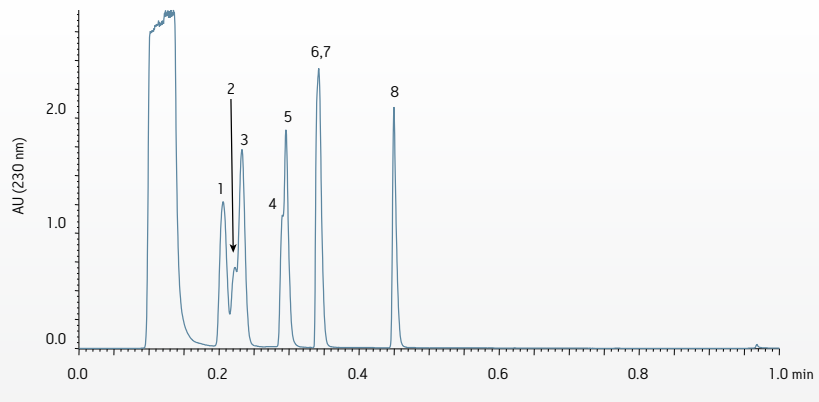
Concentration: 15 µg/mL (each) in 30% methanol

For full conditions, reference application note 720001462EN

[1] 4-methyl-m-phenylenediamine, [2] benzidine, [3] o-anisidine, [4]o-toluidine, [5] 4,4'-oxydianiline, [6] 4-Chloroaniline, [7] 6-methoxy-m-toluidine, [8] 4,4'-methylenedianiline, [9] 3,3'- dimethoxybenzidine, [10] 3,3'-dimethylbenzidine, [11] 2-naphthylamine, [12] 4,4'-Thiodianiline, [13] 4-chloro-O-toluidine, [14] 2,4,5-trimethylaniline , [15] 4,4'-methylenedio-toluidine, [16] 4-aminobiphenyl, [17] 3,3'-dichlorobenzidine, [18] 2,2'-dichloro-4,4'- methylenedianiline, [19] o-aminoazotoluene

Aromatic amines are widely used in the production of dyes, polymers, surfactants, drug substance, pesticides and corrosion inhibitors. The potential health impact of aromatic amines to consumer health/safety has resulted in increased regulations by governing agencies in the US and EU to restrict the use of these harmful chemicals in certain finished goods. By implementing UPLC for this analysis, a rapid, high resolution separation can be completed in 10 minutes; eight-fold faster than published HPLC methods.

High-Throughput Method for Cleaning Validation on BEH C_8



LC Conditions:
Column: ACQUITY UPLC BEH C_8 2.1 x 30 mm, 1.7 µm
Part Number: 186003910
Mobile Phase A: 10 mM ammonium bicarbonate, pH 10
Mobile Phase B: acetonitrile
Flow Rate: 0.8 mL/min
Gradient:

Time (min)	Profile %A	%B
0.0	65	35
0.3	0	100
0.31	65	35

Inj. Volume: 2 µL
Column Temp.: 50 °C
Instrument: ACQUITY UPLC with ACQUITY UPLC SQ Detector

MS Conditions:
Ionization Mode: ESI positive
Capillary Voltage: 3.5 kV
Cone Voltage: 30 V
Desolv. Temp.: 500 °C
Desolv. Gas: 800 L/hr
Source Temp.: 150 °C
Acquisition: full scan 150 – 750 m/z

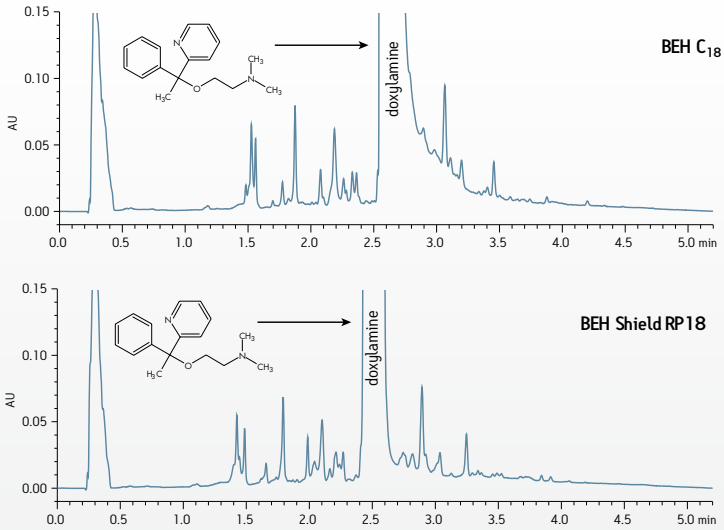
For full conditions, reference application note 720002171EN

[1] Compound A 367.1662 g/mol, [2] Compound B 204.0721 g/mol, [3] Compound C 313.0863 g/mol, [4]Compound D 244.1212 g/mol, [5] Compound E 379.1696 g/mol, [6] Compound F 661,8522 g/mol, [7] Compound G 296.0483 g/mol, [8] Compound H 368.2252 g/mol

Cleaning validation is imperative in an active pharmaceutical ingredient [API] manufacturing process to ensure that residual drug residues are properly removed from production equipment, ensuring that cross-contamination of drug products does not occur. By employing UPLC/MS for cleaning validation, a single 30-second assay was implemented for monitoring the cleanliness of a production reactor used for eight distinct drug products.

The ACQUITY UPLC BEH Shield RP18 Column contains an embedded-polar group that combines the hydrophobicity of a straight-chain-alkyl ligand (C_{18}) with the hydrophilicity of an embedded polar group (carbamate). This unique and patented bonding chemistry provides complementary selectivity to a C_{18} column while enhancing peak shape for basic compounds and yielding compatibility with 100% aqueous mobile phases.

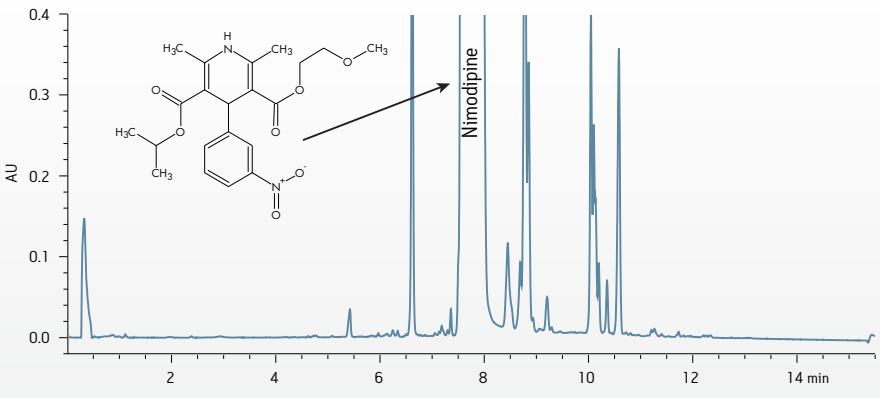
Impurity Profile of Doxylamine on BEH Shield RP18



Column:	ACQUITY UPLC BEH C_{18} ACQUITY UPLC BEH Shield RP18 2.1 x 50 mm, 1.7 µm
Part Numbers:	186002350 and 186002853, respectively
Mobile Phase A:	20 mM ammonium bicarbonate, pH 10
Mobile Phase B:	acetonitrile
Flow Rate:	0.5 mL/min
Gradient:	Time (min) / Profile %A %B 0.0 95 5 5.0 5 95 5.1 95 5 6.0 95 5
Inj. Volume:	10 µL
Column Temp.:	30 °C
Instrument:	ACQUITY UPLC with ACQUITY UPLC PDA
Sample:	Impurity profile of doxylamine
Concentration:	30 mg/mL in DMSO

Doxylamine is an antihistimine frequently used in sleep aids that works by depressing the central nervous system to induce drowsiness. When developing a purification method to isolate this drug substance from synthetic and formulation impurities, the BEH Shield RP18 column yields a narrower, more symmetrical peak than a traditional C_{18} column, making it easier to isolate the active compound from closely-eluting extraneous components.

Impurity Profile of Nimodipine on BEH Shield RP18

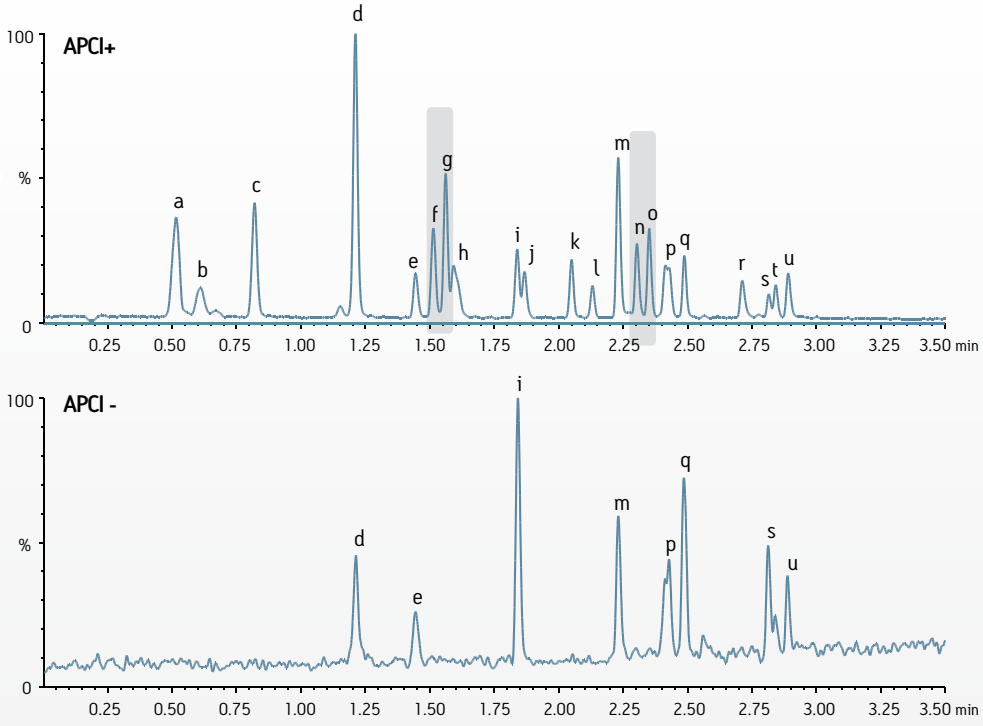


Column:	ACQUITY UPLC BEH Shield RP18 2.1 x 50 mm, 1.7 µm
Part Number:	186002853
Mobile Phase A:	20 mM ammonium formate, pH 3
Mobile Phase B:	acetonitrile
Flow Rate:	0.5 mL/min
Gradient:	Time (min) / Profile %A %B 0.0 95 5 15.0 10 90 15.1 95 5 16.0 95 5
Inj. Volume:	10 µL
Column Temp.:	30 °C
Instrument:	ACQUITY UPLC with ACQUITY UPLC PDA
Sample:	Impurity profile of nimodipine
Concentration:	30 mg/mL in DMSO

Nimodipine is a calcium channel blocker developed for the treatment of high blood pressure and is frequently prescribed for the treatment of cerebral hemorrhage. Due to the exceptional peak shape and high resolution power of the BEH Shield RP18 column, nimodipine is successfully chromatographically separated from the numerous process impurities.

Phenyl ligand containing stationary phases often provide complementary selectivity to straight-chain alkyl phases, particularly for molecules containing aromaticity due to pi-pi interactions. Due to the trifunctionally-bonded phenyl-hexyl ligand employed by ACQUITY UPLC BEH Phenyl Columns, these columns provide industry-leading chemical stability, reproducibility and peak shape for all analyte types.

Rapid Analysis of 25 Polymer Additives on BEH Phenyl



LC Conditions:

Column:	ACQUITY UPLC BEH Phenyl 2.1 x 50 mm, 1.7 µm
Part Number:	186002884
Mobile Phase A:	water
Mobile Phase B:	methanol
Flow Rate:	0.8 mL/min

Gradient:

Time (min)	Profile %A	%B
0.0	60	40
2.7	0	100
3.5	0	100
4.0	60	40
6.5	60	40

Inj. Volume:	2 µL
Column Temp.:	60 °C
Instrument:	ACQUITY UPLC with ACQUITY UPLC TQ Detector

MS Conditions:

Ionization Mode:	APCI positive and APCI negative
Corona (µA):	5.0/-5.0
Cone Voltage:	+30 V/-30V
Extractor:	+3V/-3V
Probe. Temp.:	500 °C
Desolv. Gas:	900 L/hr
Source Temp.:	150 °C
Cone Gas:	20 L/hr
Acquisition:	full scan 180 – 800 m/z

For full conditions, reference application note 720002488EN

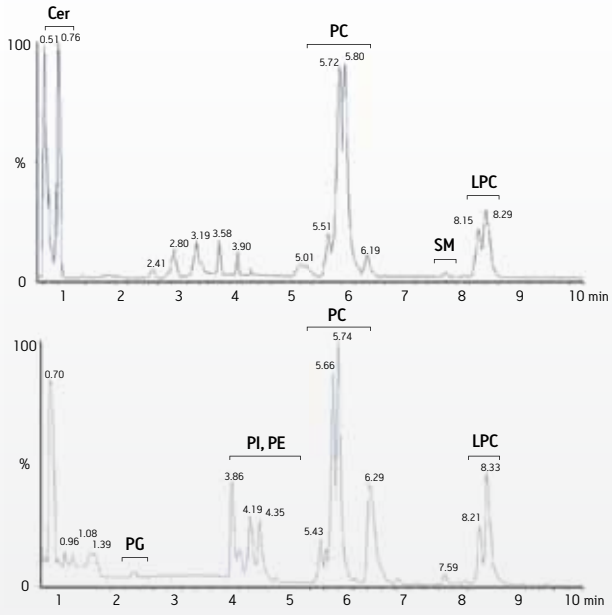
[a] Phthalic acid dimethyl ester; [b] Phthalic acid bis(2-methoxyethyl) ester; [c] Phthalic acid diethyl ester; Lowilite-20; [d] Phthalic acid dipropyl ester; [e] Tinuvin-P; [f] Phthalic acid diisobutyl ester; [g] Phthalic acid di-n-butyl ester; [h] n-butyl Phthalyl n-butyl glycolate AND Phthalic acid benzyl n-butyl ester; [i] Phthalic acid di-n-amyl ester AND Lowinox-TBM6; [j] Phthalic acid dicyclohexyl ester; [k] Phthalic acid di-n-hexyl ester; [l] Stearamide; [m] Chimassorb-81; [n] Phthalic acid di(2-ethylhexyl) ester; [o] Phthalic acid di-n-octyl ester; [p] Tinuvin-328 AND Tinuvin-326; [q] Irganox-1035; [r] Irganox-PS-800; [s] Irganox-1330; [t] Irgafos-168; [u] Lowilite-36

Polymer additives are used to improve the properties of plastic-containing products. The increased use of plastic-containing products worldwide and the concern of their safe use and re-use have increased the demand for rapid and accurate analysis of additives in plastics, food products, serum and the environment. By implementing UPLC Technology with TQD and a BEH Phenyl column, the analysis of 25 polymer additives is achieved in only 3.5 minutes; 6-10X faster than published HPLC methods.

Hydrophilic-Interaction Chromatography [HILIC] is a complementary chromatographic technique that can be used to successfully improve the retention of very polar species as well as provide an orthogonal separation mode for mixtures of polar and ionizable compounds. This is achieved by utilizing an acetonitrile-rich, low-aqueous mobile phase in combination with a polar stationary phase to elute analytes in order of increasing hydrophilicity [polarity].

The ACQUITY UPLC BEH HILIC Column utilizes an unbonded BEH particle to improve the retention of very polar basic analytes that are difficult to retain by reversed-phase chromatography while demonstrating complementary selectivity to RPLC. Additionally, the BEH HILIC column provides exceptional chemical stability and peak shape compared to silica-based HILIC stationary phases.

Separation of Lipid Classes on BEH HILIC



LC Conditions:

Column:	ACQUITY UPLC BEH HILIC 2.1 x 100 mm, 1.7 µm
Mobile Phase A:	95 acetonitrile: 5 water with 10 mM ammonium acetate, pH 8
Mobile Phase B:	50 acetonitrile: 50 water with 10 mM ammonium acetate, pH 8
Flow Rate:	0.5 mL/min

Gradient:

Time (min)	Profile %A	%B
0.0	100	0
10.0	80	20
10.1	100	0

Inj. Volume:	3 µL
Temperature:	30 °C
Instrument:	ACQUITY UPLC with Xevo Q-Tof MS

MS Conditions:

Ionization Mode:	ESI positive / ESI negative
Capillary Voltage:	2.8 kV / - 1.9 kV
Cone Voltage:	35 V
Desolv. Temp.:	500 °C
Desolv. Gas:	100 L/hr
Source Temp.:	120 °C
Acquisition:	100 – 1200 m/z

For full conditions, reference application note 720004048EN

HILIC separation of lipid classes extracted from monkey plasma

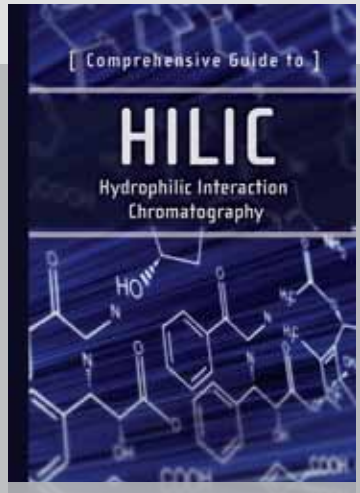
[Cer] ceramides, [PC] phosphatidylcholines, [SM] sphingomyelins, [LPC] lysophosphatidylcholines, [PG] phosphatidylglycerols, [PI] phosphatidylinositols, [PE] phosphatidylethanolamines

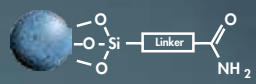
Advancements in LC/MS have enabled lipids to be studied with greater sensitivity and specificity, alleviating the impact of co-eluting species and isobaric interferences, thus enabling low-abundance lipids to be more readily detected. With the BEH HILIC column, significantly improved separation and characterization of polar lipids can be achieved.

COMPREHENSIVE GUIDE TO HILIC

This 72-page technology primer is designed to provide the reader with the basic insight of how to be successful with hydrophilic-interaction chromatography by understanding how the technique works, the parameters that impact retention and selectivity, as well as the practical considerations necessary to successfully implement HILIC within a chromatographic strategy.

Learn more at **www.waters.com/HILIC**

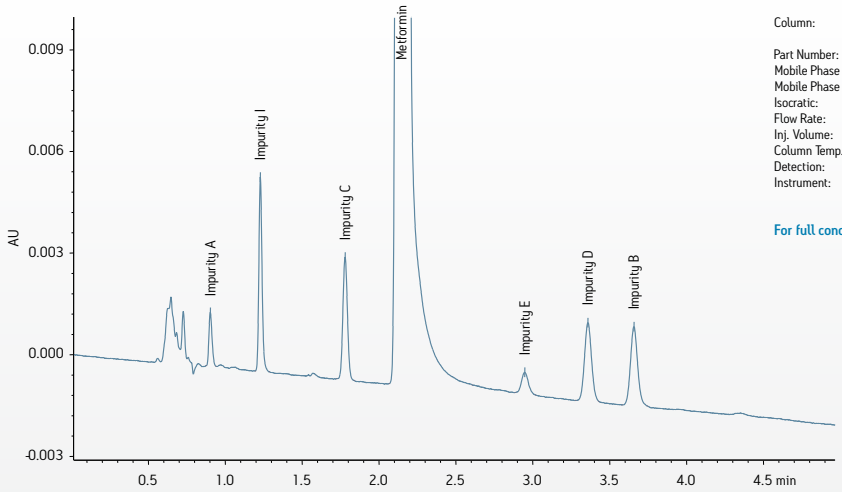




Designed to retain polar analytes and metabolites that are too polar to retain by reversed-phase chromatography, ACQUITY UPLC BEH Amide Columns enable the use of a wide range of mobile phase pH [2 – 11] to facilitate the exceptional retention of polar analytes spanning a wide range in polarity, structural moiety and pKa.

Additionally, the BEH Amide column is ideal for the analysis of carbohydrates due its **exceptional chemical stability** at high pH and high temperature to collapse reducing sugar anomers as well as **improved quantitation accuracy** due to the lack of Schiff-base formation.

Separation of Metformin and Related Substances on BEH Amide

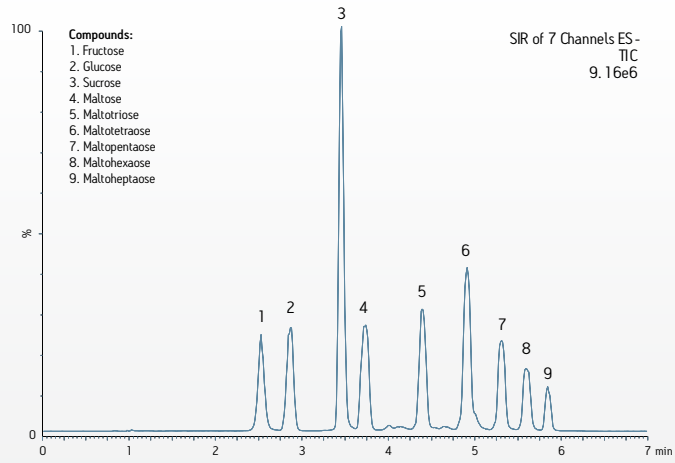


Column:	ACQUITY UPLC BEH Amide 2.1 x 150 mm, 1.7 µm
Part Number:	186004802
Mobile Phase A:	20 mM potassium phosphate, pH 2.3
Mobile Phase B:	acetonitrile
Isocratic:	80% B
Flow Rate:	0.5 mL/min
Inj. Volume:	1 µL
Column Temp.:	40 °C
Detection:	UV @ 218 nm
Instrument:	ACQUITY UPLC H-Class with ACQUITY UPLC PDA Detector

For full conditions, reference application note 720004080EN

Metformin HCl is an anti-diabetic drug commonly prescribed for the treatment of non-insulin dependent (type 2) diabetes. The LC analysis of metformin and related substances is particularly challenging due to the highly polar nature of the analytes. The ACQUITY UPLC BEH Amide Column enabled the successful retention, separation and characterization of metformin and six related substances.

UPLC-MS Analysis of Carbohydrates on BEH Amide



LC Conditions:

Column:	ACQUITY UPLC BEH Amide 2.1 x 50 mm, 1.7 µm
Part Number:	186004800
Mobile Phase A:	80 acetonitrile:20 water with 0.1% ammonium hydroxide
Mobile Phase B:	30 acetonitrile:70 water with 0.1% ammonium hydroxide
Flow Rate:	0.17 mL/min
Gradient:	Time (min) / Profile %A %B: 0.0 100 0; 5.0 40 60; 5.1 100 0
Inj. Volume:	0.7 µL
Column Temp.:	35 °C
Instrument:	ACQUITY UPLC with ACQUITY SQ detector

MS Conditions:

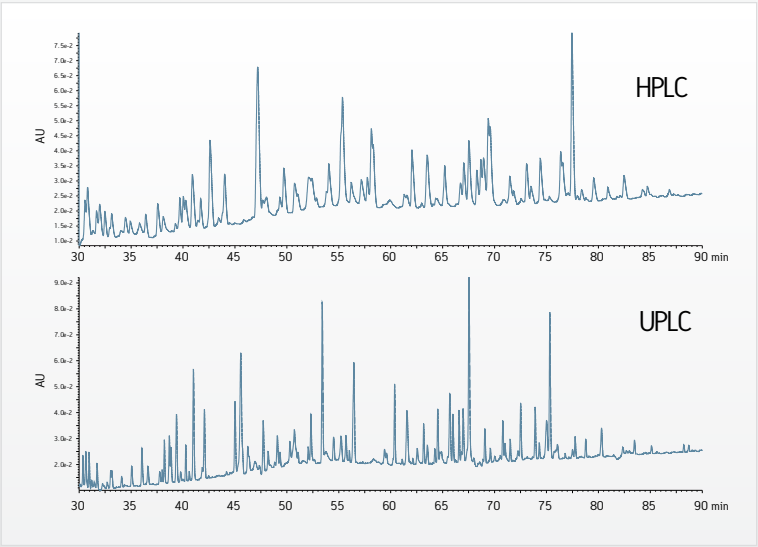
Ionization Mode:	ESI negative
Capillary Voltage:	2.8 kV
Cone Voltage:	25 V
Desolv. Temp.:	350 °C
Desolv. Gas:	500 L/hr
Source Temp.:	120 °C
Acquisition:	SIR of 179.2, 341.3, 503.4, 665.5, 827.6, 989.7, 1151.8 m/z

For full conditions, reference application note 720003212EN

Carbohydrates are the most abundant class of organic compounds in nature, and play an essential role in many biological processes. Mass spectrometry is a desirable technique for detecting carbohydrates due to its ability to achieve sensitivities 10-fold more than evaporative light scattering detection and 100-fold more than RI detection. With the BEH Amide column, a rapid and sensitive UPLC-MS analysis of mono-, di- and oligosaccharides was achieved.

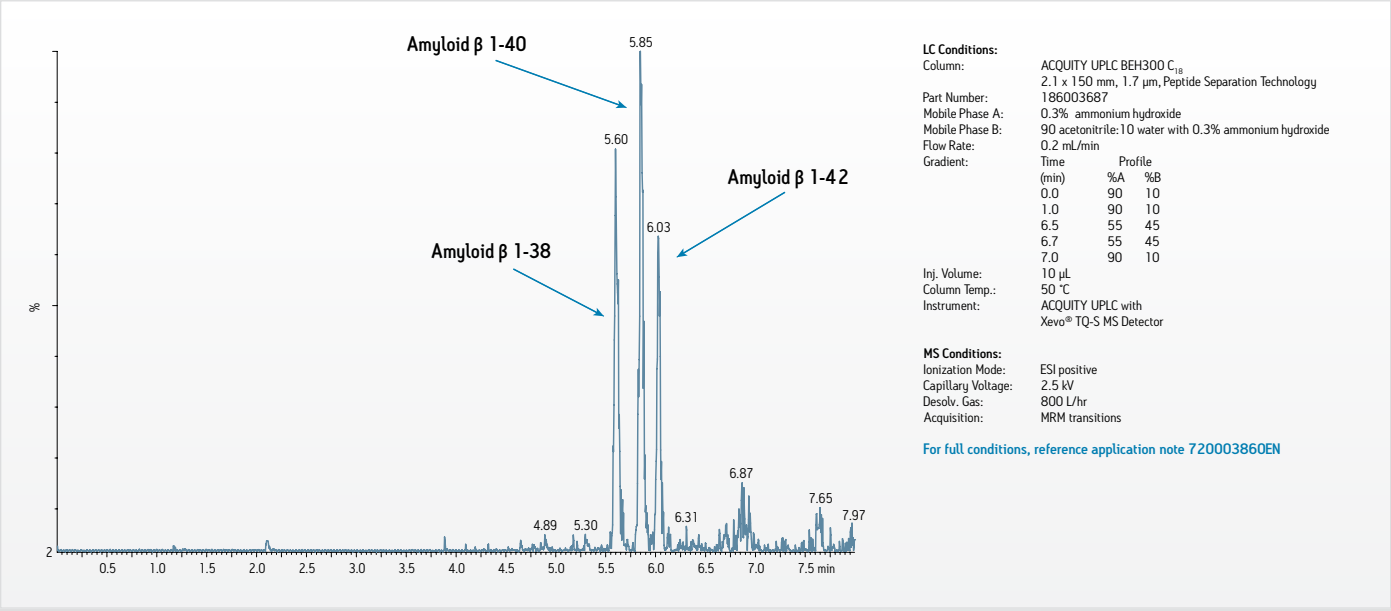
ACQUITY UPLC BEH130 and BEH300 Peptide Separation Technology Columns enable significantly improved protein and peptide characterization due to the increased resolving power that UPLC provides for these complex separations.

Improved Resolving Power in Peptide Maps



Peptide mapping is an essential technique for the characterization of proteins, particularly for the determination of protein identification based on the elution pattern of peptide fragments, confirmation of genetic stability, the determination of post-translational modifications as well as the analysis of protein sequences by mass spectrometry. Due to exceptionally reduced instrument and column dispersion, the analysis of this tryptic digest of phosphorylase b by UPLC Technology provides significantly improved resolution, peak capacity and sensitivity compared to HPLC, allowing for a more complete characterization of the protein.

Analysis of Amyloid β Peptides in Cerebral Spinal Fluid



LC Conditions:

Column:	ACQUITY UPLC BEH300 C_{18} 2.1 x 150 mm, 1.7 µm, Peptide Separation Technology
Part Number:	186003687
Mobile Phase A:	0.3% ammonium hydroxide
Mobile Phase B:	90 acetonitrile:10 water with 0.3% ammonium hydroxide
Flow Rate:	0.2 mL/min

Gradient:

Time (min)	%A	%B
0.0	90	10
1.0	90	10
6.5	55	45
6.7	55	45
7.0	90	10

Inj. Volume:	10 µL
Column Temp.:	50 °C
Instrument:	ACQUITY UPLC with Xevo® TQ-S MS Detector

MS Conditions:

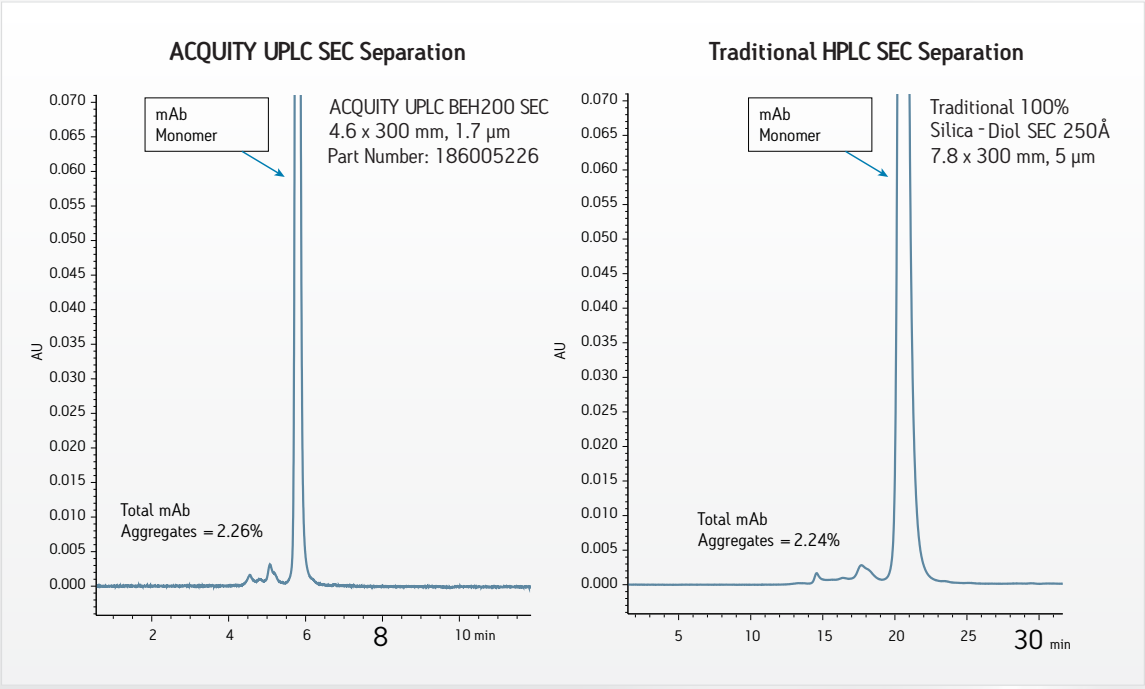
Ionization Mode:	ESI positive
Capillary Voltage:	2.5 kV
Desolv. Gas:	800 L/hr
Acquisition:	MRM transitions

For full conditions, reference application note 720003860EN

The quantification of amyloid β peptides in biological fluids has relied mainly on the use of immunoassays such as ELISA. These assays are time consuming, incur substantial development costs, are subject to cross reactivity and are labor intensive due to the requirement of an individual assay for each peptide. By developing a flexible, yet highly specific LC/MS/MS assay, a high degree of selectivity, specificity and throughput can be achieved while meeting the rigorous sensitivity requirements to properly quantitate amyloid β peptides at exceptionally low levels.

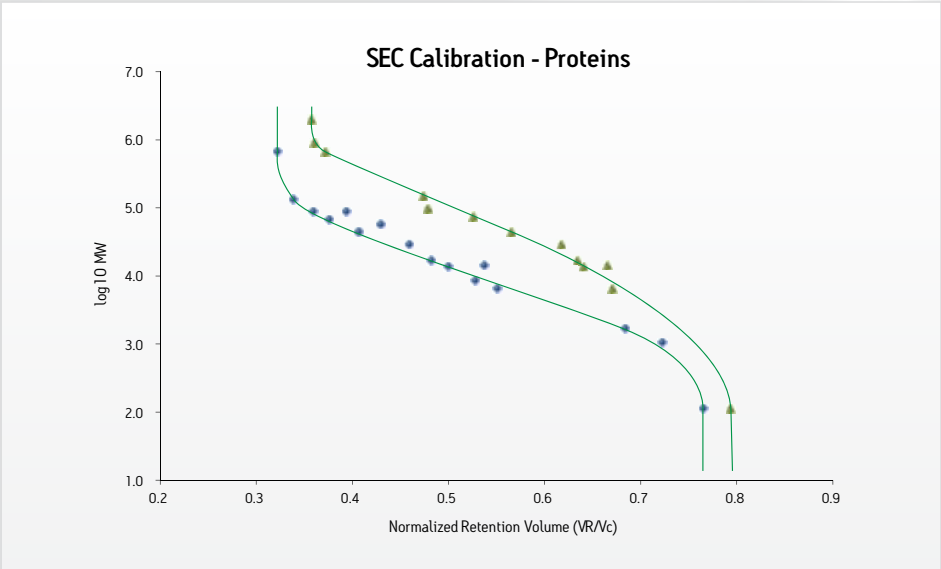
Optimized for the analysis of proteins and their aggregates, 1.7 µm ACQUITY UPLC BEH125 and BEH200 SEC Columns provide accurate aggregate determinations (m.w. 1,000 – 80,000 or 10,000 – 450,000 daltons, respectively), significantly faster than traditional HPLC SEC assays.

Robust, Fast and Accurate Determination of an mAb Monomer and Aggregates



The presence of protein aggregates can compromise the safety and efficacy of biologic-based therapeutics. Monitoring the presence of these aggregates is predominantly performed by size-exclusion chromatography. With the ACQUITY UPLC BEH200 SEC Column (the first commercially available UPLC SEC Column), exceptional improvements in resolution, throughput and sensitivity for these assays can be achieved.

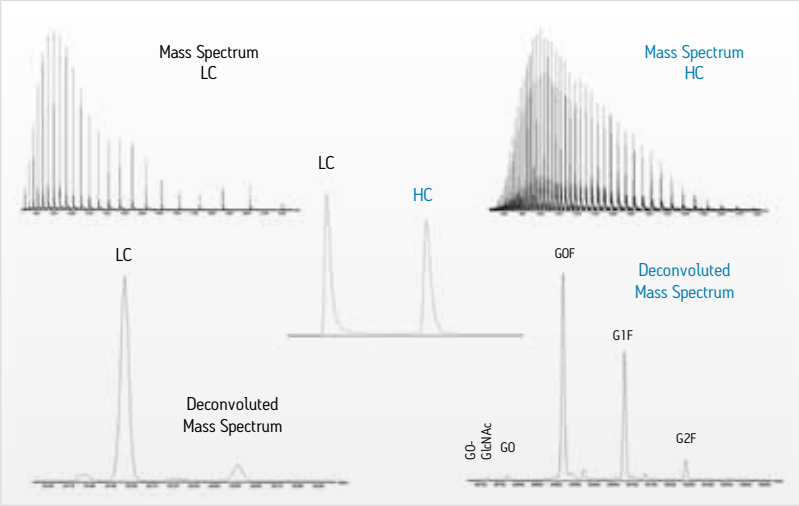
Protein Calibration Curves for ACQUITY UPLC BEH125 and BEH200 SEC Columns



Protein Separation Technology:
ACQUITY UPLC BEH300 C_4 Columns

Ideally suited for high resolution separations of proteins, ACQUITY UPLC BEH300 C_4 Columns enable the differentiation of minor isoforms of either heavy or light chains, providing enhanced assessment on the heterogeneity of a protein sample.

UPLC/MS Analysis of a Reduced Monoclonal Antibody



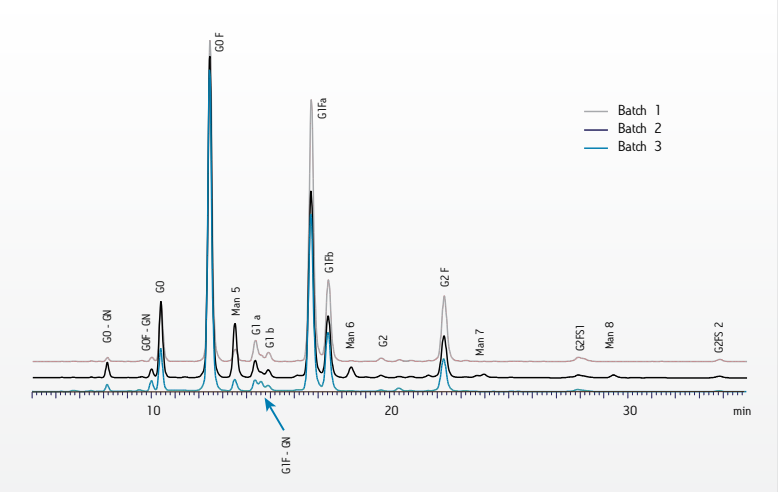
Chromatographic separation of the heavy and light chains adds further detail to the characteristics of a mAb, confirms that the glycoprotein profiles of candidate expression clones match the expectation, or indicates whether there are unusual distributions of glycoforms. By separating light and heavy chains, glycoforms may be examined more closely to enable relative component quantitation to be achieved and modifications specific to the light or heavy chains can be characterized.

For full conditions, reference application note 720003046EN.

Glycan Separation Technology:
ACQUITY UPLC BEH Glycan Columns

The monitoring of glycosylation of therapeutic proteins is essential due to the potential impact of therapeutic efficacy based on the proteins tertiary structure. The 1.7 µm ACQUITY UPLC BEH Glycan Columns provide exceptionally high resolution, thus improving the characterization of glycoproteins.

UPLC/FLR Analysis of 2-AB Labeled Glycans from Three Batches of Trastuzumab



Trastuzumab is a therapeutic rmAb (IgG1 subclass) that is widely used for the treatment of breast cancer. N-linked glycans were released from three batches of Trastuzumab enzymatically, and labeled with a fluorescent tag, 2-aminobenzamide (2-AB). The ACQUITY UPLC BEH Glycan Column was used to successfully characterize and quantitate released and labeled glycans.

For full conditions, reference application note 720003576EN.

Oligonucleotide Separation Technology: ACQUITY UPLC OST C_{18} Columns

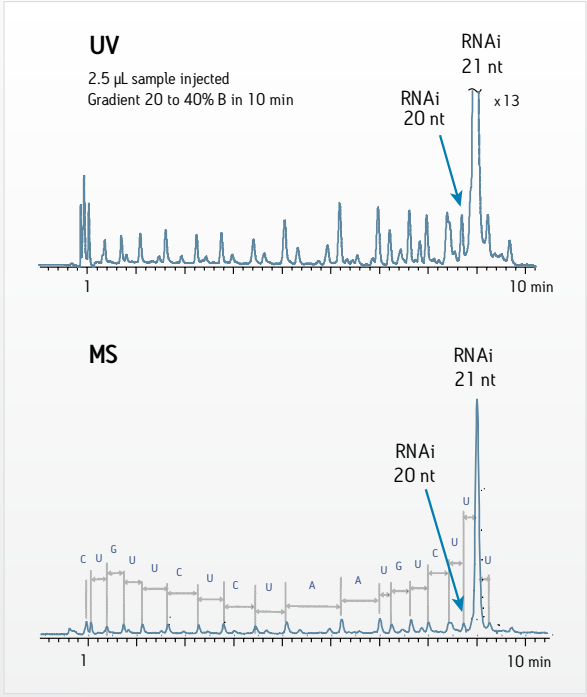
The 1.7 µm ACQUITY UPLC OST Columns are ideally-suited for the characterization of oligonucleotides by ion-pair, reversed-phase chromatography while delivering exceptional sample resolution, peak shape and extended column life.

UPLC/MS Analysis of Interfering RNA Oligonucleotides

Interfering RNA oligonucleotides contain matrix modifications to native RNA molecules to increase binding constants and nuclease resistance or to help preserve unique secondary structure. Due to the step-wise synthetic processes used to produce these molecules, the final product may contain truncated oligonucleotides as well as process-related impurities and contaminants that are critical to detect and quantitate due to the possibility that they may impact compound efficacy and safety.

The exceptional resolution of the ACQUITY UPLC OST Column enabled the full-length synthetic RNAi product to be resolved from its failure sequences in 10 minutes.

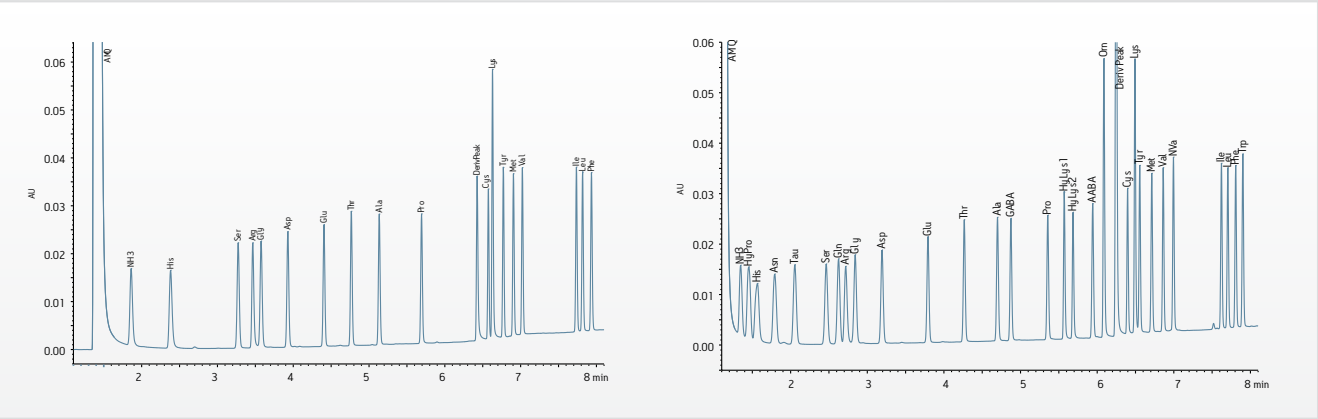
For full conditions, reference application note 720002412EN.



AccQ•Tag Ultra UPLC Amino Acid Analysis

The UPLC Amino Acid Analysis Solution is designed to ensure the accurate and precise qualitative and quantitative measurement of amino acids for protein characterization, cell culture monitoring and the nutritional analysis of foods and feeds. Based on a pre-column derivatization method, this total application solution is optimized for the accurate, reliable and reproducible analysis of amino acids.

Flexible Methodology for the Analysis of Amino Acids



The trace on the left shows the analysis of a hydrolysate standard (10 pmol/µL) and the trace on the right shows a standard mixture of the larger number of amino acids found in cell culture media (10 pmol/µL). The adaptation of the method requires only a change in dilution of the Eluent A concentrate supplied as part of the total system solution.

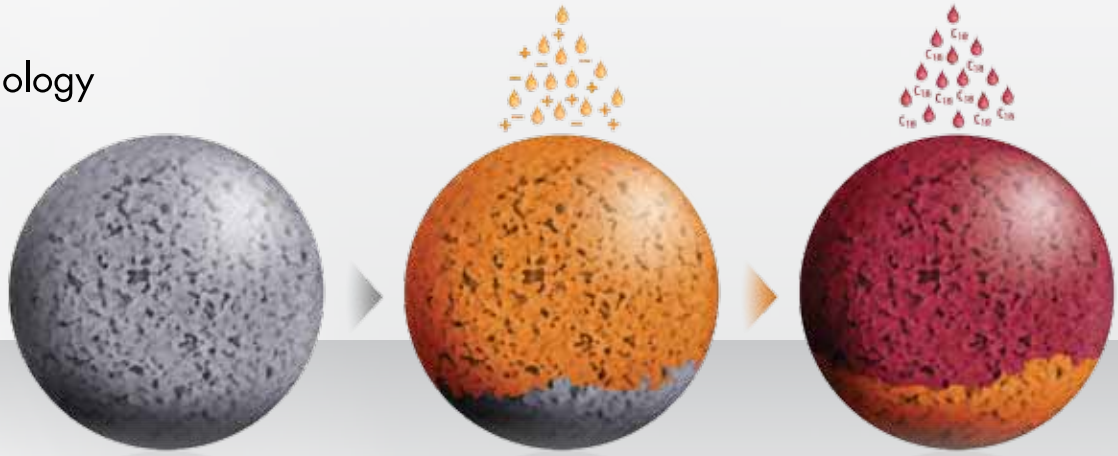
For full conditions, reference 720001837EN.

Charged Surface Hybrid [CSH] Particle Technology

The progression and evolution of materials science has led to significant advances in chromatographic materials, the most recent of which being hybrid particle technology. Hybrid-based packing materials offer exceptional peak shape and efficiency as well as industry-leading chemical stability.

Charged Surface Hybrid [CSH] Technology is the latest advancement in hybrid materials that utilizes a controlled, low-level surface charge to provide enhanced selectivity and exceptional peak shape, particularly in low-ionic-strength mobile phases.

CSH™ Technology



Unbonded BEH Particle

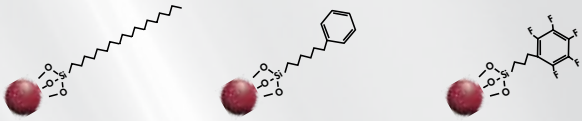
Start with the rugged, ultra-efficient, ethylene bridged hybrid (BEH) particle

Apply Controlled Surface Charge

Add reproducible low-level charge to particle surface

Bond and End Cap

Functionalize with appropriate bonded phase chemistry



For more information, reference 720003929EN.

ACQUITY UPLC	CSH C_{18}, 1.7 µm	CSH Phenyl-Hexyl, 1.7 µm	CSH Fluoro-Phenyl, 1.7 µm
Ligand Type	Trifunctional C_{18}	Trifunctional C_6 Phenyl	Trifunctional Propylfluorophenyl
Ligand Density*	2.3 µmol/m^2	2.3 µmol/m^2	2.3 µmol/m^2
Carbon Load*	15%	14%	10%
Endcap Style	proprietary	proprietary	none
USP Classification	L1	L11	L43
pH Range	1 - 11	1 - 11	1 - 8
Low pH Temp. Limit	80 °C	80 °C	60 °C
High pH Temp. Limit	45 °C	45 °C	45 °C
Pore Diameter*	130 Å	130 Å	130 Å
Surface Area*	185 m^2/g	185 m^2/g	185 m^2/g
HPLC Column Equivalent	XSelect CSH C_{18}	XSelect CSH Phenyl-Hexyl	XSelect CSH Fluoro-Phenyl
HPLC Particle Sizes	2.5, 3.5, 5 µm	2.5, 3.5, 5 µm	2.5, 3.5, 5 µm

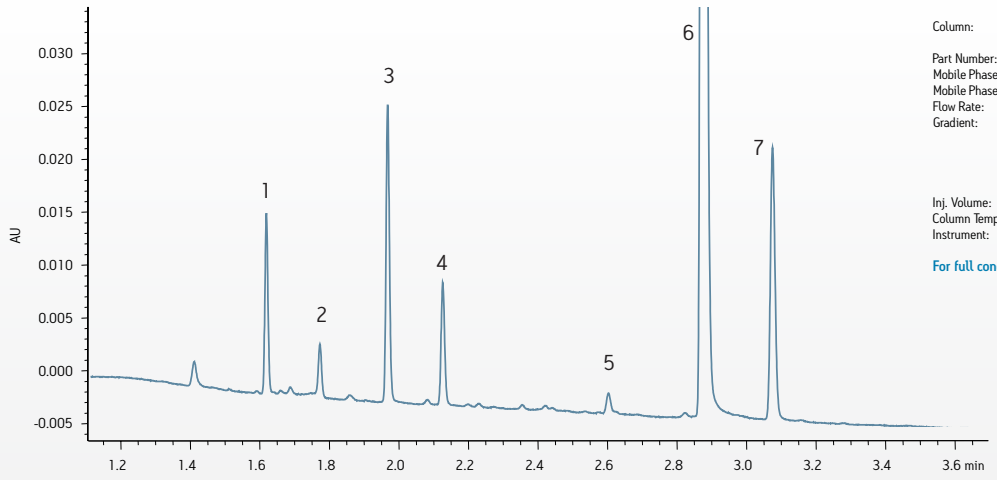
* Expected or approximate values.

ADVANTAGES OF CSH TECHNOLOGY INCLUDE:

- Unique column selectivity with industry-leading reproducibility
- Exceptional peak shape and loading capacity for basic compounds at low and high pH without the need for ion-pair reagents
- Exceptional stability and advanced column equilibration at low and high pH

The ACQUITY UPLC CSH C_{18} Column is a universal C_{18} column choice, suitable for a broad range of compound classes while providing alternate selectivity to BEH C_{18}. Built on the Charged Surface Hybrid [CSH] particle platform, the CSH C_{18} Column provides exceptional peak shape and increased loading capacity, particularly for basic compounds under low-pH, weak-ionic-strength mobile-phase conditions.

Analysis of Ziprasidone Peroxide Degradation on CSH C_{18}

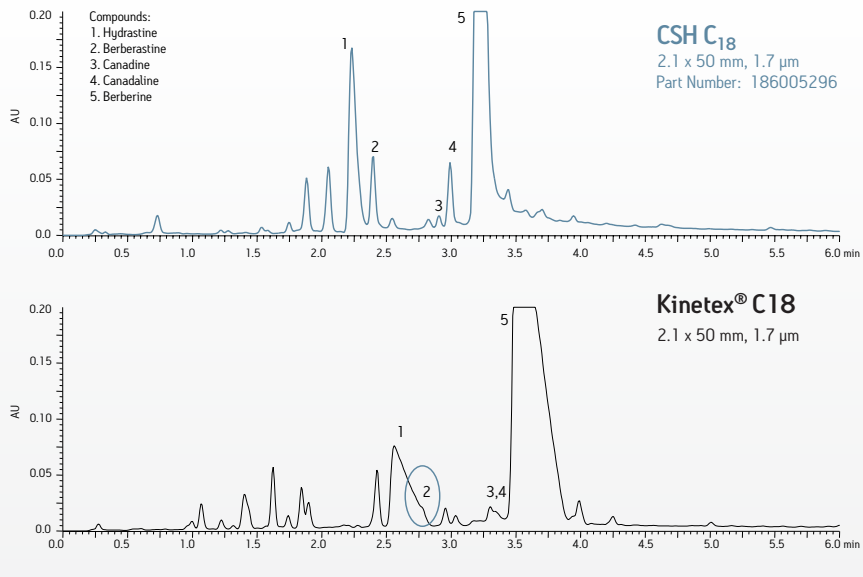


Column:	ACQUITY UPLC CSH C_{18} 2.1 x 50 mm, 1.7 µm
Part Number:	186005296
Mobile Phase A:	0.1% formic acid in water
Mobile Phase B:	acetonitrile
Flow Rate:	0.8 mL/min
Gradient:	Time (min) / %A / %B: 0.0 / 100 / 0; 8.1 / 12.5 / 87.5; 8.2 / 100 / 0
Inj. Volume:	1 µL
Column Temp.:	30 °C
Instrument:	ACQUITY UPLC H-Class with ACQUITY UPLC PDA

For full conditions, reference application note 720004072EN

Ziprasidone is an anti-psychotic drug primarily used to treat the symptoms of schizophrenia, mania and bipolar disorder by altering the activity of specific natural chemicals present in the brain. The ACQUITY UPLC CSH C_{18} was used to successfully characterize the peroxide degradation products of ziprasidone in a simple formic acid mobile phase while demonstrating exceptional peak shape and peak-to-peak resolution in a rapid analysis time.

Comparison of Goldenseal Root Extract Separation on CSH C_{18} and Kinetex C_{18}

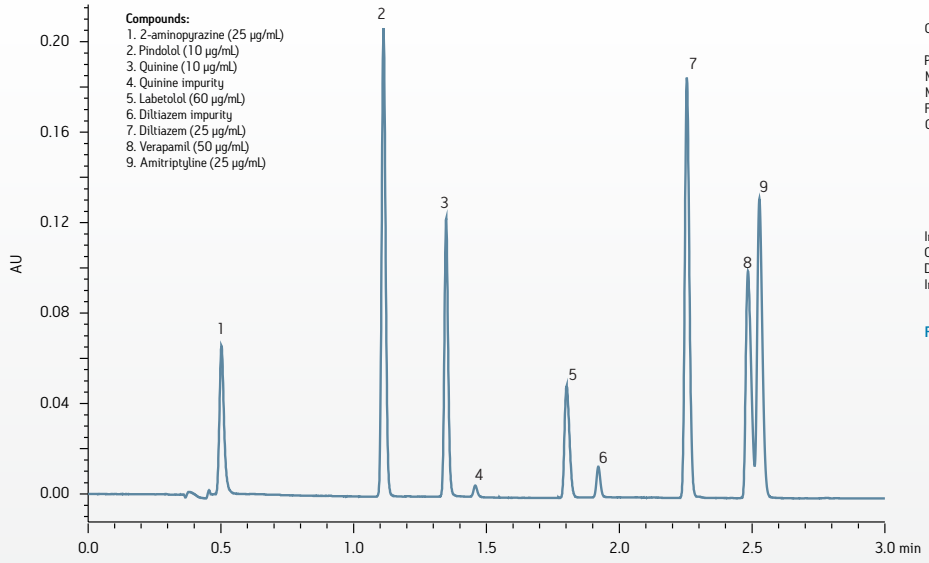


Comparative separations may not be representative of all applications.

Goldenseal is a plant native to Northeastern US and Canada that contains several isoquinoline alkaloids that have been studied for their medicinal properties. These alkaloids typically exhibit poor peak shape by reversed-phase chromatography due to their basic nature and limited sample loading in their ionized form. The low-level surface charge of the CSH C_{18} Column provides superior peak shape and sample loading capacity compared to this core-shell C18 column of equal particle size.

The ACQUITY UPLC CSH Phenyl-Hexyl Column provides complementary selectivity to straight-chain-alkyl phases, particularly for polyaromatic compounds. Built on the Charged Surface Hybrid [CSH] particle platform, the CSH Phenyl-Hexyl Column provides exceptional peak shape under low-and high-pH conditions.

Analysis of Basic Drugs on CSH Phenyl-Hexyl



Column:	ACQUITY UPLC CSH Phenyl-Hexyl 2.1 x 50 mm, 1.7 µm
Part Number:	186005406
Mobile Phase A:	10 mM ammonium formate, pH 3
Mobile Phase B:	acetonitrile
Flow Rate:	0.4 mL/min

Gradient:

Time (min)	Profile %A	%B
0.0	95	5
3.0	45	55
3.5	45	55
3.51	95	5
4.5	95	5

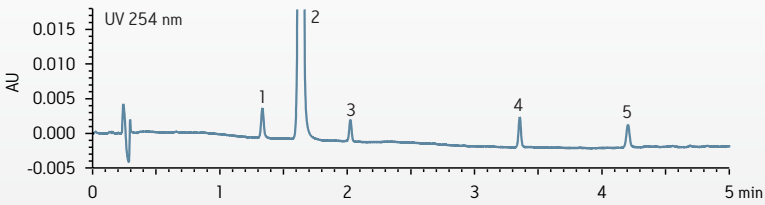
Inj. Volume:	4 µL
Column Temp.:	30 °C
Detection:	UV @ 260 nm
Instrument:	ACQUITY UPLC with ACQUITY UPLC PDA

For full conditions, reference application notebook 720003537EN

Poor peak shape and retention often result when analyzing basic compounds under low-pH, reversed-phase conditions. With a controlled, low-level surface charge inherent of the CSH particle in combination with a trifunctionally-bonded phenyl-hexyl ligand, the CSH Phenyl-Hexyl Column provides exceptional peak shape for basic compounds, even in their ionized form under acidic mobile-phase conditions.

Analysis of Clozapine and Related Compounds on CSH Phenyl-Hexyl

Compounds:
1. 8-chloro-11-(piperazin-1-yl)-5H-dibenzo[b,e][1,4]-diazepine
2. clozapine
3. 11-[2-[2-amino-4-chlorophenyl)amino]benzoyl]-4-methylpiperzine
4. 11,11'-(piperazine-1,4-diyl)bis(8-chloro-5H-dibenzo[b,e]91,4]diazepine)
5. 8-chloro-5,10-dihydro-11H-dibenzo[b,e][1,4]diazepin-11-one



LC Conditions:

Column:	ACQUITY UPLC CSH Phenyl-Hexyl 2.1 x 50 mm, 1.7 µm
Part Number:	186005406
obile Phase A:	water
Mobile Phase B:	acetonitrile
Mobile Phase C:	2% formic acid in water
Flow Rate:	0.6 mL/min

Gradient:

Time (min)	Profile %A	%B	%C
0.0	90	5	5
5.0	45	50	5
6.0	0	95	5
6.1	90	5	5
8.0	90	5	5

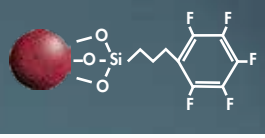
Inj. Volume:	4 µL
Column Temp.:	30 °C
Detection:	UV @ 260 nm
Instrument:	ACQUITY UPLC H-Class with ACQUITY UPLC PDA and SQD

MS Conditions:

Ionization Mode:	ESI positive
Capillary Voltage:	3.0 kV
Cone Voltage:	20 V
Extractor:	3 V
Desolv. Temp.:	350 °C
Desolv. Gas:	800 L/hr
Source Temp.:	150 °C
Acquisition:	200 – 650 m/z

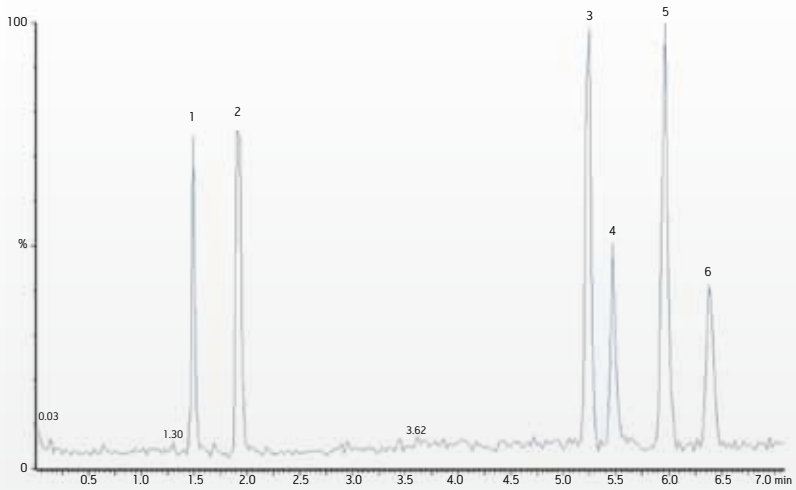
For full conditions, reference application notebook 720003537EN

Clozapine is an antipsychotic medication that is used to treat severe schizophrenia as well as reduce the risk of suicidal behavior in people with schizophrenia or similar disorders. The ACQUITY UPLC CSH Phenyl-Hexyl Column was used to successfully characterize clozapine and its related compounds in a simple formic acid mobile phase while demonstrating exceptional peak shape and peak-to-peak resolution in a rapid analysis time. An ACQUITY® SQ Mass Detector was used to identify the impurity peaks (data not shown).



The ACQUITY UPLC CSH Fluoro-Phenyl Column provides exceptional selectivity for positional isomers, halogenated compounds and polar compounds. This, in part, is due to an intricate combination of multiple retention mechanisms including dipole-dipole, hydrogen-bonding, aromatic (pi-pi) and hydrophobic interactions. However, due to the unique surface chemistry of the Charged Surface Hybrid [CSH] particle, the CSH Fluoro-Phenyl Column provides enhanced retention of acidic compounds compared to traditional PFP-bonded stationary phases.

Analysis of Beta-Lactam Antibiotics on CSH Fluoro-Phenyl



LC Conditions:

Column:	ACQUITY UPLC CSH Fluoro-Phenyl 2.1 x 100 mm, 1.7 µm
Mobile Phase A:	0.1% formic acid in water
Mobile Phase B:	methanol
Flow Rate:	0.2 mL/min
Gradient:	Time (min) Profile %A %B 0.0 80 20 3.0 30 70 7.0 30 70 7.1 80 20
Temperature:	30 °C
Instrument:	ACQUITY UPLC with Quattro Premier™ XE

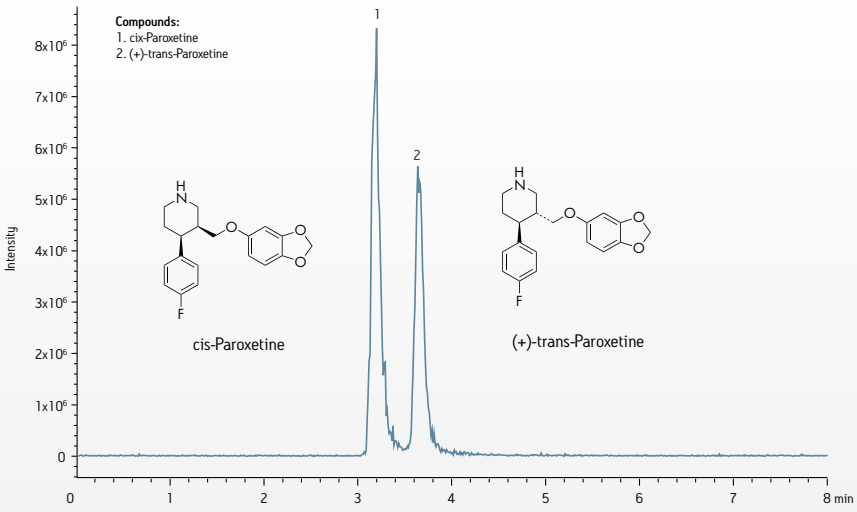
MS Conditions:

Ionization Mode:	ESI positive
Capillary Voltage:	3.2 kV
Desolv. Gas:	500 L/hr
Source Temp.:	110 °C
Acquisition:	MRM Transitions

Compounds:
1. Amoxicillin
2. Ampicillin
3. Penicillin G
4. Ceftiofur
5. Oxacillin
6. Dicloxacillin

Antibiotics are among the most frequently prescribed medications in modern medicine. Antibiotics are used to treat bacterial infections by inhibiting cell-wall synthesis of the bacterial organism. The ACQUITY UPLC CSH Fluoro-Phenyl successfully retains and separates several Beta-lactam antibiotics in a rapid analysis time. Data provided courtesy of Mr. Wei ZHOU, Technology Center of Gansu Entry-Exit Inspection and Quarantine Bureau, China.

Separation of Paroxetine Isomers on CSH Fluoro-Phenyl



LC Conditions:

Column:	ACQUITY UPLC CSH Fluoro-Phenyl 2.1 x 100 mm, 1.7 µm
Part Number:	186005352
Mobile Phase A:	water
Mobile Phase B:	methanol
Mobile Phase C:	2% acetic acid in water
Flow Rate:	0.6 mL/min
Gradient:	Time (min) Profile %A %B %C 0.0 85 10 5 5.0 75 20 5 6.0 75 20 5 6.1 85 10 5 12 85 10 5
Inj. Volume:	5 µL
Pre-Injector Vol:	200 µL
Column Temp.:	40 °C
Instrument:	ACQUITY UPLC H-Class with ACQUITY SQD Mass Detector

MS Conditions:

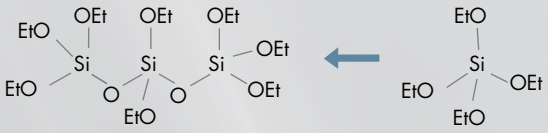
Ionization Mode:	ESI positive
Capillary Voltage:	3.0 kV
Cone Voltage:	30 V
Extractor:	3 V
Desolv. Temp.:	350 °C
Desolv. Gas:	800 L/hr
Source Temp.:	150 °C
Acquisition:	scan 100 – 600 m/z

Paroxetine is a selective serotonin reuptake inhibitors (SSRI) antidepressant that impacts chemicals in the brain that may become unbalanced. In addition to depression, paroxetine is used to treat obsessive-compulsive disorder, anxiety disorders, post-traumatic stress disorder (PTSD) as well as premenstrual dysphoric disorder (PMDD). With the unique selectivity of the ACQUITY UPLC CSH Fluoro-Phenyl Column, cis- and trans- isomers of paroxetine were successfully resolved.

High Strength Silica [HSS] Particle Technology

To complement Waters revolutionary Hybrid Particle Technology [HPT], a mechanically tolerant, silica-based material was designed to withstand UPLC pressures. High Strength Silica [HSS] particle technology was born from an innovative synthetic process that significantly increases the mechanical stability of silica while maintaining pore volumes similar to that of HPLC silica-based materials. The result is a novel particle technology that provides increased retentivity compared to hybrid particles while serving as the ideal substrate to create stationary phases that provide alternate selectivity.

HSS
HIGH STRENGTH SILICA



Polyethoxysilane (PEOS)

Tetraethoxysilane (TEOS)

ACQUITY UPLC	HSS T3 1.8 µm	HSS C_{18} 1.8 µm	HSS C_{18} SB 1.8 µm	HSS PFP 1.8 µm	HSS CN 1.8 µm
Ligand Type	Trifunctional C_{18}	Trifunctional C_{18}	Trifunctional C_{18}	Trifunctional Pentafluorophenyl	Monofunctional Cyano-Propyl
Ligand Density*	1.6 µmol/m^2	3.2 µmol/m^2	1.6 µmol/m^2	3.2 µmol/m^2	2.0 µmol/m^2
Carbon Load*	11%	15%	8%	7%	5%
Endcap Style	proprietary	proprietary	none	none	none
USP Classification	L1	L1	L1	L43	L10
pH Range	2-8	1-8	2-8	2-8	2-8
Low pH Temp. Limit	45 °C	45 °C	45 °C	45 °C	45 °C
High pH Temp. Limit	45 °C	45 °C	45 °C	45 °C	45 °C
Pore Diameter*	100 Å	100 Å	100 Å	100 Å	100 Å
Surface Area*	230 m^2/g	230 m^2/g	230 m^2/g	230 m^2/g	230 m^2/g
HPLC Column Equivalent	XSelect HSS T3	XSelect HSS C_{18}	XSelect HSS C_{18} SB	XSelect HSS PFP	XSelect HSS CN
HPLC Particle Sizes	2.5, 3.5, 5 µm	2.5, 3.5, 5 µm	2.5, 3.5, 5 µm	2.5, 3.5, 5 µm	2.5, 3.5, 5 µm

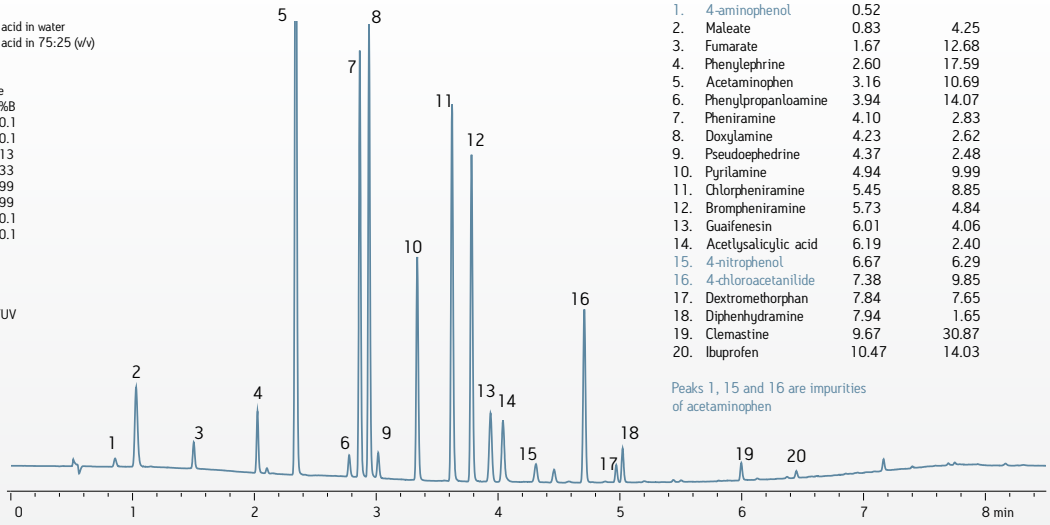
* Expected or approximate values.

The ACQUITY UPLC HSS T3 Column is ideally suited for the enhanced retention of polar compounds and metabolites by reversed-phase LC. This low-ligand density C_{18} column enables analytes to more readily access the pore structure of the material, providing balanced retention of polar and hydrophobic molecules without the need for ion-pair reagents.

Separation of Cold Medicine Active Ingredients, Impurities and Counter Ions

Column:	ACQUITY UPLC HSS T3 2.1 x 100 mm, 1.8 µm
Part Number:	186003539
Mobile Phase A:	0.15% trifluoroacetic acid in water
Mobile Phase B:	0.02% trifluoroacetic acid in 75:25 (v/v) acetonitrile:methanol
Flow Rate:	0.6 mL/min
Gradient:	Time (min) / %A / %B
	0.0 / 99.9 / 0.1
	0.5 / 99.9 / 0.1
	1.7 / 87 / 13
	3.6 / 67 / 33
	7.5 / 1.0 / 99
	8.0 / 1.0 / 99
	8.5 / 99.9 / 0.1
	9.5 / 99.9 / 0.1
Inj. Volume:	1.0 µL
Column Temp.:	30 °C
Detection:	UV @ 254 nm
Instrument:	ACQUITY UPLC with ACQUITY UPLC TUV

For full conditions, reference application note 720002005EN

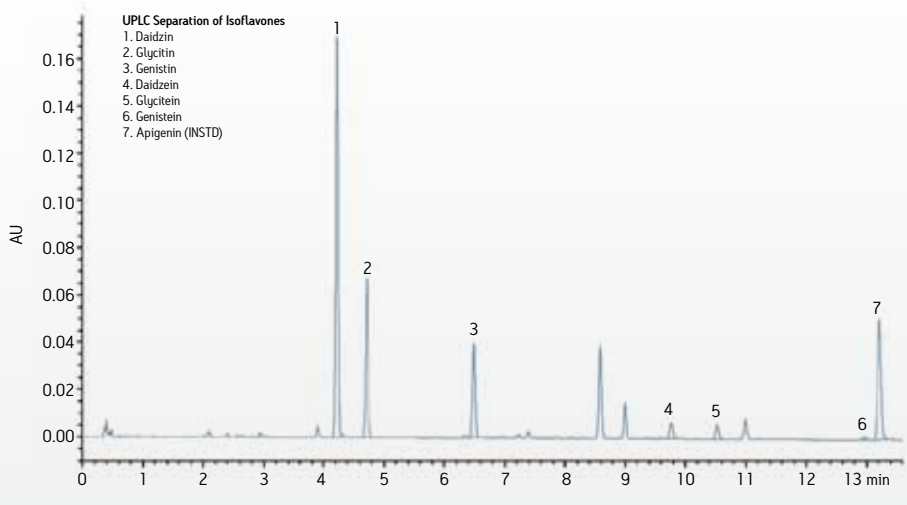


Elution Order		K Prime	USP Resolution
1.	4-aminophenol	0.52	
2.	Maleate	0.83	4.25
3.	Fumarate	1.67	12.68
4.	Phenylephrine	2.60	17.59
5.	Acetaminophen	3.16	10.69
6.	Phenylpropanloamine	3.94	14.07
7.	Pheniramine	4.10	2.83
8.	Doxylamine	4.23	2.62
9.	Pseudoephedrine	4.37	2.48
10.	Pyrilamine	4.94	9.99
11.	Chlorpheniramine	5.45	8.85
12.	Brompheniramine	5.73	4.84
13.	Guaifenesin	6.01	4.06
14.	Acetlysalicylic acid	6.19	2.40
15.	4-nitrophenol	6.67	6.29
16.	4-chloroacetanilide	7.38	9.85
17.	Dextromethorphan	7.84	7.65
18.	Diphenhydramine	7.94	1.65
19.	Clemastine	9.67	30.87
20.	Ibuprofen	10.47	14.03

Peaks 1, 15 and 16 are impurities of acetaminophen

Pharmaceutical formulations used to treat the common cold often contain multiple active ingredients to treat different symptoms. These actives can include combinations of decongestants, antihistamines, pain relievers, cough suppressants and expectorants in addition to numerous excipients, all of which exhibit different chemical properties, including polarity. It is this range of analyte polarity that often makes chromatographic methods development difficult. The ACQUITY UPLC HSS T3 Column enables a single chromatographic method to be utilized to analyze a number of different formulation compositions.

UPLC Analysis of Powdered Soy Isoflavones Extracts

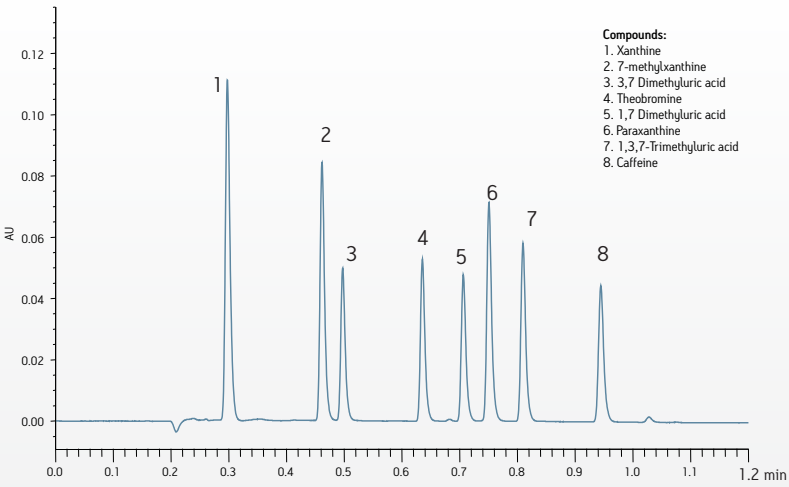


The biological effects of soy isoflavones have been proven to reduce menopausal effects in women, provide prostate health benefits in men. In addition, genistein, acting as an estrogen antagonist, has been suggested to provide anticarcinogenic properties. The ACQUITY UPLC HSS T3 Column was used to transfer the USP compendial HPLC method to UPLC, resulting in a 5X improvement in productivity while maintaining, or improving, the resolution between the components.

For full conditions, reference note 720003284EN.

The ACQUITY UPLC HSS C_{18} Column is a general-purpose silica-based C_{18} chemistry choice with applicability to a broad range of compound classes. Trifunctionally-bonded to the HSS particle substrate, the HSS C_{18} column provides exceptional peak shapes and low-pH stability while delivering increased retention in comparison to hybrid-based C_{18} columns.

Separation of Xanthine Alkaloids on HSS C_{18}

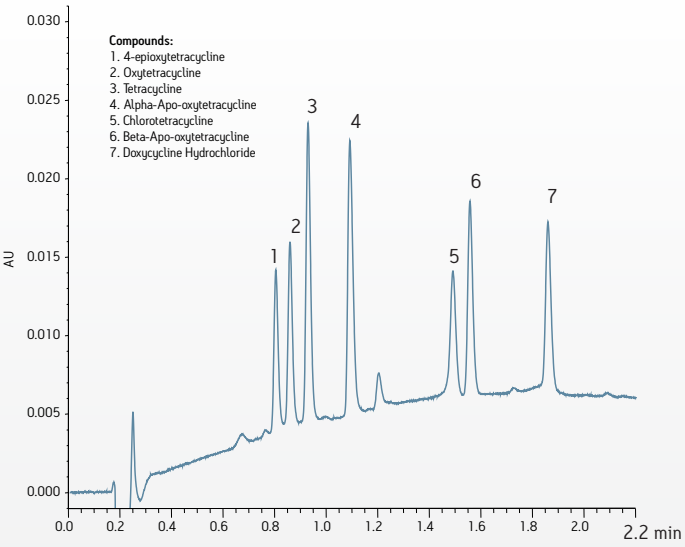


Compounds:
1. Xanthine
2. 7-methylxanthine
3. 3,7 Dimethyluric acid
4. Theobromine
5. 1,7 Dimethyluric acid
6. Paraxanthine
7. 1,3,7-Trimethyluric acid
8. Caffeine

Column:	ACQUITY UPLC HSS C_{18} 2.1 x 50 mm, 1.8 µm
Part Number:	186003532
Mobile Phase A:	20 mM ammonium formate, pH 3
Mobile Phase B:	acetonitrile
Flow Rate:	0.7 mL/min
Gradient:	Time (min) / %A / %B: 0.0 / 98 / 2; 1.2 / 77 / 23; 1.21 / 98 / 2; 1.50 / 98 / 2
Inj. Volume:	2.5 µL
Column Temp.:	40 °C
Detection:	UV @ 254 nm
Instrument:	ACQUITY UPLC with ACQUITY UPLC PDA

Xanthine alkaloids are commonly used as stimulants of the central nervous system to temporarily reduce fatigue and drowsiness. Additionally, this class of compounds has been used as bronchodilators for the treatment of asthma. The ACQUITY UPLC HSS C_{18} Column allows for the rapid analysis of several xanthine alkaloids that are part of the metabolic pathway of caffeine.

Separation of Tetracycline-Related Antibiotics on HSS C_{18}



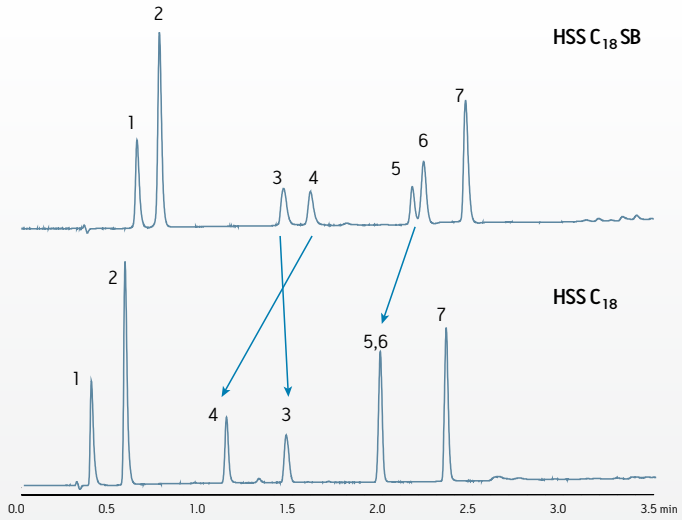
Compounds:
1. 4-epioxytetracycline
2. Oxytetracycline
3. Tetracycline
4. Alpha-Apo-oxytetracycline
5. Chlorotetracycline
6. Beta-Apo-oxytetracycline
7. Doxycycline Hydrochloride

Column:	ACQUITY UPLC HSS C_{18} 2.1 x 50 mm, 1.8 µm
Part Number:	186003532
Mobile Phase A:	10 mM oxalic acid in water, pH 2.5
Mobile Phase B:	10 mM oxalic acid in 40:60 (v/v) acetonitrile:methanol
Flow Rate:	0.65 mL/min
Gradient:	Time (min) / %A / %B: 0.0 / 85 / 15; 2.5 / 50 / 50; 2.51 / 85 / 15; 3.00 / 85 / 15
Inj. Volume:	5.0 µL
Sample Conc.:	1 µg/mL
Column Temp.:	40 °C
Detection:	UV @ 268 nm
Instrument:	ACQUITY UPLC with ACQUITY UPLC PDA

Tetracycline antibiotics are commonly prescribed for the treatment of bacterial infections. The ACQUITY UPLC HSS C_{18} Column enables a single UV-based method for the simultaneous separation of oxytetracycline, its degradation products and related substances (which may be formed during fermentation) as well as additional veterinary antibiotics.

The ACQUITY UPLC HSS C_{18} SB Column is a non-endcapped, low-coverage silica-based C_{18} chemistry that provides alternate selectivity for compounds impacted by silanophilic interactions. The increased silanol activity of the HSS C_{18} SB columns results in greater retention of basic compounds (due to secondary interactions with residual silanols), while simultaneously reducing the retention of non-basic analytes (due to the low ligand density and ionic repulsion). This unique combination of retention characteristics yields a useful method development tool to impart differences in Selectivity for Bases (SB) while maintaining exceptional peak shape.

Alternate Selectivity for Basic Compounds

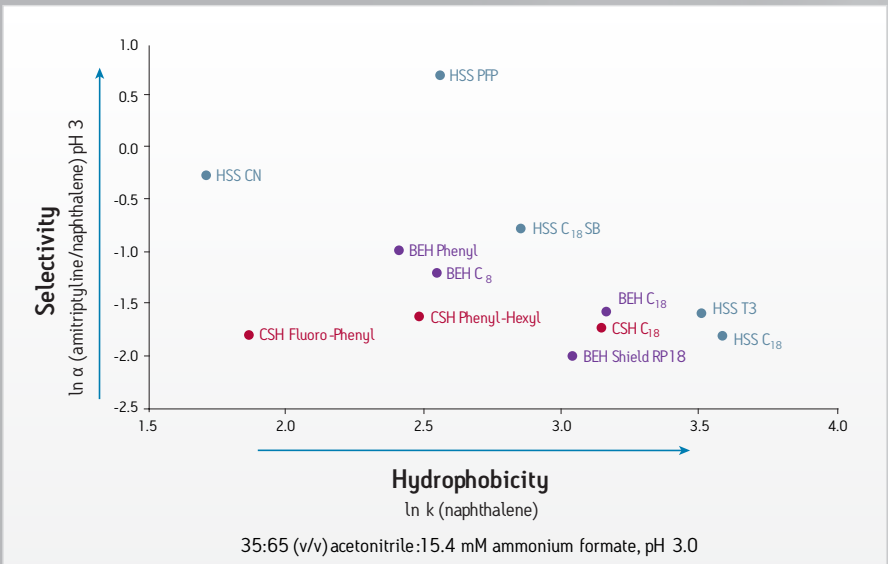


Compounds:
1. Aminopyrazine
2. Pindolol
3. Labetalol
4. Quinine
5. Verapamil
6. Diltiazem
7. Amitriptyline

Column:	ACQUITY UPLC HSS C_{18} SB and ACQUITY UPLC HSS C_{18} 2.1 x 50 mm, 1.8 µm
Part Numbers:	186004118 and 186003532, respectively
Mobile Phase A:	10 mM ammonium formate, pH 3
Mobile Phase B:	methanol
Flow Rate:	0.4 mL/min
Gradient:	Time (min) / %A / %B: 0.0 / 70 / 30; 3.0 / 15 / 85; 3.5 / 15 / 85; 3.51 / 70 / 30; 4.5 / 70 / 30
Inj. Volume:	1.0 µL
Column Temp.:	30 °C
Detection:	UV @ 260 nm
Instrument:	ACQUITY UPLC with ACQUITY UPLC PDA

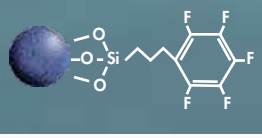
When analyzing compounds with basic pKa's in their ionized form (low-pH conditions), a majority of reversed-phase columns suffer from poor retentivity and/or poor peak shape. The innovative synthetic processes behind the ACQUITY UPLC HSS C_{18} SB Column has enabled the creation of a novel stationary phase that provides increased retention and alternate selectivity while maintaining exceptional peak shape.

COLUMN CHOICES FOR ALTERNATE SELECTIVITY



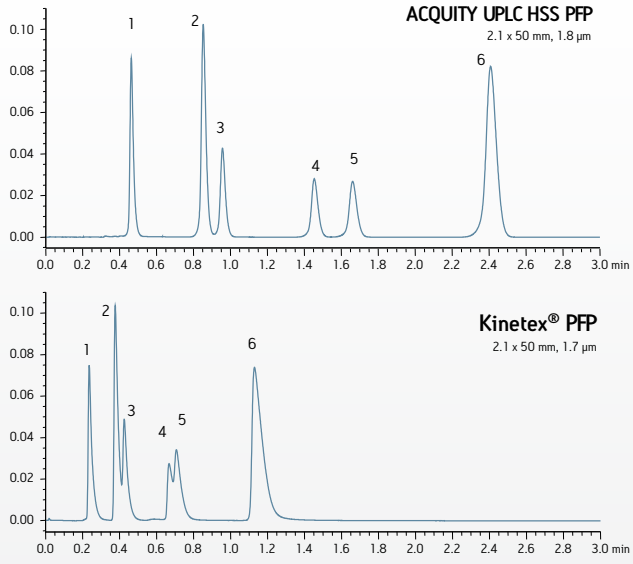
35:65 (v/v) acetonitrile:15.4 mM ammonium formate, pH 3.0

When selecting a column for a specific separation, it is important to match the properties of your analytes with the separation capabilities of a specific column. When screening multiple columns, it is important to select columns that provide differences in selectivity and hydrophobicity to maximize the potential separation capability. To the left is a reversed-phase column selectivity chart that compares these differences under low-pH conditions. The further apart the columns are on the y-axis, the more different in selectivity they are. Additionally, the columns are plotted in increasing hydrophobicity (retention) from left-to-right on the x-axis.



The ACQUITY UPLC HSS PFP Column is a trifunctionally-bonded, non-endcapped pentafluorophenyl (PFP) chemistry that provides industry-leading reproducibility and peak shape compared to other commercially-available PFP stationary phases. Due to the combination of multiple retention mechanisms that include aromatic (pi-pi), hydrogen-bonding, dipole-dipole and hydrophobic interactions, the ACQUITY UPLC HSS PFP Column is ideally-suited for planar aromatic compounds, positional isomers, halogenated compounds as well as polar analytes.

Comparison of HSS PFP and Kinetex PFP Columns for the Separation of Beta-Blockers



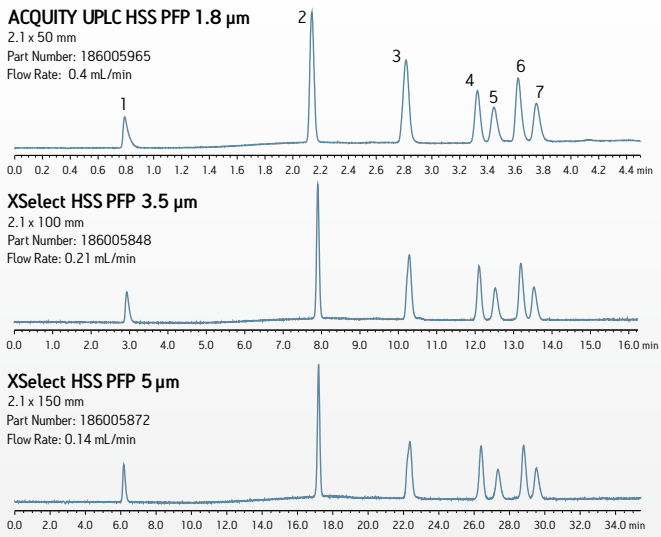
Column:	ACQUITY UPLC HSS PFP 1.8 µm (part number 186005965) and Kinetex PFP 1.7 µm, 2.1 x 50 mm
Mobile Phase A:	10 mM potassium phosphate, pH 2.5
Mobile Phase B:	acetonitrile
Flow Rate:	0.58 mL/min
Isocratic:	70% mobile phase A
Inj. Volume:	1.0 µL
Column Temp.:	25 °C
Detection:	UV @ 225 nm
Instrument:	ACQUITY UPLC with ACQUITY UPLC PDA

Compounds:
1. Atenolol
2. Pindolol
3. Metoprolol
4. Oxprenolol
5. Labetalol
6. Propranolol

Comparative separations may not be representative of all applications.

Beta blockers are drug products that block specific neurotransmitters (norepinephrine and epinephrine) from binding to beta receptors on nerves. By blocking the effect of norepinephrine and epinephrine, beta blockers may result in reduced heart rate and blood pressure as well as constrict air passages by stimulating the muscles that surround the air passages. The ACQUITY UPLC HSS PFP Column provides exceptional peak shape and retention for the separation of beta-blockers compared to the Kinetex PFP core-shell column.

Industry-Leading Reproducibility and Scalability for PFP Stationary Phases



Conditions:

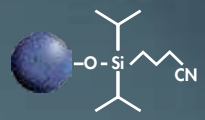
Mobile Phase A:	10 mM ammonium formate, pH 3
Mobile Phase B:	methanol
Column Temp.:	30 °C
Detection:	UV @ 260 nm
Instrument:	ACQUITY UPLC with ACQUITY UPLC PDA

Gradient conditions are scaled to maintain constant column volumes.

Column lengths are scaled to keep the ratio of column length-to-particle size constant.

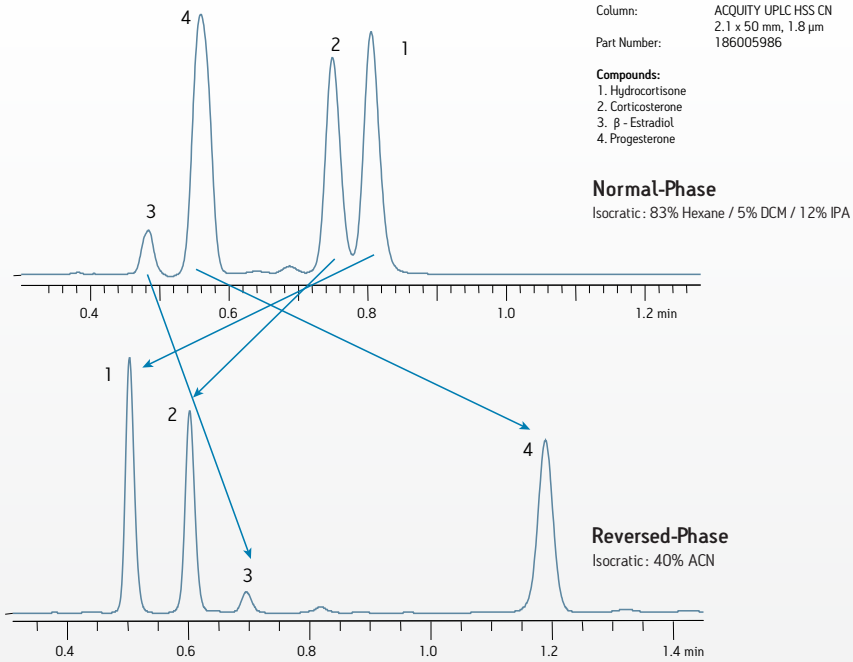
Compounds:
1. Aminopyrazine
2. Pindolol
3. Labetalol
4. Diltiazem
5. Quinine
6. Amitriptyline
7. Verapamil

Due to Waters Quality Systems approach towards manufacturing, the ACQUITY UPLC HSS PFP Column not only delivers exceptional batch-to-batch reproducibility, but also sustained selectivity across UPLC and HPLC particle sizes. As demonstrated in the adjacent figure, the same selectivity can be achieved independent of your LC separation platform on the 1.8 µm ACQUITY UPLC HSS PFP Columns as well as the 3.5 and 5 µm XSelect HSS PFP Columns.



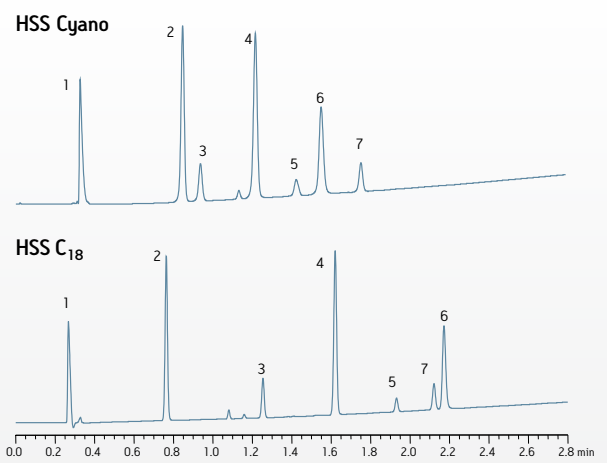
The ACQUITY UPLC HSS Cyano Columns provide low hydrophobicity and unique selectivity compared to straight-chain-alkyl columns. Due to the innovative monofunctional cyano bonding with protective alkyl-side chains, the ACQUITY UPLC HSS Cyano Column affords ultra-stable retention, exceptional peak shape and reproducibility under low- to mid-pH conditions. Additionally, the HSS Cyano column is compatible with both reversed-phase and normal-phase techniques.

The Reversed-Phase and Normal-Phase Separation of Steroids on HSS Cyano Columns



Steroids are prescribed for a number of indications that include: hormone replacement, growth and bone marrow stimulation as well as contraception. The novel bonding chemistry of the ACQUITY UPLC HSS Cyano Column enables stable and reproducible retention times under both reversed-phase and normal-phase conditions.

Complementary Selectivity to C_{18} for the Separation of Analgesics



Column: ACQUITY UPLC HSS Cyano and ACQUITY UPLC HSS C_{18} 2.1 x 50 mm, 1.8 µm
Part Numbers: 186005986 and 186003532, respectively
Mobile Phase A: 0.1% formic acid in water
Mobile Phase B: 0.1% formic acid in acetonitrile
Flow Rate: 0.467 mL/min
Gradient:

Time (min)	%A	%B
0.0	93	7
2.65	55	45
2.66	10	90
2.91	93	7
4.24	93	7

Inj. Volume: 0.5 µL
Column Temp.: 35 °C
Detection: UV @ 240 nm
Instrument: ACQUITY UPLC with ACQUITY UPLC PDA

Compounds:
1. Caffeine
2. Acetominophen
3. 2-Acetomidophenol
4. Acetanilide
5. Acetylsalicylic acid
6. Salicylic acid
7. Phenacetin

Analgesics are a classification of drugs that impact the central and peripheral nervous systems to ease pain. The novel ACQUITY UPLC HSS Cyano Column provides alternate selectivity to straight-chain-alkyl columns while maintaining exceptional peak shape for this group of analgesic compounds.

Innovative Column Technology

Although directly influenced by the dispersion [bandspread] of the LC instrumentation, the heart of the chromatographic separation lies within the column. In addition to a wide variety of available column selectivities to accommodate different sample types, a significant degree of manufacturing innovation is necessary to yield the performance expected from UPLC Column Technology: impactful resolution and sensitivity, improved productivity, unmatched reproducibility as well as exceptional mechanical and chemical stability.

In efforts to achieve these performance attributes, ground-breaking manufacturing procedures for particle synthesis, mechanical engineering, software development and column manufacturing were devised.

ENGINEERING

- Ultra-low dispersion hardware
- Innovative frit technology

BULK SYNTHESIS

- Mechanically tolerant particles
- Advanced particle sizing technology
- Sustained batch-to-batch selectivity
- Sustained selectivity across UPLC and HPLC particle sizes
- High efficiency, high mass transfer sub-2-µm BEH, HSS and CSH particles

COLUMN MANUFACTURING

- Mechanically stable beds at pressures up to 18,000 psi [1241 bar]
- Advanced column packing methodologies and equipment
- Ultra-low dispersion column test stations

TRACEABILITY

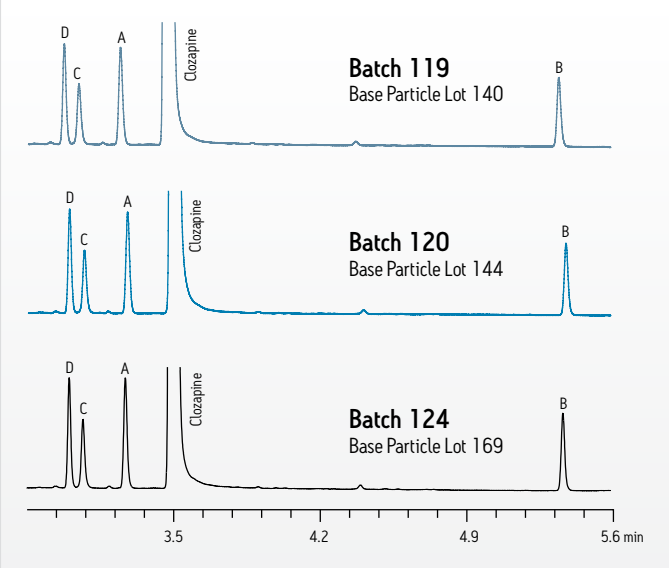
- Electronic column usage management via eCord™ Intelligent Chip Technology
- Tracks history of column's performance and usage over lifetime of the column
- Tethered to the column to ensure permanent accessibility to column history

Minimize Risk with Dependable Column Performance

The reproducibility of the chromatographic column has a critical impact on the long-term reliability and robustness of an analytical method, yet its reproducibility lies completely out of the user's control. With exceptional batch-to-batch and column-to-column reproducibility, Waters well-established particle and column manufacturing process control provides confidence in the long-term reliability of an analytical method.

ACQUITY UPLC Method Validation kits provide three batches of chromatographic media (derived from different base particles) to assess the quality, reliability and consistency of your analytical method.

Selectivity (α)				
Batch	Impurity C	Impurity A	Clozapine	Impurity B
119	1.03	1.07	1.07	1.59
120	1.03	1.07	1.07	1.58
124	1.02	1.07	1.07	1.58

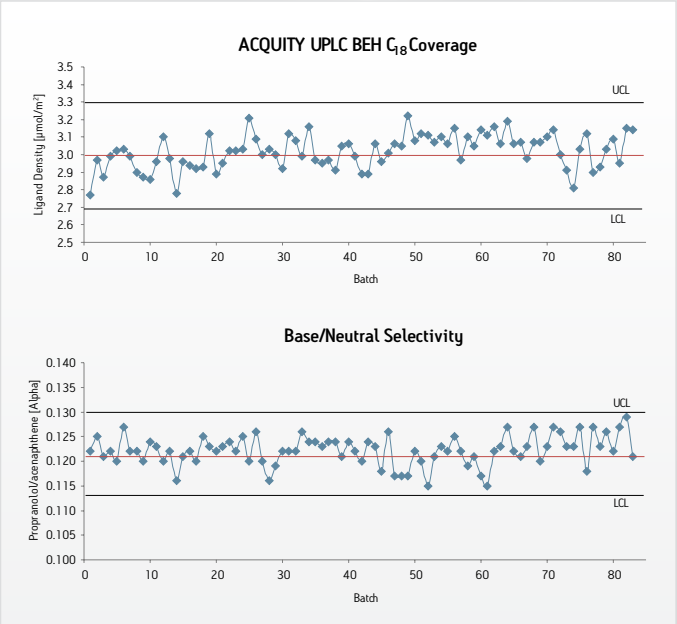


Three different batches of bonded material derived from three different base particles demonstrate the solid reproducibility that can be expected from ACQUITY UPLC Columns, assuring the long-term reproducibility of your analytical method.

Performance-Driven Reliability

Separation scientists can be assured that results achieved today will be repeatable and reproducible year after year.

With fully integrated manufacturing and stringent process control, Waters is uniquely positioned as an industry partner to minimize the risk of method variation due to differences caused by chromatographic media batch or column inconsistency.



Process control charts for 85 batches of ACQUITY UPLC BEH C_{18} demonstrating manufacturing control and long-term repeatability between material batches over the course of seven years.

Transfer Between LC Technology Platforms with Ease

An increasing number of organizations have realized the benefits of improved productivity, higher data quality and lower cost per sample as well as faster time-to-market, inherent of assays that utilize UPLC Technology. The ACQUITY UPLC H-Class System is a result of this paradigm shift, enabling the efficacy of a method to be preserved as it is transferred between LC platforms.

In addition to the proper geometric scaling of all method parameters, the successful transfer of an analytical method requires the preservation of chromatographic column selectivity and resolving power, regardless of particle size.

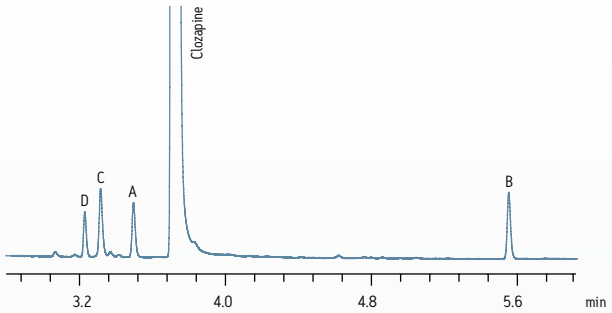
Waters industry-leading manufacturing processes not only ensure unprecedented batch-to-batch reproducibility, but also sustained selectivity between HPLC and UPLC particle sizes. Method Transfer kits leverage this unique capability, enabling the successful transfer of methods from one LC platform to another.

Method Transfer Kit

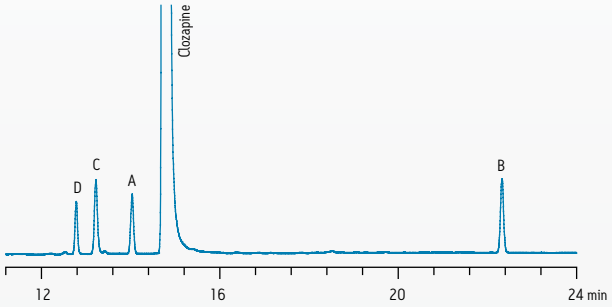
Each kit contains one UPLC column and one HPLC column.

The ACQUITY UPLC Columns Calculator can be downloaded from the ACQUITY UPLC Online Community at **www.waters.com/myuplc**

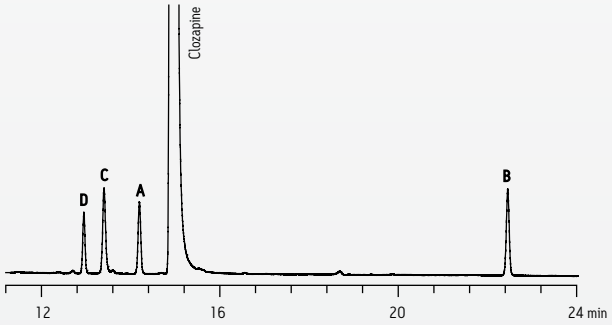
UPLC Separation on ACQUITY UPLC H-Class System



HPLC Separation on Alliance® HPLC System



HPLC Separation on ACQUITY UPLC H-Class System

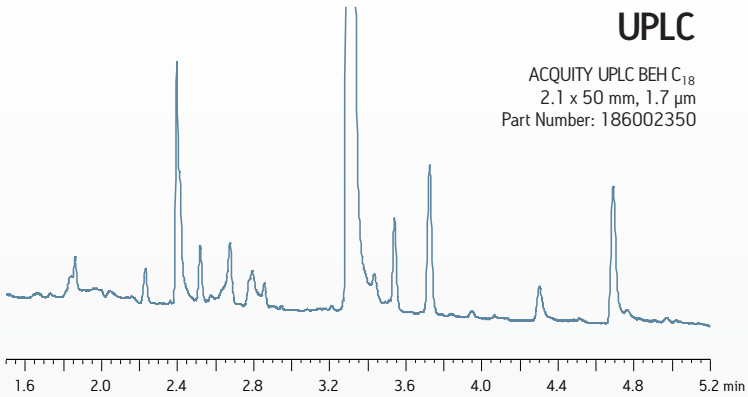


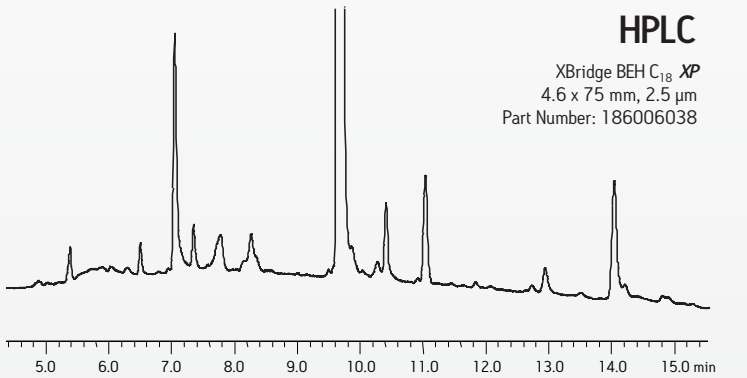
A separation of clozapine and its related compounds is used to demonstrate the exceptional scalability between different size chromatographic particles and instrument platforms to facilitate a successful method transfer.

Retention Time Relative to Clozapine					
Separation Mode	**Instrument**	**Impurity D**	**Impurity C**	**Impurity A**	**Impurity B**
UPLC	ACQUITY UPLC H-Class System	0.867	0.890	0.939	1.500
HPLC	Alliance® 2695 System	0.865	0.895	0.950	1.513
HPLC	ACQUITY UPLC H-Class System	0.867	0.898	0.951	1.507

Electronic Tools to Facilitate Method Transfer

Based on the concept of maintaining column length [L] to particle size [dp] ratio [L/dp], the ACQUITY UPLC Columns Calculator enables methods to be transferred from HPLC to UPLC or from UPLC to HPLC while preserving the integrity of the separation. In addition, this intuitive software program compensates for differences in gradient dwell volume, thus replicating the gradient profile independent of the LC system type being used.





USP Resolution Mixture of Mirtazapine

The ACQUITY UPLC Columns Calculator can be downloaded from the ACQUITY UPLC Online Community at **www.waters.com/myuplc**

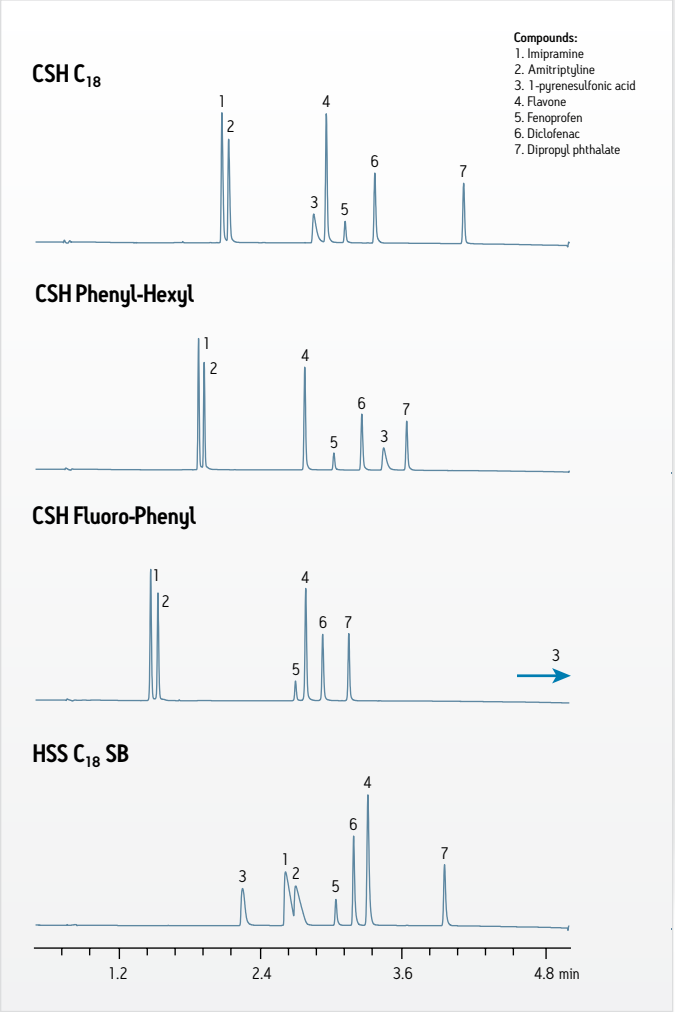
Efficient Reversed-Phase Method Development Strategy

Reversed-phase HPLC method development can take anywhere from weeks to months, incurring large operational cost. By utilizing the ACQUITY UPLC H-Class System for method development, a substantial improvement in throughput can be realized. This, in turn, reduces cost per sample and time of analysis considerably while maintaining or improving separation integrity. By developing rapid, high resolution analytical methods, products can be brought to market faster, therefore, improving the overall profitability of the assay.

There are a number of approaches to method development; the most common is a systematic screening of chemical factors (combinations of column chemistry, mobile-phase pH and organic modifier) or a column selection approach (with devoted mobile-phase components). Waters Method Development kits offer combinations of different column chemistries to accommodate your method development approach, enabling methods to be developed efficiently and effectively.

Maximum Selectivity UPLC Method Development Kit

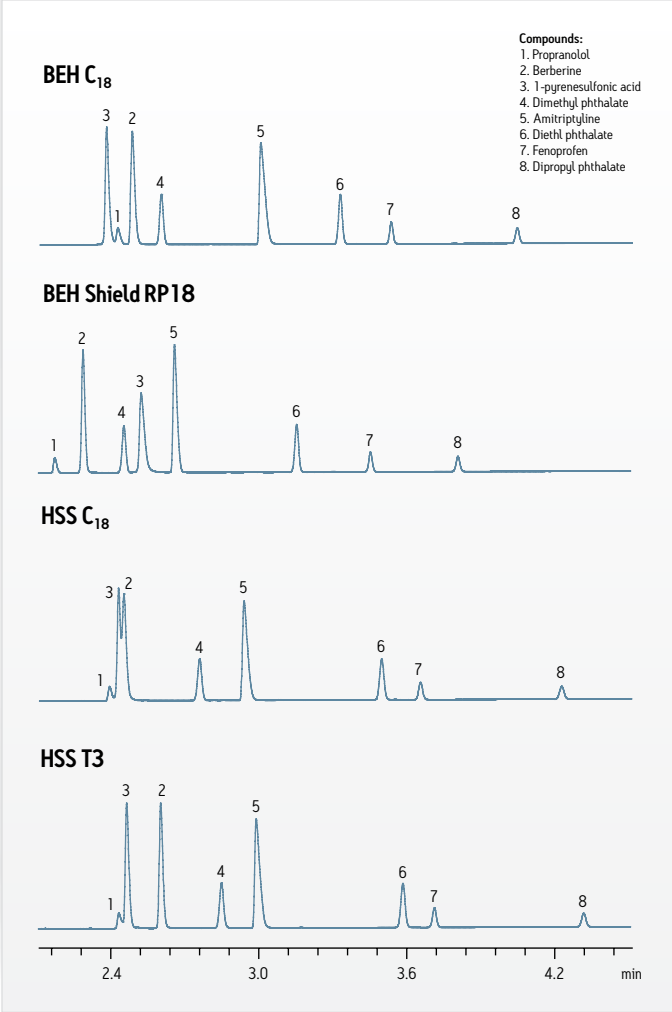
pH 2.7/ACN gradient



CSH Technology columns provide the widest range in column selectivity in the industry. Robust methods can be developed across an unparalleled range of temperature, mobile-phase pH and pressures to improve organizational efficiency and bring products to market faster.

L1 UPLC Columns Kit

pH 3/ACN gradient



With a wide range of UPLC Column selectivities available, screening multiple columns with a single mobile-phase condition can quickly lead to a successful result.

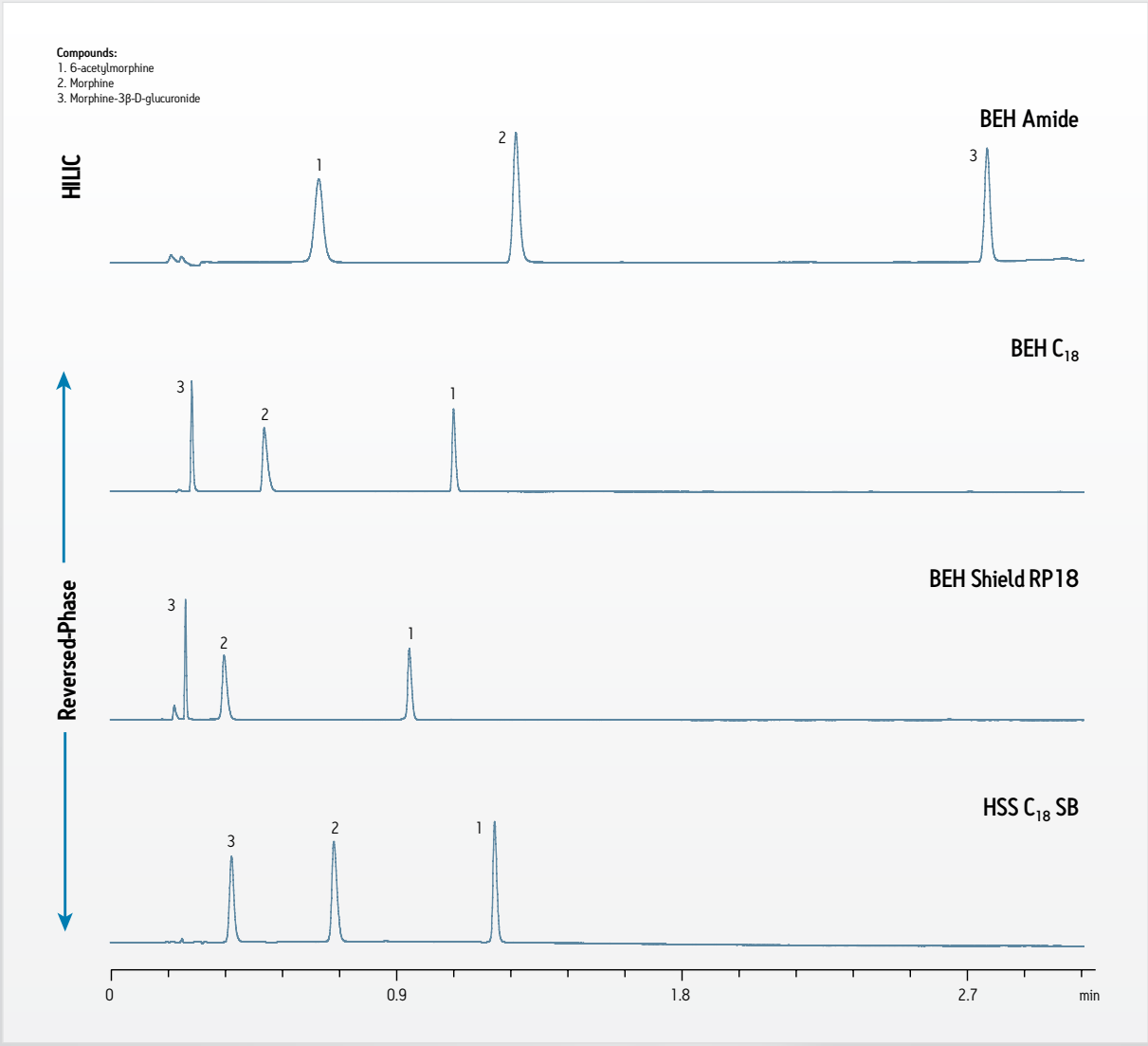
A Novel Reversed-Phase and HILIC Method Development Strategy

The retention and quantitation of polar analytes and metabolites continues to be an exceptional chromatographic challenge for analytical scientists. Reversed-phase is the most universally accepted and implemented technique, however, it is not particularly well-suited for analytes that are hydrophilic (polar).

Hydrophilic-Interaction Chromatography (HILIC) is a complementary chromatographic technique that can be used to successfully improve the retention of very polar species. However, due to the intricate combination of multiple retention mechanisms, HILIC is also a useful technique for the retention and improved MS response of ionizable species, regardless of their polarity.

The flexibility of the injector technology and quaternary solvent blending utilized by the ACQUITY UPLC H-Class System enables the sequential development of methods using a novel reversed-phase and HILIC approach. This innovative approach provides a comprehensive combination of selectivity choices to effortlessly retain and resolve compounds encompassing a broad range of polarity.

UPLC RP and HILIC Method Development Kit



Method development for morphine-related compounds using a novel reversed-phase and HILIC approach.

UPLC Column Protection – VanGuard Pre-Columns

Contamination resulting from the analysis of samples present within complex matrices, or that are particulate-laden, may result in reduced column lifetime if not properly addressed. VanGuard™ Pre-Columns are ideally suited for the physical and chemical protection of ACQUITY UPLC Columns.

Directly compatible with UPLC pressures up to 18,000 psi [1241 bar], this ultra-low dispersion direct connect guard column is specifically engineered to preserve the lifetime of an ACQUITY UPLC Column without negatively impacting its separation performance.

Key Features and Benefits of VanGuard Pre-Columns

FEATURE	BENEFIT
First pre-column for UPLC applications	Guaranteed compatibility with pressures up to 18,000 psi
Patent pending, ultra-low volume design	Minimal chromatography effects
Manufactured using UPLC Column hardware, particles and chemistries	Superior UPLC Column protection and performance
Connects directly to UPLC Column	Leaks and connection voids are eliminated

Minimal Chromatographic Effects with VanGuard Pre-Columns

LC Conditions:

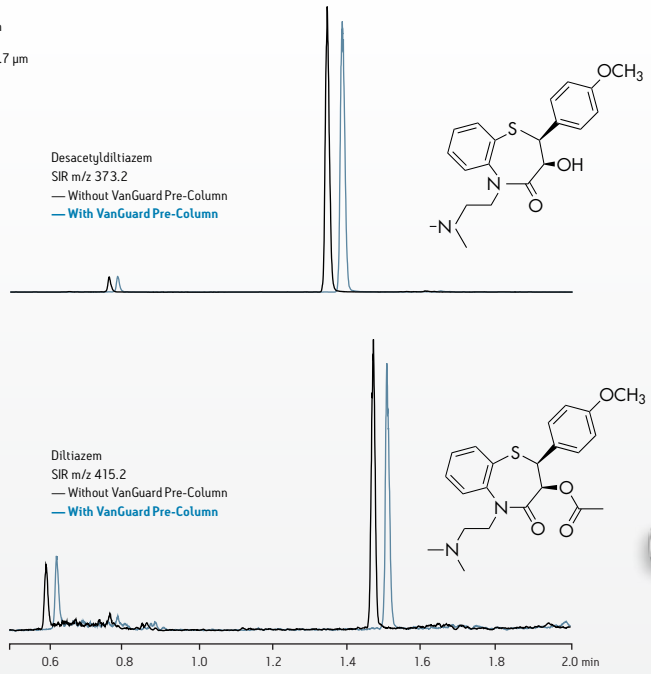
Column:	ACQUITY UPLC BEH C_{18}, 2.1 x 50 mm, 1.7 µm
Part Number:	186002350
Pre-Column:	VanGuard Pre-Column, BEH C_{18}, 2.1 x 5 mm, 1.7 µm
Part Number:	186003975
Mobile Phase A:	0.2% ammonium hydroxide in water
Mobile Phase B:	0.2% ammonium hydroxide in acetonitrile
Flow Rate:	0.8 mL/min
Gradient:	Time (min) / Profile %A %B

Time (min)	%A	%B
0.0	95	5
2.0	5	95
2.5	5	95
2.6	95	5
3.0	95	5

Injection Volume:	2 µL
Column Temp.:	40 °C
Detection:	UV @ 254 nm
Sampling Rate:	40 pts/sec
Time Constant:	0.05
Instrument:	ACQUITY UPLC with ACQUITY UPLC TUV Detector and ACQUITY SQ Detector

ACQUITY SQ Detector

ES+	
Capillary:	3.5 kV
Cone:	35 V
Source Temp:	150 °C
Desolvation Temp:	500 °C
Cone Gas Flow:	50 L/Hr
Desolvation Gas Flow:	850 L/Hr
SIR:	373.2 m/z, 415.2 m/z
MS Interscan Delay:	0.005 sec
Dwell:	0.005 sec



Protein Precipitation Procedure

- Spike plasma with 500 ng/mL of diltiazem and desacetyldiltiazem
- Take 200 µL of spiked plasma and add to 1.5 mL centrifuge tube
- Add 600 µL of acetonitrile to the centrifuge tube containing the spiked plasma
- Centrifuge for 10 minutes at 13000 RPM
- Take 650 µL of supernatant and evaporate to dryness with nitrogen
- Reconstitute with 400 µL of a 50:50 MeOH:H_2O solution (results in a 203.1 ng/mL conc.)

VanGuard Pre-Columns are uniquely designed to protect and prolong ACQUITY UPLC Column performance while contributing minimal chromatographic effects.

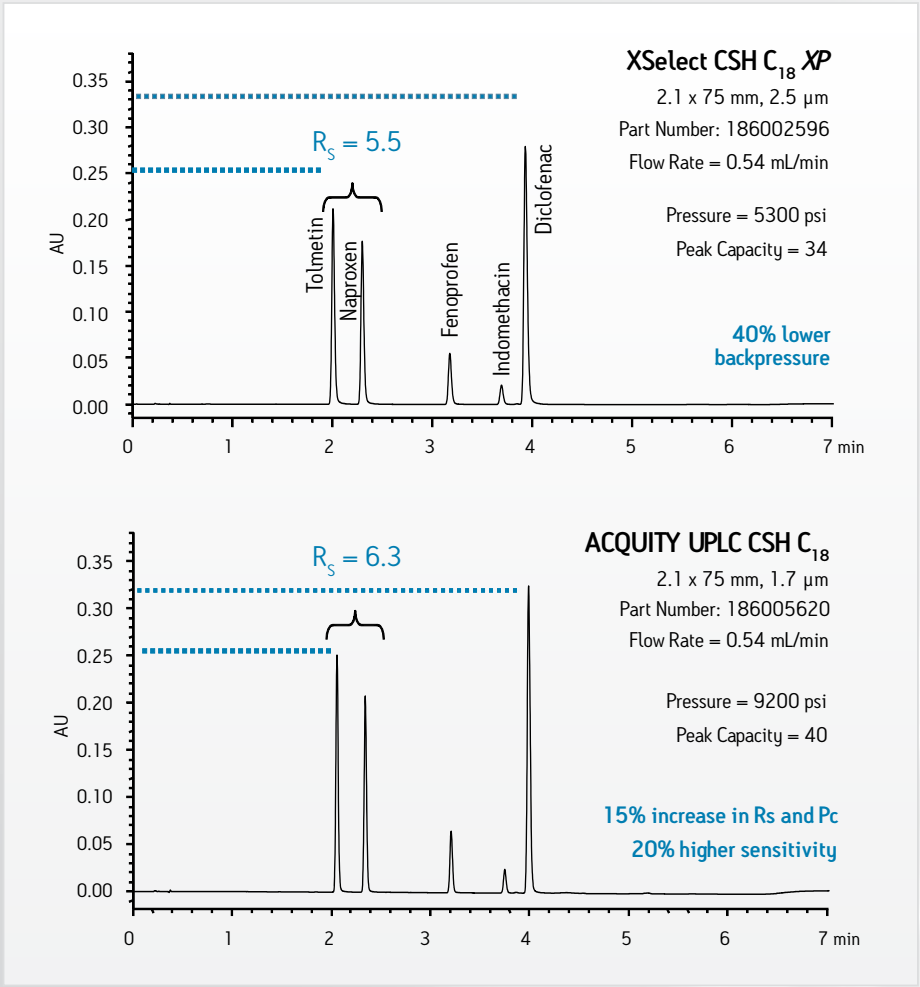
Extended Performance [*XP*] 2.5 µm Columns

NEW XBridge and XSelect e*X*tended *P*erformance [*XP*] 2.5 µm Columns enable exceptional separation performance, robustness and throughput for HPLC assays while being fully compatible with all HPLC, UHPLC and UPLC Technology platforms.

XP 2.5 µm Columns provide an alternative to 1.7 µm UPLC Columns for use on an ultra-low dispersion ACQUITY UPLC Instrument. With 40% lower backpressure than 1.7 µm columns, ***XP*** 2.5 µm Columns can be utilized for fit-for-purpose analyses at intermediate backpressures. Alternatively, since ***XP*** 2.5 µm Columns are compatible with pressures up to 15,000 psi (1034 bar), flow rate can be increased to further expedite sample throughput for simple chromatography on your UPLC System.

In addition, ***XP*** 2.5 µm Columns are available in 14 different selectivities that are directly scalable to 1.7/1.8 µm UPLC Columns as well as larger 3.5/5 µm XBridge and XSelect HPLC Columns, thus providing flexibility to seamlessly transfer methods between HPLC and UPLC platforms.

40% Lower Backpressure on Your UPLC



Separations were performed on an ACQUITY UPLC H-Class System.

For more information and a complete listing of part numbers, visit **www.waters.com/xp**

Ordering Information

ACQUITY UPLC BEH Columns

Chemistry	Particle Size	Dimension	Part No. 1 Pack	Part No. 3 Pack
BEH C_{18}	1.7 µm	1.0 x 50 mm	186002344	176000861
BEH C_{18}	1.7 µm	1.0 x 100 mm	186002346	176000862
BEH C_{18}	1.7 µm	1.0 x 150 mm	186002347	176001044
BEH C_{18}	1.7 µm	2.1 x 30 mm	186002349	176001304
BEH C_{18}	1.7 µm	2.1 x 50 mm	186002350	176000863
BEH C_{18}	1.7 µm	2.1 x 75 mm	186005604	-
BEH C_{18}	1.7 µm	2.1 x 100 mm	186002352	176000864
BEH C_{18}	1.7 µm	2.1 x 150 mm	186002353	176001048
BEH C_{18}	1.7 µm	3.0 x 30 mm	186004659	176001794
BEH C_{18}	1.7 µm	3.0 x 50 mm	186004660	176001795
BEH C_{18}	1.7 µm	3.0 x 75 mm	186005609	-
BEH C_{18}	1.7 µm	3.0 x 100 mm	186004661	176001796
BEH C_{18}	1.7 µm	3.0 x 150 mm	186004690	176001797
BEH Shield RP18	1.7 µm	1.0 x 50 mm	186002851	176000874
BEH Shield RP18	1.7 µm	1.0 x 100 mm	186002852	176000875
BEH Shield RP18	1.7 µm	1.0 x 150 mm	186003373	176001045
BEH Shield RP18	1.7 µm	2.1 x 30 mm	186003909	176001309
BEH Shield RP18	1.7 µm	2.1 x 50 mm	186002853	176000876
BEH Shield RP18	1.7 µm	2.1 x 75 mm	186005605	-
BEH Shield RP18	1.7 µm	2.1 x 100 mm	186002854	176000877
BEH Shield RP18	1.7 µm	2.1 x 150 mm	186003376	176001049
BEH Shield RP18	1.7 µm	3.0 x 30 mm	186004667	176001802
BEH Shield RP18	1.7 µm	3.0 x 50 mm	186004668	176001803
BEH Shield RP18	1.7 µm	3.0 x 75 mm	186005610	-
BEH Shield RP18	1.7 µm	3.0 x 100 mm	186004669	176001804
BEH Shield RP18	1.7 µm	3.0 x 150 mm	186004670	176001805
BEH C_{8}	1.7 µm	1.0 x 50 mm	186002875	176000882
BEH C_{8}	1.7 µm	1.0 x 100 mm	186002876	176000883
BEH C_{8}	1.7 µm	1.0 x 150 mm	186003374	176001046
BEH C_{8}	1.7 µm	2.1 x 30 mm	186003910	176001310
BEH C_{8}	1.7 µm	2.1 x 50 mm	186002877	176000884
BEH C_{8}	1.7 µm	2.1 x 75 mm	186005606	-
BEH C_{8}	1.7 µm	2.1 x 100 mm	186002878	176000885
BEH C_{8}	1.7 µm	2.1 x 150 mm	186003377	176001050
BEH C_{8}	1.7 µm	3.0 x 30 mm	186004663	176001798
BEH C_{8}	1.7 µm	3.0 x 50 mm	186004664	176001799
BEH C_{8}	1.7 µm	3.0 x 75 mm	186005661	-
BEH C_{8}	1.7 µm	3.0 x 100 mm	186004665	176001800
BEH C_{8}	1.7 µm	3.0 x 150 mm	186004666	176001801
BEH Phenyl	1.7 µm	1.0 x 50 mm	186002882	176000905
BEH Phenyl	1.7 µm	1.0 x 100 mm	186002883	176000906
BEH Phenyl	1.7 µm	1.0 x 150 mm	186003375	176001047
BEH Phenyl	1.7 µm	2.1 x 30 mm	186003911	176001311
BEH Phenyl	1.7 µm	2.1 x 50 mm	186002884	176000907
BEH Phenyl	1.7 µm	2.1 x 75 mm	186005607	-
BEH Phenyl	1.7 µm	2.1 x 100 mm	186002885	176000908
BEH Phenyl	1.7 µm	2.1 x 150 mm	186003378	176001051
BEH Phenyl	1.7 µm	3.0 x 30 mm	186004671	176001806
BEH Phenyl	1.7 µm	3.0 x 50 mm	186004672	176001807
BEH Phenyl	1.7 µm	3.0 x 75 mm	186005612	-
BEH Phenyl	1.7 µm	3.0 x 100 mm	186004673	176001808
BEH Phenyl	1.7 µm	3.0 x 150 mm	186004674	176001809
BEH HILIC	1.7 µm	1.0 x 50 mm	186003457	176001089
BEH HILIC	1.7 µm	1.0 x 100 mm	186003458	176001090
BEH HILIC	1.7 µm	1.0 x 150 mm	186003459	176001091
BEH HILIC	1.7 µm	2.1 x 50 mm	186003460	176001092
BEH HILIC	1.7 µm	2.1 x 75 mm	186005608	-
BEH HILIC	1.7 µm	2.1 x 100 mm	186003461	176001093
BEH HILIC	1.7 µm	2.1 x 150 mm	186003462	176001094
BEH HILIC	1.7 µm	3.0 x 50 mm	186004675	176001810
BEH HILIC	1.7 µm	3.0 x 75 mm	186005613	-
BEH HILIC	1.7 µm	3.0 x 100 mm	186004676	176001811
BEH HILIC	1.7 µm	3.0 x 150 mm	186004677	176001812

ACQUITY UPLC BEH Columns

Chemistry	Particle Size	Dimension	Part No. 1 Pack	Part No. 3 Pack
BEH Amide	1.7 µm	1.0 x 50 mm	186004848	176001914
BEH Amide	1.7 µm	1.0 x 100 mm	186004849	176001915
BEH Amide	1.7 µm	1.0 x 150 mm	186004850	176001916
BEH Amide	1.7 µm	2.1 x 30 mm	186004839	176001906
BEH Amide	1.7 µm	2.1 x 50 mm	186004800	176001907
BEH Amide	1.7 µm	2.1 x 75 mm	186005657	-
BEH Amide	1.7 µm	2.1 x 100 mm	186004801	176001908
BEH Amide	1.7 µm	2.1 x 150 mm	186004802	176001909
BEH Amide	1.7 µm	3.0 x 30 mm	186004803	176001910
BEH Amide	1.7 µm	3.0 x 50 mm	186004804	176001911
BEH Amide	1.7 µm	3.0 x 75 mm	186005658	-
BEH Amide	1.7 µm	3.0 x 100 mm	186004805	176001912
BEH Amide	1.7 µm	3.0 x 150 mm	186004806	176001913

ACQUITY UPLC CSH Columns

Chemistry	Particle Size	Dimension	Part No. 1 Pack	Part No. 3 Pack
CSH C_{18}	1.7 µm	1.0 x 50 mm	186005292	176002136
CSH C_{18}	1.7 µm	1.0 x 100 mm	186005293	176002137
CSH C_{18}	1.7 µm	1.0 x 150 mm	186005294	176002138
CSH C_{18}	1.7 µm	2.1 x 30 mm	186005295	176002139
CSH C_{18}	1.7 µm	2.1 x 50 mm	186005296	176002140
CSH C_{18}	1.7 µm	2.1 x 75 mm	186005620	-
CSH C_{18}	1.7 µm	2.1 x 100 mm	186005297	176002141
CSH C_{18}	1.7 µm	2.1 x 150 mm	186005298	176002142
CSH C_{18}	1.7 µm	3.0 x 30 mm	186005299	176002143
CSH C_{18}	1.7 µm	3.0 x 50 mm	186005300	176002144
CSH C_{18}	1.7 µm	3.0 x 75 mm	186005623	-
CSH C_{18}	1.7 µm	3.0 x 100 mm	186005301	176002145
CSH C_{18}	1.7 µm	3.0 x 150 mm	186005302	176002146
CSH Fluoro-Phenyl	1.7 µm	1.0 x 50 mm	186005349	176002150
CSH Fluoro-Phenyl	1.7 µm	1.0 x 100 mm	186005347	176002148
CSH Fluoro-Phenyl	1.7 µm	1.0 x 150 mm	186005348	176002149
CSH Fluoro-Phenyl	1.7 µm	2.1 x 30 mm	186005350	176002151
CSH Fluoro-Phenyl	1.7 µm	2.1 x 50 mm	186005351	176002152
CSH Fluoro-Phenyl	1.7 µm	2.1 x 75 mm	186005622	-
CSH Fluoro-Phenyl	1.7 µm	2.1 x 100 mm	186005352	176002153
CSH Fluoro-Phenyl	1.7 µm	2.1 x 150 mm	186005353	176002154
CSH Fluoro-Phenyl	1.7 µm	3.0 x 30 mm	186005354	176002155
CSH Fluoro-Phenyl	1.7 µm	3.0 x 50 mm	186005355	176002156
CSH Fluoro-Phenyl	1.7 µm	3.0 x 75 mm	186005625	-
CSH Fluoro-Phenyl	1.7 µm	3.0 x 100 mm	186005356	176002157
CSH Fluoro-Phenyl	1.7 µm	3.0 x 150 mm	186005357	176002158
CSH Phenyl-Hexyl	1.7 µm	1.0 x 50 mm	186005404	176002161
CSH Phenyl-Hexyl	1.7 µm	1.0 x 100 mm	186005402	176002159
CSH Phenyl-Hexyl	1.7 µm	1.0 x 150 mm	186005403	176002160
CSH Phenyl-Hexyl	1.7 µm	2.1 x 30 mm	186005405	176002162
CSH Phenyl-Hexyl	1.7 µm	2.1 x 50 mm	186005406	176002163
CSH Phenyl-Hexyl	1.7 µm	2.1 x 75 mm	186005621	-
CSH Phenyl-Hexyl	1.7 µm	2.1 x 100 mm	186005407	176002164
CSH Phenyl-Hexyl	1.7 µm	2.1 x 150 mm	186005408	176002165
CSH Phenyl-Hexyl	1.7 µm	3.0 x 30 mm	186005409	176002166
CSH Phenyl-Hexyl	1.7 µm	3.0 x 50 mm	186005410	176002167
CSH Phenyl-Hexyl	1.7 µm	3.0 x 75 mm	186005624	-
CSH Phenyl-Hexyl	1.7 µm	3.0 x 100 mm	186005411	176002168
CSH Phenyl-Hexyl	1.7 µm	3.0 x 150 mm	186005412	176002169

ACQUITY UPLC HSS Columns

Chemistry	Particle Size	Dimension	Part No. 1 Pack	Part No. 3 Pack
HSS T3	1.8 µm	1.0 x 50 mm	186003535	176001127
HSS T3	1.8 µm	1.0 x 100 mm	186003536	176001129
HSS T3	1.8 µm	1.0 x 150 mm	186003537	176001130
HSS T3	1.8 µm	2.1 x 30 mm	186003944	176001375
HSS T3	1.8 µm	2.1 x 50 mm	186003538	176001131
HSS T3	1.8 µm	2.1 x 75 mm	186005614	-
HSS T3	1.8 µm	2.1 x 100 mm	186003539	176001132
HSS T3	1.8 µm	2.1 x 150 mm	186003540	176001133
HSS T3	1.8 µm	3.0 x 30 mm	186004678	176001813
HSS T3	1.8 µm	3.0 x 50 mm	186004679	176001814
HSS T3	1.8 µm	3.0 x 75 mm	186005617	-
HSS T3	1.8 µm	3.0 x 100 mm	186004680	176001815
HSS T3	1.8 µm	3.0 x 150 mm	186004681	176001816
HSS C_{18}	1.8 µm	1.0 x 50 mm	186003529	176001121
HSS C_{18}	1.8 µm	1.0 x 100 mm	186003530	176001122
HSS C_{18}	1.8 µm	1.0 x 150 mm	186003531	176001123
HSS C_{18}	1.8 µm	2.1 x 30 mm	186003987	176001398
HSS C_{18}	1.8 µm	2.1 x 50 mm	186003532	176001124
HSS C_{18}	1.8 µm	2.1 x 75 mm	186005615	-
HSS C_{18}	1.8 µm	2.1 x 100 mm	186003533	176001125
HSS C_{18}	1.8 µm	2.1 x 150 mm	186003534	176001126
HSS C_{18}	1.8 µm	3.0 x 30 mm	186004682	176001817
HSS C_{18}	1.8 µm	3.0 x 50 mm	186004683	176001818
HSS C_{18}	1.8 µm	3.0 x 75 mm	186005618	-
HSS C_{18}	1.8 µm	3.0 x 100 mm	186004684	176001819
HSS C_{18}	1.8 µm	3.0 x 150 mm	186004685	176001820
HSS C_{18} SB	1.8 µm	1.0 x 50 mm	186004114	176001556
HSS C_{18} SB	1.8 µm	1.0 x 100 mm	186004115	176001557
HSS C_{18} SB	1.8 µm	1.0 x 150 mm	186004116	176001558
HSS C_{18} SB	1.8 µm	2.1 x 30 mm	186004117	176001559
HSS C_{18} SB	1.8 µm	2.1 x 50 mm	186004118	176001560
HSS C_{18} SB	1.8 µm	2.1 x 75 mm	186005616	-
HSS C_{18} SB	1.8 µm	2.1 x 100 mm	186004119	176001561
HSS C_{18} SB	1.8 µm	2.1 x 150 mm	186004120	176001562
HSS C_{18} SB	1.8 µm	3.0 x 30 mm	186004686	176001821
HSS C_{18} SB	1.8 µm	3.0 x 50 mm	186004687	176001822
HSS C_{18} SB	1.8 µm	3.0 x 75 mm	186005619	-
HSS C_{18} SB	1.8 µm	3.0 x 100 mm	186004826	176001823
HSS C_{18} SB	1.8 µm	3.0 x 150 mm	186004689	176001824
HSS Cyano	1.8 µm	1.0 x 50 mm	186005982	176002703
HSS Cyano	1.8 µm	1.0 x 100 mm	186005983	176002704
HSS Cyano	1.8 µm	1.0 x 150 mm	186005984	176002705
HSS Cyano	1.8 µm	2.1 x 30 mm	186005985	176002706
HSS Cyano	1.8 µm	2.1 x 50 mm	186005986	176002707
HSS Cyano	1.8 µm	2.1 x 75 mm	186005987	176002708
HSS Cyano	1.8 µm	2.1 x 100 mm	186005988	176002709
HSS Cyano	1.8 µm	2.1 x 150 mm	186005989	176002710
HSS Cyano	1.8 µm	3.0 x 30 mm	186005990	176002711
HSS Cyano	1.8 µm	3.0 x 50 mm	186005991	176002712
HSS Cyano	1.8 µm	3.0 x 75 mm	186005992	176002713
HSS Cyano	1.8 µm	3.0 x 100 mm	186005993	176002714
HSS Cyano	1.8 µm	3.0 x 150 mm	186005994	176002715

AccQ•Tag Ultra UPLC Amino Acid Analysis

Chemistry	Particle Size	Dimension	Part No. 1 Pack
UPLC AAA Application Add-on Kit*			176001279
AccQ-Tag Ultra UPLC Column	1.7 µm	2.1 x 100 mm	186003837

** This kit is intended to enable existing ACQUITY UPLC Systems for AAA applications. The Add-on kit contains the AccQ•Tag Ultra chemistries, column, documentation as well as additional hardware accessories needed for AAA applications.*

ACQUITY UPLC HSS Columns

Chemistry	Particle Size	Dimension	Part No. 1 Pack	Part No. 3 Pack
HSS PFP	1.8 µm	1.0 x 50 mm	186005961	176002690
HSS PFP	1.8 µm	1.0 x 100 mm	186005962	176002691
HSS PFP	1.8 µm	1.0 x 150 mm	186005963	176002692
HSS PFP	1.8 µm	2.1 x 30 mm	186005964	176002693
HSS PFP	1.8 µm	2.1 x 50 mm	186005965	176002694
HSS PFP	1.8 µm	2.1 x 75 mm	186005966	176002695
HSS PFP	1.8 µm	2.1 x 100 mm	186005967	176002696
HSS PFP	1.8 µm	2.1 x 150 mm	186005968	176002697
HSS PFP	1.8 µm	3.0 x 30 mm	186005969	176002698
HSS PFP	1.8 µm	3.0 x 50 mm	186005970	176002699
HSS PFP	1.8 µm	3.0 x 75 mm	186005971	176002700
HSS PFP	1.8 µm	3.0 x 100 mm	186005972	176002701
HSS PFP	1.8 µm	3.0 x 150 mm	186005973	176002702

Peptide Separation Technology: BEH130 and BEH300 C_{18}

Chemistry	Particle Size	Dimension	Part No. 1 Pack
BEH130 C_{18}	1.7 µm	2.1 x 50 mm	186003554
BEH130 C_{18}	1.7 µm	2.1 x 100 mm	186003555
BEH130 C_{18}	1.7 µm	2.1 x 150 mm	186003556
BEH300 C_{18}	1.7 µm	1.0 x 50 mm	186005592
BEH300 C_{18}	1.7 µm	1.0 x 100 mm	186005593
BEH300 C_{18}	1.7 µm	1.0 x 150 mm	186005594
BEH300 C_{18}	1.7 µm	2.1 x 50 mm	186003685
BEH300 C_{18}	1.7 µm	2.1 x 100 mm	186003686
BEH300 C_{18}	1.7 µm	2.1 x 150 mm	186003687

Protein Separation Technology: BEH125 and BEH200 Size Exclusion

Chemistry	Particle Size	Dimension	Type	Part No. 1 Pack
BEH125 SEC	1.7 µm	4.6 x 30 mm	Guard Column	186006504
BEH125 SEC	1.7 µm	4.6 x 150 mm	Column	186006505
BEH125 SEC	1.7 µm	4.6 x 300 mm	Column	186006506
BEH200 SEC	1.7 µm	4.6 x 30 mm	Guard Column	186005793
BEH200 SEC	1.7 µm	4.6 x 150 mm	Column	186005225
BEH200 SEC	1.7 µm	4.6 x 300 mm	Column	186005226

Protein Separation Technology: BEH300 C_4

Chemistry	Particle Size	Dimension	Part No. 1 Pack
BEH300 C_4	1.7 µm	1.0 x 50 mm	186005589
BEH300 C_4	1.7 µm	1.0 x 100 mm	186005590
BEH300 C_4	1.7 µm	1.0 x 150 mm	186005591
BEH300 C_4	1.7 µm	2.1 x 50 mm	186004495
BEH300 C_4	1.7 µm	2.1 x 100 mm	186004496
BEH300 C_4	1.7 µm	2.1 x 150 mm	186004497

Glycan Separation Technology

Chemistry	Particle Size	Dimension	Part No. 1 Pack
BEH Glycan	1.7 µm	2.1 x 50 mm	186004740
BEH Glycan	1.7 µm	2.1 x 100 mm	186004741
BEH Glycan	1.7 µm	2.1 x 150 mm	186004742

Oligonucleotide Separation Technology

Chemistry	Particle Size	Dimension	Part No. 1 Pack
OST C_{18}	1.7 µm	2.1 x 50 mm	186003949
OST C_{18}	1.7 µm	2.1 x 100 mm	186003950
OST C_{18}	1.7 µm	2.1 x 150 mm	186005516

ACQUITY UPLC Method Transfer Kits [MTK]*

Package Name	UPLC Column 2.1 mm ID	HPLC Column 4.6 mm ID	Part No.
CSH C_{18} 1.7 to 5 µm MTK	50 mm, 1.7 µm	150 mm, 5 µm	186005529
CSH Phenyl-Hexyl 1.7 to 5 µm MTK	50 mm, 1.7 µm	150 mm, 5 µm	186005530
CSH Fluoro-Phenyl 1.7 to 5 µm MTK	50 mm, 1.7 µm	150 mm, 5 µm	186005531
BEH C_{18} 1.7 to 5 µm MTK	50 mm, 1.7 µm	150 mm, 5 µm	186004958
BEH Shield RP18 1.7 to 5 µm MTK	50 mm, 1.7 µm	150 mm, 5 µm	186004959
BEH HILIC 1.7 to 5 µm MTK	50 mm, 1.7 µm	150 mm, 5 µm	186004960
HSS C_{18} 1.8 to 5 µm MTK	50 mm, 1.8 µm	150 mm, 5 µm	186004961
HSS T3 1.8 to 5 µm MTK	50 mm, 1.8 µm	150 mm, 5 µm	186004962
HSS C_{18} SB 1.8 to 5 µm MTK	50 mm, 1.8 µm	150 mm, 5 µm	186004963
HSS Cyano 1.8 to 5 µm MTK	50 mm, 1.8 µm	150 mm, 5 µm	186005979
HSS PFP 1.8 to 5 µm MTK	50 mm, 1.8 µm	150 mm, 5 µm	186006000
CSH C_{18} 1.7 to 3.5 µm MTK	50 mm, 1.7 µm	100 mm, 3.5 µm	186005532
CSH Phenyl-Hexyl 1.7 to 3.5 µm MTK	50 mm, 1.7 µm	100 mm, 3.5 µm	186005533
CSH Fluoro-Phenyl 1.7 to 3.5 µm MTK	50 mm, 1.7 µm	100 mm, 3.5 µm	186005534
BEH C_{18} 1.7 to 3.5 µm MTK	50 mm, 1.7 µm	100 mm, 3.5 µm	186004964
BEH Shield RP18 1.7 to 3.5 µm MTK	50 mm, 1.7 µm	100 mm, 3.5 µm	186004965
BEH HILIC 1.7 to 3.5 µm MTK	50 mm, 1.7 µm	100 mm, 3.5 µm	186004966
BEH Amide 1.7 to 3.5 µm MTK	50 mm, 1.7 µm	100 mm, 3.5 µm	186004967
HSS C_{18} 1.8 to 3.5 µm MTK	50 mm, 1.8 µm	100 mm, 3.5 µm	186004968
HSS T3 1.8 to 3.5 µm MTK	50 mm, 1.8 µm	100 mm, 3.5 µm	186004969
HSS C_{18} SB 1.8 to 3.5 µm MTK	50 mm, 1.8 µm	100 mm, 3.5 µm	186004970
HSS Cyano 1.8 to 3.5 µm MTK	50 mm, 1.8 µm	100 mm, 3.5 µm	186005980
HSS PFP 1.8 to 3.5 µm MTK	50 mm, 1.8 µm	100 mm, 3.5 µm	186006001
CSH C_{18} 1.7 to 3.5 µm High Rs MTK	100 mm, 1.7 µm	150 mm, 3.5 µm	186005535
CSH Phenyl-Hexyl 1.7 to 3.5 µm High Rs MTK	100 mm, 1.7 µm	150 mm, 3.5 µm	186005536
CSH Fluoro-Phenyl 1.7 to 3.5 µm High Rs MTK	100 mm, 1.7 µm	150 mm, 3.5 µm	186005537
BEH C_{18} 1.7 to 3.5 µm High Rs MTK	100 mm, 1.7 µm	150 mm, 3.5 µm	186004971
BEH Shield RP18 1.7 to 3.5 µm High Rs MTK	100 mm, 1.7 µm	150 mm, 3.5 µm	186004972
BEH HILIC 1.7 to 3.5 µm High Rs MTK	100 mm, 1.7 µm	150 mm, 3.5 µm	186004973
BEH Amide 1.7 to 3.5 µm High Rs MTK	100 mm, 1.7 µm	150 mm, 3.5 µm	186004974
HSS C_{18} 1.8 to 3.5 µm High Rs MTK	100 mm, 1.7 µm	150 mm, 3.5 µm	186004975
HSS T3 1.8 to 3.5 µm High Rs MTK	100 mm, 1.7 µm	150 mm, 3.5 µm	186004976
HSS C_{18} SB 1.8 to 3.5 µm High Rs MTK	100 mm, 1.7 µm	150 mm, 3.5 µm	186004977
HSS Cyano 1.8 to 3.5 µm High Rs MTK	100 mm, 1.8 µm	150 mm, 3.5 µm	186005981
HSS PFP 1.8 to 3.5 µm High Rs MTK	100 mm, 1.8 µm	150 mm, 3.5 µm	186006002

* Each kit contains one UPLC column and one HPLC column. The ACQUITY UPLC Columns Calculator can be downloaded from the ACQUITY UPLC Online Community at **www.waters.com/myuplc**

UPLC Column Spare Parts

Description	Qty.	Part No.
1.0 mm ID UPLC column 0.2 µm inlet/outlet frit	3	700003775
2.1 mm ID UPLC column 0.2 µm inlet/outlet frit	3	700003776
3.0 mm ID UPLC column 0.2 µm inlet/outlet frit	3	700004790
1.0 mm ID UPLC column inlet end nut	1	700003777
1.0 mm ID UPLC column outlet end nut	1	700003778
2.1 mm ID UPLC column inlet end nut	1	700003779
2.1 mm ID UPLC column outlet end nut	1	700003780
3.0 mm ID UPLC column inlet end nut	1	700004792
3.0 mm ID UPLC column outlet end nut	1	700004791

ACQUITY UPLC Column In-Line Particulate Filter Unit

Description	Part No.
In-line filter holder and six 0.2 µm replacement filters	205000343
Five 0.2 µm replacement filters (with end nut replacements)	700002775

ACQUITY UPLC Method Validation Kits [MVK]**

Chemistry	Particle Size	Column Length	Part No. 2.1 mm ID	Part No. 3.0 mm ID
CSH C_{18}	1.7 µm	50 mm	186005571	186005573
CSH C_{18}	1.7 µm	100 mm	186005572	186005574
CSH Phenyl-Hexyl	1.7 µm	50 mm	186005579	186005581
CSH Phenyl-Hexyl	1.7 µm	100 mm	186005580	186005582
CSH Fluoro-Phenyl	1.7 µm	50 mm	186005575	186005577
CSH Fluoro-Phenyl	1.7 µm	100 mm	186005576	186005578
BEH C_{18}	1.7 µm	50 mm	186004044	186004691
BEH C_{18}	1.7 µm	100 mm	186004045	186004692
BEH C_8	1.7 µm	50 mm	186004046	186004693
BEH C_8	1.7 µm	100 mm	186004047	186004694
BEH Shield RP18	1.7 µm	50 mm	186004048	186004695
BEH Shield RP18	1.7 µm	100 mm	186004049	186004696
BEH Phenyl	1.7 µm	50 mm	186004050	186004697
BEH Phenyl	1.7 µm	100 mm	186004052	186004698
BEH HILIC	1.7 µm	50 mm	186004053	186004699
BEH HILIC	1.7 µm	100 mm	186004054	186004700
BEH Amide	1.7 µm	50 mm	186004807	186004809
BEH Amide	1.7 µm	100 mm	186004808	186004810
HSS T3	1.8 µm	50 mm	186004055	186004701
HSS T3	1.8 µm	100 mm	186004056	186004702
HSS C_{18}	1.8 µm	50 mm	186004057	186004703
HSS C_{18}	1.8 µm	100 mm	186004058	186004704
HSS C_{18} SB	1.8 µm	50 mm	186004137	186004705
HSS C_{18} SB	1.8 µm	100 mm	186004138	186004709
HSS Cyano	1.8 µm	50 mm	186005996	186005998
HSS Cyano	1.8 µm	100 mm	186005997	186005999
BEH130 C_{18}	1.7 µm	100 mm	186004896	-
BEH300 C_{18}	1.7 µm	100 mm	186004897	-
BEH300 C_4	1.7 µm	100 mm	186004899	-
OST C_{18}	1.7 µm	100 mm	186004898	-
BEH Glycan	1.7 µm	100 mm	186004907	-

**Each kit contains 3 columns from 3 different batches of material.

VanGuard Pre-Column 3 Packs (Guard Columns)

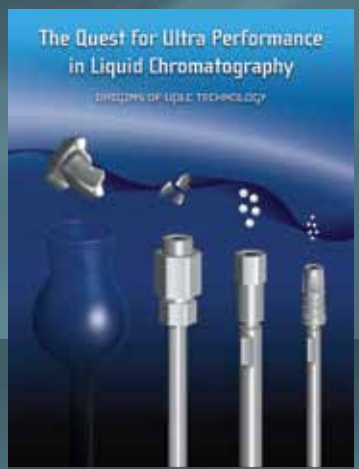
Chemistry	Particle Size	Dimension	Part No. 3 Pack
BEH C_{18}	1.7 µm	2.1 x 5 mm	186003975
BEH Shield RP18	1.7 µm	2.1 x 5 mm	186003977
BEH C_8	1.7 µm	2.1 x 5 mm	186003978
BEH Phenyl	1.7 µm	2.1 x 5 mm	186003979
BEH HILIC	1.7 µm	2.1 x 5 mm	186003980
BEH Amide	1.7 µm	2.1 x 5 mm	186004799
CSH C_{18}	1.7 µm	2.1 x 5 mm	186005303
CSH Fluoro-Phenyl	1.7 µm	2.1 x 5 mm	186005358
CSH Phenyl-Hexyl	1.7 µm	2.1 x 5 mm	186005413
HSS T3	1.8 µm	2.1 x 5 mm	186003976
HSS C_{18}	1.8 µm	2.1 x 5 mm	186003981
HSS C_{18} SB	1.8 µm	2.1 x 5 mm	186004136
HSS Cyano	1.8 µm	2.1 x 5 mm	186005995
HSS PFP	1.8 µm	2.1 x 5 mm	186005974
BEH130 C_{18}	1.7 µm	2.1 x 5 mm	186003975
BEH300 C_{18}	1.7 µm	2.1 x 5 mm	186004629
BEH300 C_4	1.7 µm	2.1 x 5 mm	186004623
BEH Glycan	1.7 µm	2.1 x 5 mm	186004739

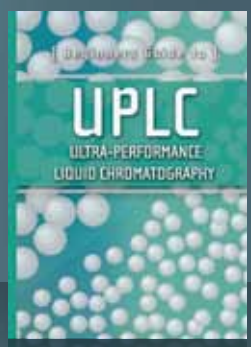
ACQUITY UPLC Method Development Kits [MDK]

Package Name	Qty.	Chemistries	Particle Size(s)	Configuration	Part No.
Maximum Selectivity UPLC Method Development Kit: The widest selectivity offering from method development at low and high pH. Best choice for low ionic strength additives (i.e., formic acid)					
Maximum Selectivity UPLC Method Development Kit	4/pk	CSH C_{18}, CSH Phenyl-Hexyl, CSH Fluoro-Phenyl, HSS C_{18} SB	CSH 1.7 µm; HSS 1.8 µm	2.1 x 50 mm	176002123
Maximum Selectivity UPLC Method Development Kit	4/pk	CSH C_{18}, CSH Phenyl-Hexyl, CSH Fluoro-Phenyl, HSS C_{18} SB	CSH 1.7 µm; HSS 1.8 µm	2.1 x 100 mm	176002124
Maximum Selectivity UPLC Method Development Kit	4/pk	CSH C_{18}, CSH Phenyl-Hexyl, CSH Fluoro-Phenyl, HSS C_{18} SB	CSH 1.7 µm; HSS 1.8 µm	3.0 x 50 mm	176002125
Maximum Selectivity UPLC Method Development Kit	4/pk	CSH C_{18}, CSH Phenyl-Hexyl, CSH Fluoro-Phenyl, HSS C_{18} SB	CSH 1.7 µm; HSS 1.8 µm	3.0 x 100 mm	176002126
High & Low pH, Widest Selectivities UPLC Columns Kit: Maximize separation selectivity by exploring low and high mobile-phase pH					
High & Low pH, Widest Selectvities UPLC Columns Kit	4/pk	BEH C_{18}, BEH C_8, BEH Shield RP18, BEH Phenyl	BEH 1.7 µm	2.1 x 50 mm	176001042
High & Low pH, Widest Selectvities UPLC Columns Kit	4/pk	BEH C_{18}, BEH C_8, BEH Shield RP18, BEH Phenyl	BEH 1.7 µm	2.1 x 100 mm	176001043
High & Low pH, Widest Selectvities UPLC Columns Kit	4/pk	BEH C_{18}, BEH C_8, BEH Shield RP18, BEH Phenyl	BEH 1.7 µm	3.0 x 50 mm	176001881
High & Low pH, Widest Selectvities UPLC Columns Kit	4/pk	BEH C_{18}, BEH C_8, BEH Shield RP18, BEH Phenyl	BEH 1.7 µm	3.0 x 100 mm	176001882
UPLC Method Development Kit: Maximize separation selectivity by exploring low and high mobile-phase pH (BEH columns) and accommodate for the retention of polar compounds (HSS T3)					
UPLC Method Development Kit	4/pk	BEH C_{18}, BEH Shield RP18, BEH Phenyl, HSS T3	BEH 1.7 µm; HSS 1.8 µm	2.1 x 50 mm	176001603
UPLC Method Development Kit	4/pk	BEH C_{18}, BEH Shield RP18, BEH Phenyl, HSS T3	BEH 1.7 µm; HSS 1.8 µm	2.1 x 100 mm	176001604
UPLC Method Development Kit	4/pk	BEH C_{18}, BEH Shield RP18, BEH Phenyl, HSS T3	BEH 1.7 µm; HSS 1.8 µm	3.0 x 50 mm	176001883
UPLC Method Development Kit	4/pk	BEH C_{18}, BEH Shield RP18, BEH Phenyl, HSS T3	BEH 1.7 µm; HSS 1.8 µm	3.0 x 100 mm	176001884
L1 UPLC Columns Kit: C_{18} columns that differ in silanol activity and hydrophobicity within the US Pharmacopeia L1 classification					
L1 UPLC Columns Kit	4/pk	BEH C_{18}, BEH Shield RP18, HSS C_{18}, HSS T3	BEH 1.7 µm; HSS 1.8 µm	2.1 x 50 mm	176001605
L1 UPLC Columns Kit	4/pk	BEH C_{18}, BEH Shield RP18, HSS C_{18}, HSS T3	BEH 1.7 µm; HSS 1.8 µm	2.1 x 100 mm	176001606
L1 UPLC Columns Kit	4/pk	BEH C_{18}, BEH Shield RP18, HSS C_{18}, HSS T3	BEH 1.7 µm; HSS 1.8 µm	3.0 x 50 mm	176001885
L1 UPLC Columns Kit	4/pk	BEH C_{18}, BEH Shield RP18, HSS C_{18}, HSS T3	BEH 1.7 µm; HSS 1.8 µm	3.0 x 100 mm	176001886
Mass Spec UPLC Columns Kit: Straight-chain alkyl C_{18} columns that differ in silanol activity, peak shape, selectivity and hydrophobicity while exhibiting no MS bleed					
Mass Spec UPLC Columns Kit	4/pk	BEH C_{18}, HSS C_{18}, HSS T3, HSS C_{18} SB	BEH 1.7 µm; HSS 1.8 µm	2.1 x 50 mm	176001607
Mass Spec UPLC Columns Kit	4/pk	BEH C_{18}, HSS C_{18}, HSS T3, HSS C_{18} SB	BEH 1.7 µm; HSS 1.8 µm	2.1 x 100 mm	176001608
Mass Spec UPLC Columns Kit	4/pk	BEH C_{18}, HSS C_{18}, HSS T3, HSS C_{18} SB	BEH 1.7 µm; HSS 1.8 µm	3.0 x 50 mm	176001887
Mass Spec UPLC Columns Kit	4/pk	BEH C_{18}, HSS C_{18}, HSS T3, HSS C_{18} SB	BEH 1.7 µm; HSS 1.8 µm	3.0 x 100 mm	176001888
Low pH, Widest Selectivities UPLC Columns Kit: A diverse grouping of column selectivities for the development of a reversed-phase method in low-pH mobile phases					
Low pH, Widest Selectvities UPLC Columns Kit	4/pk	BEH Shield RP18, BEH Phenyl, HSS C_{18}, HSS C_{18} SB	BEH 1.7 µm; HSS 1.8 µm	2.1 x 50 mm	176001609
Low pH, Widest Selectvities UPLC Columns Kit	4/pk	BEH Shield RP18, BEH Phenyl, HSS C_{18}, HSS C_{18} SB	BEH 1.7 µm; HSS 1.8 µm	2.1 x 100 mm	176001610
Low pH, Widest Selectvities UPLC Columns Kit	4/pk	BEH Shield RP18, BEH Phenyl, HSS C_{18}, HSS C_{18} SB	BEH 1.7 µm; HSS 1.8 µm	3.0 x 50 mm	176001889
Low pH, Widest Selectvities UPLC Columns Kit	4/pk	BEH Shield RP18, BEH Phenyl, HSS C_{18}, HSS C_{18} SB	BEH 1.7 µm; HSS 1.8 µm	3.0 x 100 mm	176001890
Maximum Selectivity RP and HILIC Method Development Kit: Offers the widest separation selectivity by combining HILIC and RP stationary phases to retain analytes encompassing a broad polarity range					
Maximum Selectivity RP and HILIC Method Development Kit	4/pk	CSH C_{18}, CSH Phenyl-Hexyl, CSH Fluoro-Phenyl, BEH Amide	CSH 1.7 µm; BEH 1.7 µm	2.1 x 50 mm	176002127
Maximum Selectivity RP and HILIC Method Development Kit	4/pk	CSH C_{18}, CSH Phenyl-Hexyl, CSH Fluoro-Phenyl, BEH Amide	CSH 1.7 µm; BEH 1.7 µm	2.1 x 100 mm	176002128
Maximum Selectivity RP and HILIC Method Development Kit	4/pk	CSH C_{18}, CSH Phenyl-Hexyl, CSH Fluoro-Phenyl, BEH Amide	CSH 1.7 µm; BEH 1.7 µm	3.0 x 50 mm	176002129
Maximum Selectivity RP and HILIC Method Development Kit	4/pk	CSH C_{18}, CSH Phenyl-Hexyl, CSH Fluoro-Phenyl, BEH Amide	CSH 1.7 µm; BEH 1.7 µm	3.0 x 100 mm	176002130
UPLC RP and HILIC Method Development Kit: A novel approach that maximizes separation selectivity by combining distinct RP and HILIC stationary phases to retain analytes encompassing a broad polarity range					
UPLC RP and HILIC Method Development Kit	4/pk	BEH C_{18}, BEH Shield RP18, BEH Amide, HSS C_{18} SB	BEH 1.7 µm; HSS 1.8 µm	2.1 x 50 mm	176001959
UPLC RP and HILIC Method Development Kit	4/pk	BEH C_{18}, BEH Shield RP18, BEH Amide, HSS C_{18} SB	BEH 1.7 µm; HSS 1.8 µm	2.1 x 100 mm	176001960
UPLC RP and HILIC Method Development Kit	4/pk	BEH C_{18}, BEH Shield RP18, BEH Amide, HSS C_{18} SB	BEH 1.7 µm; HSS 1.8 µm	3.0 x 50 mm	176001961
UPLC RP and HILIC Method Development Kit	4/pk	BEH C_{18}, BEH Shield RP18, BEH Amide, HSS C_{18} SB	BEH 1.7 µm; HSS 1.8 µm	3.0 x 100 mm	176001962
UPLC HILIC Method Development Kit: Effortlessly develop HILIC methods at low pH (bases) and high pH (acids) for polar and/or ionizable compounds					
UPLC HILIC Method Development Scouting Kit	4/pk	BEH Amide, BEH HILIC	BEH 1.7 µm	2.1 x 50 mm	176001963
UPLC HILIC Method Development Scouting Kit	4/pk	BEH Amide, BEH HILIC	BEH 1.7 µm	2.1 x 100 mm	176001964
UPLC HILIC Method Development Scouting Kit	4/pk	BEH Amide, BEH HILIC	BEH 1.7 µm	3.0 x 50 mm	176001965
UPLC HILIC Method Development Scouting Kit	4/pk	BEH Amide, BEH HILIC	BEH 1.7 µm	3.0 x 100 mm	176001966

EDUCATIONAL PRIMERS FROM WATERS

Description	Part Number
Beginners Guide to UPLC	715002099
Quest for Ultra Performance in Liquid Chromatography	715002098
Comprehensive Guide to HILIC	715002531





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